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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

REICHE: FLORA DE CHILE
V. 5 1910

82. Family SOLANACEAE

Flowers hermaphroditic, actinomorphic or rarely zygomorphic. Calyx gamosepalous, from (4-) 5 divisions. Corolla gamopetalous, (4-)5 divisions of varying aestivation. Stamens of the actinomorphic flowers (4-)5 and all of them fertile; in the zygomorphic flowers were are 4 didynamous, at times 2 of them reduced to staminodia. Disc present. Ovary bicarpelary, of 2 or 4 valves. Seeds furnished with endosperm, embryo erect or curved--plants herbaceous or woody, leaves alternate; only toward the floral regions does it seem to have leaves of a distinct size (both?) paired and alternate. The flowers generally clustered in cymes, rarely solitary and terminating little branches. (Fabiana). Ca. 75 genera distributed over the globe; in Chile 17 genera belong to the sub-families of the Solaneae, Datureae, Cestreae and Salpiglosideae; the genus Datura (of Datureae) probably not indigenous, but completely acclimated.

Key to the Sub-families

I. The embryo clearly curved into a semicircle. The five stamens fertile.

A. Ovary 2-loculate.....1. Solaneae
B. Ovary 4-loculate.....2. Datureae

II. The embryo erect or slightly arcuate.

A. All the stamens fertile.....3. Cestreae
B. Only 2 or 4 stamens fertile.....4. Salpiglossideae

Key to the Genera

I. Corolla actinomorphic
  A. Fruit a berry, at times a little succulent
    1. Corolla rotate (with the tube very short). Filaments very short, the anthers in a cone..... 6. Solanum
    2. Corolla bell-shaped, cylindric
      a. Shrubs or little shrubs
        (a) Shrubs armed
          o. Corolla white, sometimes pintado (painted? tinged? mottled?) violet color. Berries lacres (waxen?) or black..... 1. Lycium
          oo. Corolla greenish-yellow Chile boreal.....2. Dunalia
          ooo. Corolla purple. Southern Chile.....4. Latua
        (b) Shrubs not armed
          o. Little low shrubs of the North with the corolla white, companulate.....3. Phrodus
          oo. Shrubs a little taller. Corollas hypocraterimorphic. Berries black.....10. Cestrum

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b. Plants herbaceous
(a) Leaves undivided. Stems spreading. Corollas blue..5. Cacabus
(b) Leaves parted
o. Corolla infundibular.7. Jaborosa
oo. Corolla bell shaped..8. Trechonaetes

B. Fruit a capsule open in 2 or 4 valves
1. Capsule thorny.....9. Datura
2. Capsule smooth
a. Shrubs
(a) Stamens clearly exserted from the corolla.....12. Vestia
(b) Stamens included
o. Flowers vertical, 1(-2) terminal the little branches.....11. Fabiana
oo. Flowers clustered in cymes.....13. Nicotiana
b. Herbaceous plants
(a) Flowers in cymes.....13. Nicotiana
(b) Flowers solitary in the axils
o. Corolla funnelform..14. Petunia
oo. Narrow tube of corolla dilated abruptly.....15. Nierembergia

II. Corolla zygomorphic
A. The lobes of the corolla entire or escotadas (emarginate?).....16. Salpiglossis
B. The lateral lobes palmatepinnatifid.....17. Schizanthus

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Localities for species of Solanaceae in cases where only genus description and key to species was translated from Reiche. (In case of Nicotiana, Nierembergia, et cetera, species localities will be found included in the translation.)

1. Lycium

chilense -- Desde la provincia de Aconcagua a la de Maule, en la costa i en el interior, hasta en las cordilleras bajas.

glaucum -- Zona litoral de la provincia de Atacama (Hueso Parado).

minutifolium -- En el interior de las provincias de Atacama i Coquimbo

deserti -- Provincia de Atacama (Cachiyuyal, Taltal, Breas).

crassispina -- En el interior del desierto de Atacama i Coquimbo (Agua de Varas, Acerillo, Rivadavia).

stenophyllum -- En el interior de las provincias de Atacama i Coquimbo.

humile -- La planta forma manchones en las vegas salobres en el interior del desierto de Atacama (Vegas del Chaco, de la Encantada, 2500 m.)

2. Dunalia

lycioides -- En Colombia, Ecuador, Peru, Bolivia i el estremo norte de Chile (Aico en la provincia de Tacna.)

3. Phrodus

microphyllus -- Provincia de Coquimbo.

bridgesii -- En el interior de las provincias de Atacama i Coquimbo. Noviembre i Diciembre.

pendulus -- En el interior de la provincia de Atacama, Setiembre a Diciembre

4. Latua

pubiflora -- En la zona litoral desde la provincia de Valdivia a Chiloe (Alerzales de la Cordillera Pelada; San Pedro; Ancud; etc.). Planta mui venenosa; el consumo de los frutos produce demencia.

5. Cacabus

integrifolius -- En el interior de la provincia de Tarapaca (Guavina, al este del pueblo de Tarapaca).

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6. Solanum

Too many species to list localities for.

7. Jaborosa

magellanica -- En la rejion del Estrecho de Magallanes (Peninsula Brunswick, Tierra del Fuego). Enero, Febrero.

volkmanni -- Cordilleras de Chillan, de la Araucania.

caulescens -- En las cordilleras altas de lae provincias de Coquimbo a Linares; tambien en las faldas orientales. Enero, Febrero.

araucana -- Cordilleras de la Araucania (La Cueva).

decurrens -- En las cordilleras arjentinas i chilenas al rededor de 4,000 m.; de localidades chilenas el Museo Nacional no posee muestras.

pinnata -- Cordillera de Linares; parece planta escasa. Enero.

8. Trechonaetes

laciniata -- Cordilleras altas de las provincias centrales (Uspallata, 2,200 m.) i boreales. Enero, Febrero.

parviflora -- Provincia de Tarapaca (Socaire, Machuca, Aguas Calientes).

lanigera -- Cordillera de la provincia de Atacama, en rejiones limitrofes con la Arjentina (entre Quebrada del Diablo i Antofagasta). Enero.

floribunda -- En la Republica Arjentina (Antofagasta de la Sierra), talvez tambien en las rejiones vecinas de Chile.

9. Datura

stramonium -- En terrenos cultivados de las provincias boreales i centrales. Octubre a Febrero.--La epoca de la introduccion se ignora.

17. Schizanthus

pinnatus -- Planta bonita, primaveral desde la provincia de Coquimbo hasta la Araucania. Octubre, Noviembre.

alpestris -- En las cordilleras de las provincias de Coquimbo i Aconcagua (Cuncumen).

gracilis -- En las provincias centrales i australes (hasta Llanquihue).

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laetus -- En la rejion pastosa de la zona litoral de la provincia de Atacama (Cachinal, Paposo, etc.) Diciembre.

latifolius -- Zona litoral de la provincia de Curico (Llico). Diciembre.

floribundus -- Zona litoral de la provincia de Santiago.

gayanus -- Cordillera de Nahuelbuta

humilis -- Zona litoral de la provincia de Maule (Constitucion). Diciembre, Enero.

litoralis -- En la zona litoral de las provincias de Coquimbo i Aconcagua. Setiembre, Octubre, Planta hermosisima que merece ser cultivada en los jardines.

grahami -- En las cordilleras de Coquimbo hasta Araucania. Enero, Febrero.

laciniosus -- En Chile, se ignora la localidad especial.

san romani -- Zona litoral de la provincia de Atacama (Paposo).

hookeri -- En las cordilleras desde Coquimbo hasta la Araucania; en las de Santiago alrededor de 1800 m. Enero, Febrero.

integrifolius -- Provincia de Atacama (Taltal, Hueso Parado). Diciembre.

lacteus -- Provincia de Atacama (Taltal, Hueso Parado). Diciembre.

candidus -- Zona litoral de las provincias de Atacama i Coquimbo. Octubre.

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1. Lycium - L.

Calyx, funnel shaped or shortly cylindrical, with five irregular, permanent teeth. Corolla cylindrical or funnel shaped, with the tube short or long; the limb of four-five imbricated divisions in the bud. Four-five stamens, more or less exserted, inserted in the corolla tube. Anthers with two small pockets which open by lateral dehiscence. Disc little marked. Ovary bilocular. Style filiform with the end thick, indistinctly bilobed. Fruit a berry. Generally many seeds with the embryo very curved. Shrubs much branched, sometimes thorny, the leaves alternate, entire, axillary, solitary, few flowers. Corolla white, sometimes violet colored.--Ca seventy species of the sub-tropical and temperate regions of the globe; very numerous and of a very complicated system in South America; in Chile some seven species of which L. chilense is a polymorphic type.

Observation: In the exposition, I adopted the system of Miers, with the modification of uniting the two sections Mesocope and Macrocope into one; since the length of the corolla limb, larger than the tube (Macrocope) or larger than half of it can scarcely have sufficient value. The system of Terraciano is inadmissable since it confuses the species with cylindrical and infundibular corollas.

I. Infundibular corollas with the divisions of the limb longer than half the tube (Mesocope Miers, Macrocope Miers).
   - A. Shrubs of a clear green with white corollas, more or less violet colored outside and in the middle of the divisions of the limb.....1. chilense
   - B. Little shrubs of a glaucous green with the corollas of an unclear violet.....2. glaucum

II. White cylindrical corollas with the divisions of the limb shorter than half the tube (Brachycope Miers).
   - A. Tall shrubs with (lacres) berries.
     1. Calyx cup shaped with the teeth little marked.
        - a. Leaves smaller, 1-5 mm. long.....3. minutifolium
        - b. Leaves larger.
          - (a) Thin branches, of dark-ash color red.....4. deserti
          - (b) Thicker branches of a dark yellow.....5. crassipina

     2. Calyx shortly cylindrical with the divisions as long as the tube.....6. stenophollum
   - B. A. small shrub tendido (spreading? creeping?) along the ground; branches cespitose; berries dark.....7. humilde

2. Dunalia - H. B. Kth.

Calyx short and broad, more or less irregularly dentate. Corolla cylindrical, larger than the calyx, with the limb shortly five lobed, sometimes with intermediary folds and teeth. Stamen

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inserted in the lower half of the corolla tube, appendaged at the base. Anthers with two locules of lateral dehiscence. Disc obscure. Ovary bilocular with many ovules. Stigma very shortly bilobed. The fruit is a polyspermous berry, surrounded by the calyx. Seeds compressed with the embryo very curved. Trees and shrubs sometimes thorny with the leaves entire, fascicled, and the flowers axillary, solitary, or in groups of three-four.--Ca. eight species, from Mexico to the western boundary of the tropical region of South America, in the north of Chile one species.

3. Phrodus - Miers.

Calyx cylindrical, campanulate, divided almost in half in five divisions, enlarged during fructification. Corolla campanulate; with the limb plaited and of five broad divisions. Stamens inserted in the lower part of the corolla tube; anthers bilobed, the two locules of lateral dehiscence. Disc existent. Ovary bilocular with numerous ovules; the style with the stigma bilobed. Berry globular, a little succulent, surrounded by the calyx. Seeds compressed with the embryo curved. Plants slightly woody, much branched. Leaves small, entire, fascicled, more or less glandular-pubescent. Flowers axillary, solitary, shortly pedunculate. Corolla showy, yellow-white. Some 2-3 species in the northern provinces of Chile, resembling certain species of Alona Lindl. (Nolanaceas).

I. Stigma a little enlarged. Insertion of the leaves nude (knotty?).
   A. Leaves spatulate-oblong.....1. microphyllus
   B. Leaves spatulate-linear..... ....2. Bridgesii
II. Stigma transversally dilated. Leaves not nude at insertion.....3. pendulans

4. Latua - Phil.

Calyx campanulate, up to the middle divided in five divisions of valvate aestivation. Corolla with the tube long, enclosed at the base and under the limb which has five valvate and plaited divisions between them. Five stamen inserted in the base of the corolla tube; projecting from the tube, with the anthers ovoid, with two locules of lateral dehiscence. Ovary bilocular, with many ovules. Sytle with the stigma short and broadly bilobed. The fruit is a globular berry, surrounded by the extended and enlarged calyx. Seeds numerous, somewhat compressed with the embryo curved. Shrub hairy or finely hairy, sometimes with spine in the insertion of the alternate, entire, fascicled leaves on little short, lateral branches Flowers solitary, large. An endemic species in southern Chile.

5. Cacabus - Bernh.

Calyx shortly campanulate, five parted, membranous. Corolla campanulate or infundibular; the limb plaited in five longitudinal bands. Five stamens, of unequal length, inserted in the base of the corolla tube and inclused in it. The anthers with two locules

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of lateral dehiscence. Ovary bilocular, with many ovules. Stigma with two small oblong lobes. The fruit is a berry with a thin pericarp, contained in the persistent, enlarged, and five cornered calyx. Seeds numerous, compressed, with the embryo curved. Herbs annual, diffusely branched, hairy. Leaves largely petiolate. Flowers solitary, axillary. Ca. four species of the western tropical region of South America; one of them (of somewhat problematic classification) in the cordilleras of northern Chile.

6. Solanum - L.

Calyx campanulate and horizontally extended, of five, rarely of four or of a greater number of divisions. Corolla of the same number as the calyx, with the tube short; the limb rotate, angular or plaited. Stamen with the filaments short and the anthers arranged in a cone, opening through a terminal pore which toward the bottom extends in a lineal cut or opening. Disc little marked. Ovary two-locular (in the section Lycopersicum, also plurilocular). The style ends in two short stigmas. Ovules numerous. Fruit a berry. Seeds compressed with the embryo curved. Herbaceous or woody plants, sometimes spiny, of very varied aspect. Leaves alternate, entire to tri-pinnate. Inflorescence in clusters, axillary or extra axillary, terminal, or lateral. Peduncles with the base articulated. Corollas white, violet or yellow. Berries green, yellow, red, black. Ca. nine hundred species, of which many (principally of the sub-section Morella) are poorly defined; distributed over the world, very abundant in South America. From Chile we have described more than eighty species; the fifty admitted to continuation have certainly been reduced to half, which completes the knowledge of its fruits.

7. Jaborosa - Juss.

Calyx campanulate, five parted, little increased in fructification. Corolla infundibular, almost hypocraterimorphic with the tube long, somewhat hairy inside, slightly broadened toward the throat. Limb of five extended divisions. Filaments inserted in the upper half of the tube. Anthers basifixed with the locules parallel and of lateral dehiscence. Disc little marked. Ovary two-five lobed (bilobed in the Chilean species). Ovules numerous. Berry globular, a little succulent, with numerous, compressed seeds. Embryo curved. Perennial plants with the root thick and the stems short, more or less spread out or creeping along the ground. Leaves notched-pinnatifid. Flowers sometimes largely pedunculate, with the corollas whitish. Ca. Eight-ten species from Mexico to the Andean region of South America to Tierra del Fuego; six species in Chile.

I. The base of the filaments fastened to the corolla tube; its end free; the anthers reach the apex of the limb. (Himeranthus Endl.).....1. magellanica

II. Filaments open or free, sometimes very short. (Lonchestigma Dun).

A. Very short filaments

1. Corolla hairy outside

a. Divisions of the limb ovate-acuminate.....2. Volkmanni

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b. Divisions of the limb linear-lanceolate, largely acute.
(a) Short, linear bracts, sometimes uni-dentate.....3. caulescens
(b) Bracts as long as the peduncles, spatulate.....4. araucana
2. Corolla tomentose outside.....5. decurrens
B. Filaments longer than the anthers.....6. pinnata

8. Trechonaetes - Miers.

Calyx of five divisions which increase a little during fructification. Corolla campanulate, of five divisions. Five stamen inserted from the middle to the base of the corolla tube; filaments thin, larger than the dorsifixed anthers. Disc a little marked. Style filiform with the stigma (bilamelado), (in T. floribunda and in T. parviflora more globular and four lobed). The fruit is a berry, a little succulent, with numerous compressed seeds. Plants low with numerous seeds, spreading (but compare T. floribunda). Leaves notched-pinnatifid. Ca. four-five species of the cordillera regions of Chile and of Argentina.

I. Stems short, spreading.
A. Plants hairy or more or less scattered with white hairs.
1. Corolla broadly campanulate, 1-1.5 cm. long; calyx of five largely acuminate divisions.....1. laciniata
2. Corolla campanulate--infundibular, from 8-16 mm. long; calyx of five short, triangular divisions.....2. parviflora
B. Plant entirely covered with long hairs.....3. longiflora
II. Stems straight, branched.....4. floribunda

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9. Datura - L.

Calyx large tubular, herbaceous, limb of five divisions, the lower part persistent, the upper part at last falling. Corolla funnel shaped with the limb wide, folded, twisted in the bud; the divisions prolonged into a point. Five stamens, inserted in the lower part of the corolla tube. Anthers basifixed; narrow, of lateral dehiscence. Ovary 2-locular, with false walls 4-locular. Style filiform, terminated by 2 lamelliform stigmas. Numerous ovules. The fruit is a dehiscent capsule in 4 valves, with the pericarp generally thorny. Seeds gruesas (large? thick?), flattened, with the testa marked by deep depressions. Embryo very curved. Plants dichotomously branched, leaves blandas (plane?) entire or dentately incised. The flowers large, showy, in the angles of the fork. Ca. 10 (?) species principally in the tropical and sub-tropical regions of the globe; one of them also in Chile, of the section Stramonium Bernh.

10. Cestrum - L.

Calyx campanulate or tubular, 5-dentate, persistent. Corolla (of the Chilean species) hypocraterimorphic, of 5 divisions of induplicate aestivation (valvate with the margins enroscatos (curled? twisted?) 5 stamens inserted about in the middle of the tube, provided with a scaly appendage at the point of insertion, the filaments hairy toward the bottom; anthers short, almost dorsifixed, of lateral dehisence. Style filiform with the stigma subglobose, indistinctly bilobed. Ovary bilocular. The fruit is a berry, somewhat succulent, with some polyhedrical seeds. The embryo is a little arcuate. Plants woody with the leaves alternate, upright. Inflorescence cymose. Corollas white, yellow or red. Ca. 140 species of the tropical and subtropical regions of America; in Chile one species.

J. F. (Juan Fernandez?) 1. C. Palqui L'Herit. Stirp. I page 73 tab. 36. - Gay V, page 95; (C. virgatum R. et Pav.; C. auriculatum L'Herit. cited No. Act. XIX Suppl. I page 391). "Palqui"

Shrub with the older leaves ash color--red. The new organs ± tomentose. Leaves of a clear green, fetid when ground between the fingers; persistent or falling according to the locality; lanceolate, acute, slender petiolate, hairless; 6-8 cm. long. In the axils of the leaves, many times there are short leafy buds, whose leaves have been taken for stipules. Numerous flowers disposed in axillary and terminal cymes. Corollas with the tube gradually enlarged toward the throat; the divisions of the limb with tomentose margins. The color varies from clear yellow to violet; in this last case all of the flower is of this color. Berries ellipsoidal, of a darkish purple. Shrub of 1-2 m. In the leaves the Uredinacea, Uromyces Cestri Mont. produces yellow pustules. The caterpillar of Sphinx Cestri Blanch., the monroi ( ), lives on the leaves. The plant resembles Nicotiana glauca R. Grah. I a Vestia lycioides Willd.

1. Plant of Brazil, Uruguay, Argentina, Peru and of Chile, here very frequent from the province of Coquimbo across the central provinces; but it seems that from Concepcion to the south the plant becomes less frequent; in JF. (Juan Fernandez?) it is a weed

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introduced from the continent. El Palqu has great fame in popular medicine. Murillo, Pl. med. du Chili. Page 156.)

Observation: Cestrum nocturnum L. & C. diurnum, which according to speg. Plant. page 191 is found in Chili, are not of this country. C. elegans (Scheidw.) of Mexico is valued as an ornamental shrub.

11. Fabiana - R. and Pav.

Calyx cylindrical with five narrow divisions. Corolla large cylindrical, expanded toward the apex; the limb of 5 short divisions, horizontal, open. Stamens 5, unequal, inserted in the lower half of the corolla. Anthers subglobose with the connective short and the bolsidas (lobes? cells?) almost separate. Stigma globose, ± bilobed. Ovary bilocular. The capsule opens in 2 valves parted again in the apex, its narrow margins folded inside. Seeds numerous. --Ca. 16 South American species from Bolivia and the south of Brazil to Patagonia, resembling in appearance the genus Tamarix. In Chile ca. 8 species of a system in part very confused; principally in the province of Coquimbo.

I. The leaves, when they exist, above the principal and lateral branches
  A. The adult and new branches furnished with leaves
    1. Corollas white, yellow-white or bluish
      a. The leaves somewhat divergent from the branch
        (a) Leaves ovate, very thick..1. imbricata
        (b) Leaves linear-spatulate
          o. Calyx cylindric divisions.....2. viscosa
          oo. Calyx triangular lanceolate divisions.3. deserticola
      b. The leaves densely appressed against the sturdy branches
        (a) Leaves narrowly linear-spatulate.....4. cordifolia
        (b) Leaves triangular-ovate, very compact.....5. squamata
    2. Corollas intensely yellow.....6. Barriosi
  B. The branches not leafy.....7. denudata
II. The leaves, mostly small and confined to the lateral branchlets, short and subglobose (referring to lvs.? or to branchlets?).....8. Bryoides

1. F. imbricata R. et. Pav. Flor. per. et chil. II page 12 Tab. 122 fig. b.--Gay V page 41; (F. imbricata) R. et Pav. var araucana Phil. Anal. Univ. Santiago, vol. 90 (1895) page 759. "Pichi."

Much branched shrub with the main branches vertical, the lateral branchlets short, very numerous. Leaves very numerous, atejadas (appressed?), sessile, ovate, scaly, hairy, entire, concave on the upper side, sometimes marked by 2 furrows on the dorsal side (in consequence of the desiccation?); from 1-1.5 mm. long; (more loose and larger in the variety araucana founded on a dried specimen). Flowers solitary, terminal in the lateral

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branches, sessile, vertical. Calyx very short, prismatic with 5 short, obtuse teeth. Stamens inserted in the lower part of the corolla, of unequal length. Anthers short, much escotados (hollowed out? depressed? sulcate?) in the apex. Style with the stigma subglobular, very shortly bilobed. Capsule 5-6 mm. long. Shrub 1-2 m.

From the province of Coquimbo to the Patagonian region, also on the Argentinean side, mainly in the gravel along rivers. The infusion of the leaves served as diuretic (Murillo, Plantes med. du Chili, page 136; Sierralta in Anal. Univ. Santiago, vol. 69 (1886) page 487).

var. biflora Remy, Gay V, page 41 (like the species but Remy and again Weddell admit the possibility that it might look like a variety of F. imbricata).

Stems ± procumbent (always?). The leaves somewhat larger, more spreading. The terminal flowers from 1-2.

In the cordilleras of the central provinces.

2. F. viscosa Hook. and Arn. Bot. Beech. page 36 in annot. --Gay V, page 42; (F. ericoides Dun. in D.C. Prodr. XIII to page 590; F. densa Remy, mentioned by Phil. Anal. Univ. Santiago, Vol. 90 (1895) page 762). "Pichinilla"

Shrub with the bark ashen-yellow, puberulent-viscid. Leaves alternate, sparser than in the other species, ± divergent from the branches, linear to linear-spatulate, obtuse, sometimes almost cylindrical with the dorsal surface level or raised (depending on the drying) from 5-7 mm. long; (in F. ericoides from 10-14 mm.) Flowers terminal on the lateral branchlets. Calyx bell shaped, prismatic, with 5 divisions linear-cylindric and ± equal in length to the tubular part. Corolla yellow-white, from three to four times the length of the calyx. Divisions of the limb broadly triangular-oblong, acuminate, reflexed. Stigma short, thick, bilobed in F. ericoides according to Dunal almost membranous and peltate perhaps because of the pressure during pressing. Capsule yellow, from 5-7 mm. long.

In the cordilleras of the provinces of Atacama and Coquimbo (Huanta, 2,200 m.) January, February.

3. F. deserticola R.; F. ericoides Dun. ex Phil Viaje a la prov. Tarap. page 61, Num. 273)

Shrub with thick, rigid branches, covered with ash-colored bark. The new branches, leaves and flowers densely hairy and glandular. Leaves thick, narrowly linear, markedly divergent from the branch, of a yellow green, obtuse, from 8-10 mm. Flowers numerous, terminal and axillary, shortly peduncled. Calyx bell shaped cylindrical, 10-ridged, opening in 5 triangular-lanceolate acute divisions. Corolla twice the length of the calyx, yellowish white. The limb of 5 triangular, acute divisions. Stigma short, thick, bilobed. Capsule yellow, 5 mm. long.

In the high cordilleras of the province of Antofagasta. (3,000 m.) January.

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4. F. coridifolia Dun. D.C. Prodr XIII page 590; (according to Wedd. chlor. and. II page 94, the original name of cordifolia is a slip of the pen for coridifolia; F. lutescens Phil. Anal. Univ. Santiago vol. 90 (1895) page 760.)

Shrub with the main branches spreading (always?) reddish yellow; the secondary branches ascending, much branched, viscid-puberulent varnished. Leaves narrowly linear, obtuse, narrow toward the base, pulverulent, plane on both sides, 6-10 mm. long by 1 mm. wide. Flowers solitary, shortly peduncled; the calyx tubular-prismatic, with 5 linear-cylindrical, obtuse teeth; 3-5 mm. Corolla white, with 5 ovoid, sharp divisions; 12 mm. Stems 0.5-1 m.

In the cordilleras of the province of Coquimbo.

*5. F. squamata Phil. Viaje a la prov. Tarap. page 61 Num. 271.

Small shrub with erect branches entirely covered with appressed ovate-triangular leaves between which shoot forth resinous yellow masses; 1.5-2 mm. long. Flowers terminal on the branchlets, on our museum sheets already destroyed. Divisions of the calyx leaf-like. Corolla green, cylindrical, 5 mm. long. Capsule of 5 mm.

Province of Tarapaca. (Cebollar 4,200 m.)

6. F. barriosi Phil. Anal. Vol. 90 (1895) page 763. 'Tolilla.'

Much branched shrub with the old branches covered with a grey, rough bark. The new branches and the leaves hairy, glandular-varnished. Leaves very narrowly linear-spatulate, obtuse, up to 10 mm. long. Flowers terminal and lateral, shortly peduncled. Calyx with the tube short, bell shaped, of 5 linear divisions, obliquely extended and longer than the tube. Corolla intensely yellow, twice as long as the calyx; the limb of five short, wide, acuminate divisions. Stigma globular, shortly bilobed. Dics conspicuous, orange-colored. Capsule 5 mm. long. Stems 1-1.5 m.

In the southernmost corner of the province of Coquimbo, near the mouth of the river Limari, at the eastern foot of the mountain Frai Jorje. September.

*7. F. denudata, Miers, Lond. Journ. Bot. V (1846) page 163.--Gay V, page 43. 'Tolilla.'

A small broom-like shrub, with many slender, vertical, prismatic, somewhat flexuous branches, varnished-viscid and terminating in spines. Leaves scarce, caducous, linear-spatulate, obtuse, fleshy, up to 10 mm. long. Flowers terminal and lateral, shortly peduncled, from 2-4 mm. long. Flowers terminal on the branchlets. Calyx tubular with five triangular short teeth. Corolla white, 8-10 mm. long, with the tube narrow, pubescent outside, and the limb divided into 5 somewhat deep, plaited divisions. Disc waxy, bilobed. Capsule greenish-yellow, 5 mm. long. Shrub of 0.8 to 1.5 m.

From the high cordilleras of the province of Tarapaca toward the south in the Argentine and Chilean territory, according to Miers even in the cordilleras of Mendoza. January, February.

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*8. F. bryoides Phil. Flor. atac. N.° 278 Tab. V fig. D.
"Pata de perdiz": a partridge's foot.

A low shrub, somewhat varnished, with many thick, cylindrical vertical branches, entirely covered with lateral, short, subglobose branchlets, densely clothed with little scale-like leaves 1-1.5 mm. long. Flowers terminal in the ascending small branches. Calyx cylindrical, with five linear divisions. Corolla white, 1 cm. long; the tube very narrow toward the base, enlarged toward the top, contracted below the limb, with five small, deep, obtuse plaited divisions. Stigma subglobose, shortly bi-parted. Capsule subglobose, 2-3 mm. long.

In the high cordilleras of the provinces of Tarapaca, Antofagasta, Atacama; around 4,000 m.

Observation 1: F. grandiflora Dun. D.C. Prodr. XIII page 591 and F. squamuligera Dun. l. c. are Nolanaceae.

Observation 2: The small species of Benthamiella Speg. are of Southern Patagonia, without reaching Chilean territory.

12. Vestia - Willd.

Calyx cylindrical--bellshaped with five teeth. Corolla with the tube large, cylindric, contracted at insertion of the stamens, hairy inside; a little enlarged toward the limb of five divisions, finally deciduous with the exception of the base. Stamens 5, exserted, ± of equal length. Anthers short, dorsifixed, with the lobes separated. Disc little marked. Style exserted with the stigma shortly bilobed. Ovary bilocular. Capsule ovoid, obtuse, longer than the calyx, opening in two valves, ± bifid. Seeds numerous, irregularly polyhedrical with the embryo almost erect inside the endosperm. Hairy shrubs, with the leaves entire and 1-3 flowers on lateral branches. A Chilean species.

1. V. lycioides Willd. Enum. Hort. Berol. page 208.--Gay V, page 97; (Cantua ligustrifolia Juss.; Cantua foetida Pers.; Periphragmos foetidus R. and Pav; Cestrum vespertinum Hort. Val) 'Huevil'.

Hairy shrub with long, green branches. Leaves of a clear green with some scattered hairs when new; subovate or lanceolate-elliptic, tapered toward the base, associated with small axillary branches; up to 6 cm. long. Flowers nodding, peduncled. Calyx 1 cm. in length, their teeth little marked. Corolla yellow, 4 cm. long, green or purple. Seeds dark red, 2-3 mm. Shrub from 1-1.5 m.; fetid, closely resembling Cestrum parqui L'Herit., not at all the habit of a species of Fabiana, as upheld in Naturl. Pflanz.-Fam. IV 3. b. page 32.

From the province of Valparaiso to Llanquihue and Chiloe in humid thickets. November to February.

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13. Nicotiana. - L. (*)

Calyx ovoid or cylindrical-bell shaped, of 5 divisions. Corolla infundibular or hypocraterimorphic with the tube cylindrical, sometimes enlarged above or contracted at the throat. The limb of five divisions of induplicate aestivation. Five stamens inserted in the lower part of the corolla tube. Ovoid anthers with the locules deeply separated and of lateral dehiscence. Ovary bilocular. Style filiform with the stigma thick, shortly bilobed. Capsule dehiscent in two bifid valves. Seeds very numerous, very small with the surface deeply wrinkled. Embryo straight and slightly arcuate. Annual or perennial herbs, rarely shrubs. Leaves alternate, entire or at times sinuous-lobulate. Flowers in panicles or racemes. Corollas green, yellow, white or red.--- Ca. 40 species principally American; in Chile ca. 18 species of uncertain taxonomy.

Key to the sections.

I. Corolla generally yellowish-green (but see no. 4), infundibular to hypocraterimorphic, ventricose or cylindric, with the throat frenquently contracted. Flowers in racemes or panicles.....Section I. Rustica.

II. Corolla white or red, hypocraterimorphic, with the tube cylindrical and the limb segments obtuse or acute. Flowers in racemes or panicles.....Section II. Petunioides.

Observation. In the section Tabacum (Corolla infundibuliform with the throat inflated and the limb horizontally extended; the flowers cymosepaniculate) there are no wild species in Chile, only the cultivated species N. tabacum L. of tropical America; those cultivated extend from the province of Aconcagua to Colchagua and to some extent even farther south; it is also found as an ornamental.

(*)Comes, O. Monographie du genre Nicotiana. Naples 1899.-This monograph unfortunately omits some of the Chilean species.

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Key to the species.

Section I. Rustica

I. Leaves ovoid-cordate.

A. Plants woody, shrubby, glaucous.....1. glauca

B. Plants herbaceous, or woody only at base, not glaucous.

1. Plants green.

a. Leaf blade very ruggose. Calyx divisions scarcely acute.....2. breviloba

b. Leaf blade undulate, almost ruggose. Calyx divisions acute.....3. solanifolia

2. Plants with younger portions white-tomentose4. cordifolia

II. Leaves not cordate, oblong, almost linear.

A. Leaves with the margins frequently crisped.

1. Leaf blades oblong-lanceolate, the lower ones up to 15 cm. long.....5. Pavonii

2. Leaf blades oblong-linear, up to 4 cm. long.6. crispa

B. Leaves with the margins entire or undulate

1. Corolla 10-15 mm. long

a. Upper leaves in the form of large bracts

a. Stems elevados (ascending ?), leafy...7. longibracteata

b. Almost all the leaves in a radical rosette.....8. frigida

b. Upper leaves not in the form of bracts....9. brachysolen

2. Corolla 8-10 mm. long

a. Flowers arranged in little heads or terminal spikes.

a. Lowest leaves oblong

o. Stems leafy, branched.....10. oulophylla

oo. Stems with few leaves, little branched, scape-like.....11. monticola

b. Radical leaves (all?) narrowly linear.12. linearis

b. Flowers in racemes. Stem much branched, with linear leaves.....13. floribunda

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Section II Petunioides

I. Corolla tube 5 (-7) times the length of the calyx.

A. Leaves crispate-undulate.....14. noctiflora

B. Leaves entire or undulate.

1. Lower leaves and those of the middle mostly acuminate-acute.

a. Corolla tube narrow, gradually dilated upwards.....15. acuminata

b. Corolla tube narrow within the calyx, then abruptly dilated.....16. caudigera

2. Lower leaves and those of the middle oblong, acute.....17. longiflora

II. Corolla tube 2 1/2 times the length of the calyx (*).....18. angustifolia

Section I - Rustica

1. N. glauca Grah. Edinb. N. Philos. Journ. (1828) p. 175; Bot. Mag. tab. 2837; Comes l.c.p. 26; (N. arborea Dietr.; Nicotinodendrum glaucum Griseb.).

Small tree or hairy shrub, glaucous. Leaves largely petiolate, unevenly ovate - heart-shaped, acuminate, entire or slightly wavy; laminas up to 10cm. long on petioles of 3-4cm. Flowers numerous and panicled. Calyx cylindrical-ovoid, from 3-10mm. long, with five short acute teeth. Corolla yellow, the tube pubescent, cylindrical, from 3-4cm. long. The limb of five ovoid, very short divisions. Capsule of the length of the calyx. Trunks of 1.5-3m.

Plant of Brazil and Argentina; for some years acclimated in the littoral zones of the provinces of Aconcagua, Valparaiso and Santiago; closely resembling Cestrum parqui but distinguishable by the glaucous color of the leaves, and the capsules. December to February.

(*) Compare the varieties of Nicotiana acuminata.

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*2. N. breviloba Jeffrey, Kew Bull. (1894) p. 102, No. 87; Comes l.c. p. 25.

Herbaceous plant, glandular, pubescent. Leaves petiolate, broadly ovate, heart-shaped, very undulating and crisped on the margins, with the anthers rounded; laminas 12-18cm. long by 12 cm. wide. Flowers panicled, very shortly peduncled; the peduncles with very small, pointed bracts. Calyx from 12-14mm. long, bell shaped, with uneven triangular, scarcely acute teeth. Corolla of 4cm., cylindrical, somewhat inflated at the top, with the divisions of the limb small, rounded, reflexive. Stamens enclosed in the corolla tube inserted in lower half of tube; the filaments hairy toward the insertion. It does not exist in the National Museum and seems little different from the following species.
Province of Coquimbo (Cuming.).

*3. N. solanifolia Walp. Rep. Bot. Syst. III (1844-45) p. 12 - Gay V, p. 55; (Comes l.c.p. 26; (N. cardiophylla (Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 772.)

A perennial plant, robust, tall, glandular, pubescent. Stalk thick, branchy, sometimes a little woody. Lower leaves petiolate, ovate-orbicular, soft to the touch obtuse, with the margins undulate to crisped, closely pubescent on the principal nerves, the base heart-shaped, up to 30cm. long. The leaves becoming successively smaller up the stem. Numerous flowers, laxly paniculate. Calyx ovoid; with five short, acute, uneven teeth 1cm. long. Corolla greenish yellow, with the tube broadly cylindrical, of 4-5cm., somewhat contracted toward the base and under the limb of five short, broad, obtuse, reflexing divisions. Capsule of 1.5cm. shorter than the calyx. Stalks 1-2m.

A very ornamental plant of the littoral region of the Province of Atacama, between 25° and 28° l.m. September - October.

J.F.4 N cordifolia Phil. Bot. Zeit. XIV (1856) Column 646; Joh. Flora de J.F. p. 83; Comes l.c. p. 26)

Perennial plant, robust, tall; youngest parts and the interiores (inner?) surfaces of the leaves finely and densely white tomentose. Stems thick, branching, somewhat woody. Leaves petiolate, suborbicular to ovate-orbicular, obtuse, with the margins entire, somewhat undulate, the upper surface green, very slightly pubescent; the nerves white-tomentose. Numerous flowers flojamente (loosely? or flexuous?) paniculate. Calyx cylindrical with five very short teeth; from 8-10mm. Corolla of a darkish violet, white-pubescent outside, the narrow tube dilated toward the top, from 2-2.5cm. long; the limb of five short, obtuse divisions reflexed at the ends.

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Capsule bivalved, as long as the calyx. Stems 1-2m.

Archipelago of Juan Fernandez; endemic plant in Masafuera (Quebrada de las Vacas). October.

*? 5. N. Pavonii Dun. DC. Prodr. XIII to p. 561; Comes l.c.p. 29.
Annual plant, viscid, with the stem somewhat tomentose. Leaves ovate or ovate-lanceolate; all of them indistinctly wavy-dentate at intervals ending in a long petiole, acute or acuminate, pubescent on both surfaces, the laminas up to 15 cm. long by 5cm. wide on petioles of 3cm. Flowers in flojas (weak? flexible?) racemes on long, axillary rhaches. Peduncle with a bract at the base. Calyx almost bilobed, one of its five teeth being much longer and wider than the others. Corolla yellowish with the tube inflated, cylindrical, contracted below the limb, of 2cm., long, i.e. double the length of the calyx. The limb of five very short obtuse divisions. Capsule covered by the enlarged calyx. The only specimen preserved differs in the leaves being very much crisped and by being more hirsute-glandular than tomentose; can it be of this species? Stem 0. 5m.

In Peru, Bolivia, Uruguay; in the extreme north of Chile: Prov. of Tarapaca (Napa) according to Phil. Viaje a la prov. Tarap. p. 62, no. 275.

6. N. crispa Phil. Flor. atac. Num. 280, not Cav. nor Desf.
Apparently a perennial, hirsute-glandular. Stems several from the same root, branched. Leaves sessile, oblong-linear, pinnatilobate, with 4-5 pairs of obtuse crisped lobes, 3-4cm. long. Axillary flowers toward the end of the branches, shortly peduncled. Calyx bellshaped-cylindrical, 6-8mm., with five ovoidoblong acute divisions. Corolla yellowish-green, with the tube cylindrical, narrow within the calyx, then abruptly enlarged, 2cm. long. The limb very short, of five successive heart-shaped, folded divisions, not horizontally extended. Hairy filaments in the base very prominent in the corolla tube. Capsule as long as the calyx. Stalks 0. 3-0.6m.

In the high meadows of the provinces of Antofogasta and Atacama. January-February.

VII. N. longibracteata Phil. Viaje a la prov. Tarap. p. 62, no. 276; Comes l.c. p. 30.
Glandular-puberulent plant; fetid, viscid. Stem slender. Leaves a little hairy, with the margins entire or undulate, ciliate; the lower ones oblong, acuminate, tapering into a long petiole; the successive ones on petioles shorter with the blades shorter and sharper; the upperones in the form of long and very narrow linear bracts. The lower leaves up to 12cm. long by 2.5cm. wide. The few very shortly pedunculate flowers form a narrow panicle among the floral leaves.

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Calyx cylindrical, inflated membranous, marked by 5 green nerves, 12mm. long, extended in 5 short, obtuse, almost equal teeth. Corolla green, a little longer than the calyx, its tube narrower in the lower part; the limb of 5 short, obtuse divisions, of a green darker than the tube. Capsule unknown. Stems 0.4m.

Province of Tarapaca (Incahuasi, 3500m.). January.

*8. N. frigida Phil. Flor. atac. No. 282.
Annual plant, hirsute-glandulous, mainly toward the apex. One or many straight stems. Almost all of the leaves in a radical rosette, narrowly lanceolate, acute, the lower ones tapering into a long petiole; the upper ones (of the floral region) sessile; the lower ones almost 8cm. long; the petiole taking up half of the length. Flowers few, arranged in a terminal raceme; the peduncles ("pedunculos" but = pedicels ?) from 8-12mm., in the axils of the bracts, i.e. floral leaves. Calyx cylindrical, membranous, except for the 6 green nerves; el limbo abierto (spreading above ? or merely passing into ?) in 5 very short triangular teeth; 1cm. long. Corolla 1.5cm., green with the limb of 5 folded, semi-circular ovate divisions. The filaments very prominent in the interior of the corolla tube. The calyx increases with the development of the ovoid capsule which measures 12mm. long by 7mm. wide. Stems 0.1-0.2m.

In the high cordilleras of the provinces of Atacama and Coquimbo.

*9. N. brachysolen Phil. Viaje a la prov. Tarap. p. 62 no. 279; Comes l.c. p. 30.
Viscid, puberulent plant with the stem branched, furrowed (when dry). Leaves casi pelados (somewhat hairy) the lower ones rosulate? oblong acute, with margins undulate, narrowed into a petiole, to 15cm. long by 2.5cm. wide; the leaves of the slender stems sessile, with the base dilated, of much smaller dimensions. Flowers disposed in axillary racemes, vertical; pedunculos (pedicels?) very short (3-4mm.). Calyx cylindrical, 9mm., almost bilobed with one much larger segment, hirsute-glandular. Corolla greenish, a little larger (12mm.) than the calyx; corolla tube cylindrical, a little contracted under the limb of 5 broad acuminate divisions. The filaments hairy in the base. Capsule ovoid, hidden in the calyx. Stems 0.5m.

Provinces of Tacna, Tarapaca (Calcahuay) to Atacama.-- The specimens from Torona (Prov. of Tacna) are like N. undulata R. and Pav.

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10. N. oulophylla Dun. DC. Prodr. XIII p. 560; (Petunia viscosa Miers, ex Colla, Mem. Tor. vol. 38, p. 135, tab. 45; N. parviflora Phil. Linnaea XXXIII p. 198; N. Collae Phil. Anal. vol. 90 (1895) p. 765).

Annual plant, hirsute-glandular. Lower leaves in a rosette, sometimes already dead on flowering, oblong, tapering into a petiole, with the apex acuminate or acute and the margins entire or wavy. The leaves of the slender stems sessile, narrower and sharper, the upper ones filiform. The dimensions of the leaves variable according to the robustness of the individual. Stems simple or branching from the base. Flowers few, in the axils of the bracts, on spikes or short branches and crowded toward the end of the branches. Calyx cylindrical-prismatic, membranous between the ribs, divided to the middle, into 5 linear, obtuse teeth, from 6-8mm. Corolla greenish-yellow, little larger than the calyx, with the tube cylindrical, dilated, then somewhat contracted under the limb of 5 sub-triangular divisions. Capsule covered by the calyx. Stems 0.1-0.4m.

Province of Atacama to Valparaiso, in the littoral zone and in the interior. September to December.

11. N. monticola Dun. DC. Prodr. XIII p. 564; Comes l.c.p.31; (N. alpina Poepp. mscr.; N. Miersii Remy, Gay V. p. 56 N. corymbosa Remy, l.c.p. 57; N. lychnoides Remy, l.c. p. 57; N. scapigera Phil. Flor. atac. no. 281; ? N. parvula Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 768).

Annual plant, very variable. One stem, or various ascending ones, hirsute-glandular. Lower leaves in a rosette, oblong, obtuse, a little hairy, narrowed in a long petiole, with the margins somewhat undulate, dimensions varying with the individual; the leaves of the small stems few, shorter. The lower flowers spring from the axils of the radical leaves; the others are arranged in terminal inflorescences which are panicles contracted into the shape of little heads. Calyx hirsute-glandular, cylindrical, almost membranous, with 5 more obscure nerves, from 4-5mm. long, with 5 short obtuse teeth, somewhat unequal. Corolla of a pale green, yellow to whitish, twice the length of the calyx. Tube cylindrical; the limb of five short, scarcely extended divisions. Capsule of 2 bifid valves, at the end somewhat longer than the calyx. -N. parvula with the flowers less crowded together into a little head.

From the provinces of the North (Tarapaca) to the central provinces in the cordilleras; here at times dwarfed individuals reach the snow regions. January, February.

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12. N. linearis Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 766.
Differs from the preceding species (to which it could possibly united as a variety) by being ash-colored-hirsute and in the shape of the radical leaves which are narrowly linear (in one of the two existing specimens there is also an oblong leaf). Stems 0.1-0.2m. Cordilleras of Talca.

*13. N. floribunda (Phil.) R.; (Waddingtonia floribunda Phil. Flor. atac. no. 283; Petunia parviflora Juss. sec Benth. et Hook. Ind. Kew.; compare also specimens asemilladas de (assimilated from?) N. oulophylla).
Annual plant, shortly glandular-hirsute. Stem straight with various branches arramilletadas (?) from the base. The lower leaves oblong, the others lanceolate, acute, 2.3cm. long, the upper ones narrow to filiform. Flowers racemose or axillary, the leaf or bract being larger than the flower. Calyx divisions as long as the tube. Corolla of an unknown color, 1 1/2 times as long as the tube; the tube narrow, the limb short, little extended. Capsule shorter than the calyx, opening in four valves (not in 2 valves as it must be in Petunia). Seeds of a dark brown. Philippi attributes to his Waddingtonia valvate aestivation of corolla lobes; but surely it is the same induplicative aestivation as the genus Nicotiana.

Desert of Atacama (Chanaral, Las Animas); Province of Coquimbo (Waddingtonia coquimbana Phil. ex sched.).

Section II. Petunioides.

14. N. noctiflora Hook. Bot. Mag. tab 2785; DC. Prodr. XIII p.566; Comes l.c. p.38.--Gay V. p. 53, "Tabaco."
Perennial plant, glandular-puberulent, with the stem branching. Lower leaves oblong, petiolate, obtuse; the next ones lanceolate, sessile and acute, the margins crisped; the upper ones linear, entire; those of the middle 3-5cm. long. Flowers loosely paniculate. Calyx cylindrical with 5 lanceolate, unequal teeth 1cm. long. Corolla whitish inside, reddish outside, odorous, open only at night; tube up to 4 times as long as the calyx; limb open in 5 obtuse obcordate sections. Stamens of unequal length, with the base hairy. Capsule longer than the calyx. Stems o.5-0.8m.

In the low cordilleras from the Province of Aconcagua to those of Maule; also in Argentina. January, February.

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15. N. acuminata Grah. Bot. Mag. tab. 2919; DC. Prodr. XIII p. 567; Comes l.c. p. 38. - Gay V. p. 53; (Petunia acuminata Grah.)

Annual plant, glandular-puberulent, with branching stem. Lower leaves broadly ovate-lanceolate, entire, petiolate, very acuminate-acute, sometimes somewhat heart-shaped; in robust individuals the blade to 10cm. long on a petiole of equal length; the leaves of the tallinas (slender stems?) successively narrower and smaller; the upper ones very narrowly linear. Flowers loosely racemose or paniculate. Calyx cylindrical, membranous, green only along the 5 nerves; open in 5 unequal narrowly linear teeth, almost as long as the tube; the total length of the calyx 1-1.5m. Corolla white, hypocraterimorphic with the tube very large, narrow, from 4-6 cm. The limb open in 5 horizontally extended divisions, marked by a green line on the lower surface, obtuse, escotadas (emarginate?). Capsule somewhat longer than the cylindrical part of the calyx.

From the province of Aconcagua across the central provinces, as much in the littoral zones as in the interior, also in the low cordilleras. December to February.

var. parviflora Comes l.c. p. 39; (N. Berteriana Hort. Monsp.; DC. Prodr. XIII p. 568; N. heterophylla Phil. Anal. Univ. Santiago vol. 90 (1895) p. 767).

Leaves narrower. Flowers smaller with the segments of the corolla mucronulate.

Provinces of Valparaiso, Santiago.

var. cirrhoides (Miers) Comes l.c. p. 39; (N. cirrhoides Miers, DC. Prodr. XIII p. 567. - Gay V. p. 54).

Leaves narrower, attenuated in a slender appendage, dilated toward the end. Segments of the corolla "cuspidados" terminating in a short point; but in DC. l.c. it says that these segments are narrow and terminate in a very large cusp. There are no specimens in the National Museum.

Province of Valparaiso (Concon).

var. multiflora (Phil.) R.; (N. multiflora Phil. Linnaea XXXIII p. 197).

The type differs by being more robust, with the stem thick, much branched. Leaves large (up to 25cm.) ovate. Flowers numerous. The corolla tube 3-4 times the length of the calyx.

Province of Aconcagua (Choapa).

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Observation: N. uspallatensis Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 770 seems based on robust individuals of N. acuminata (with the lower leaves somewhat heart-shaped); It is from the Argentine side of the fields of Aconcagua (Banos del Inca).

*16. N. caudigera Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 764; N. modesta Phil. l.c. p. 765).

Annual plant, somewhat glandular-hairy. Stems branched or simple. Lower leaves largely petiolate, oblong, acuminate, dimensions varying with the individual. Cauline leaves of the same shape with the base cuneiform and the apex very tapered (drawn out). The upper leaves narrow. Flowers racemose, towards the end of the branches throughout the inflorescence shortly pedunculate (pedunculadas, but = pedicel?) (3-4mm.). Calyx ovoid-cylindrical, membranous, green only along the length of the nerves; the teeth uneven, filiform, as long as the tube of the calyx, up to 2cm. Corolla white, with the tube narrowly cylindrical only within the calyx, then broadly tubular; somewhat contracted just under the limb with its 5 obtuse, short divisions, finally spreading horizontally; the corolla tube 4cm long. Capsule ovoid, covered by the enlarged calyx. -It differs from N. acuminata only by the wider corolla tube.

In the low cordilleras of the Province of Atacama.

17. N. longiflora Cav. Descr. p. 106; DC. Prodr. XIII p. 566; Comes l.c. p. 43. - Gay. V. p. 52.

Perennial plant, glandular-hairy. Stalk branching, cerdoso (bristly?)-harsh. Lower leaves in a rosette, spatulate-lanceolate, undulate, obtuse, attenuated in a short petiole, the successive ones oblong, heartshaped-lanceolate, semi-clasping, undulate, somewhat denticulate; the upper ones linear. Flowers loosely racemose. Calyx cylindrical-bellshaped with 5 unequal, linear-lanceolate segments. Corolla white-violet, hypocraterimorphic, somewhat hairy outside, open and fragrant at night; the tube slender-cylindric up to 7 times the length of the calyx, inflated under the limb of 5 ovoid-lanceolate, obtuse divisions, sometimes escotadas (literally "Hollowed out"). Capsule as long as the calyx.

In Mexico, Brazil, Paraguay and Argentina; in Chile only the following variety.

var. pauciflora (Remy) Comes l.c. p. 44; (N. pauciflora Remy, Gay V. p. 52; N. copehapina Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 771).

The leaves pubescent; in Remy's description he does not say which are semi-clasping. Only a few flowers (2-7), far apart. Corollas to 7cm. long, with quite a wide tube (accord-

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ing to the description of Remy and the specimens in the National Museum). Stamens exserted (Remy). Capsule covered by the calyx.

Provinces of Atacama, Coquimbo, Aconcagua (Choapa, Los Andes), O'Higgins (Rancagua). January.

Observation: This seems to belong to N. oligantha Phil. Anal. Univ. Santiago, vol. 90 (1895) p. 767, whose specimens have been lost.

Annual with stem erect, slender, densely hairy-hirsute. Leaves petiolate, sharp, the lower ones ovoid, the successive ones consecutively more narrow; the lower ones with blades of 7 cm. on petioles of 4-5cm. Flowers racemose, numbering 2-7. Pedunculos (pedicels?) 1cm. Calyx of the same length; the teeth slightly unequal, obtuse, linear, as long as the tube. Corolla white with the tube narrow, 5 times as long as the calyx. The limb of 5 obtuse divisions. Fruit unknown. Stem 0.45m.

Province of Talca.

18. N. angustifolia R. & Pav. Flor. per. et chil. II p. tab. 130, fig.a; Comes l.c.p. 51 - Gay V. p. 55; according to the Ind. Kew. it is identical with N. pusilla L., which seems hardly probable).

Annual plant, viscid pubescent. Stem with long thin branches. Lower leaves lanceolate, narrowed into a short petiole, entire the following ones successively more narrow; the lower ones up to 7cm. long. Flowers panicled. Short pedunculos (peduncles? pedicels?). Linear bracts. Cylindrical calyx with 5 uneven teeth of 10-12mm. Corolla white with the tube cylindrical, green, of 2.5-3cm., 3 times (according to Remy 5 times) the length of the calyx. The limb of 5 ovoid-acute divisions. Capsule conical, obtuse; longer than the calyx (according to Remy shorter than it). Stems 0.2-0.3m.

In Chile (Concepcion), in Brazil. I have not seen typical specimens; according to Remy (in Gay l.c.) the figure of R. & Pav. is bad, but the description which Remy gives of the species does not permit distinguishing it from N. longiflora; Comes adheres to the diagnosis of R. & Pav.

var. crispa Comes l.c.p. 52; (N. Cavanillesii Dun. DC. Prodr. XIII p. 572.

A small plant, with the stem harsh, slender with the apex forked. Leaves lanceolate-linear, undulate-crisped. Panicles dichotomous. Calyx villous, corolla tube 3 times

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the length of the calyx, the limb small with obtuse, suborbicular segments.

Peru, Argentina; in Chile according to a specimen gathered by Nee and conserved in the herbarium of Madrid; it is not represented in the National Museum.

PROBLEMATICAL SPECIES

(1) N. Langsdorffii. Weinm. according to Comes l.c. page 28. it is also found in Chile; according to D.C. Prodr. in Ind. Kew. it is a Brasilian plant. In the Herb. Mus. Nac. there is no specimen of Chilean origin.

*(2) coquimbana Phil. Anal. Univ. Santiago vol. 90 (1895) page 769.

Annual plant, low, hairy. Stem slender. Radical leaves almost rosetted, oblong, acute, narrowed into a short petiole. Leaves of the slender stems linear, acuminate, sometimes with the margins undulate. Flowers arranged in loose panicles, very shortly pedunculadas (peduncled? pedicelled?). Calyx 8mm. long; its teeth as long as the tube. Corolla green, 2 1/2 times as long as the calyx; the divisions of the limb short, obtuse. Fruit unknown. The specimens all lost.

Province of Coquimbo (Paihuano.)

Observation 1: On the use of tobacco in Chile before the conquest, Dr. Lenz communicated the following paragraph to me:

The aborigines of Chile used tobacco, smoking it in a pipe or cuchimba (kita) and drawing the smoke through the mouth or absorbing the fine dust through the nose. It seems that before the conquest this use was limited to the religious and medicinal ceremonies of the sacerdotal doctors. But Nunez de Pineda and Basunon in the "Happy Captivity", page 160, speaking of an Indian say: "Zahumar con el humo de la quita que traia en la boca de ordinario". I do not know if the generalization of the custom of smoking is due to the importation of a better type of tobacco. Before the conquest it might have been that in the ceremony only Chilean or cultivated species of tobacco were used. (April 1908).

Observation 2: The genus Dittostigma Phil. occurs in the Argentine Republic (Mendoza) not in Chile as sustained in the Ind. Kew., Naturl. Planzenfam., Genera siphonogamarum, etc.

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14. Petunia - Juss.

Calyx of five deep obtuse divisions. Corolla infundibuliform or hypocraterimorphic, with the tube cylindrical or dilated toward the throat; the limb of five divisions of atagada (?) aestivation. Five stamens of unequal length, one being shorter than the others. Anthers with the little cells much (deeply) separated. Ovary bilocular with many ovules. Style filiform with the stigma capitate or shortly bilobed. Capsule of two undivided valves. Seeds with the surface much wrinkled. Plants herbaceous with the leaves entire and the flowers solitary, axillary. Ca. 15 South American species; of the three Chilean species perhaps none is really of the genus; compare Nicotiana. P. nyctaginiflora Juss. (with respect to the hybrids) is an ornamental plant. Concerning P. viscosa Miers see Nicotiana oulophylla Dun.

I. Plants not low, tufted
   A. Stems spreading. Corolla infundibuliform-bell shaped..... 1. humifusa
   B. Stems erect, much branched. Corolla with the tube long, cylindrical.....2. Cumingiana
II. Small low plants, tufted..... 3. minima

*?1. P. humifusa Dun. D.C. Prodr. XIII page 574.

Annual plant with tendidos (spreading?) stems somewhat glandular-puberulent. Leaves somewhat fleshy, oblong-linear, subspatulate, undulate, obtuse, slowly tapered into the clasping petiole; the middle nerve prominent on the lower surface; from 3-4 cm. long. Solitary axillary flowers on long filiform peduncles (2.5-3 cm.). Calyx membranous, bell shaped, deeply parted in 5 oblong-linear obtuse divisions 1.5 cm. long. Corolla 2.5 cm. long with the tube narrow within the calyx, then abruptly infundibuliform or bell shaped; the base yellow, the rest of an unknown color. Stamens of unequal length, inserted in the top of the corolla tube, puberulent. Style straight, half the length of the corolla. Ovary short, subglobose. Stigma capitate. Fruit unknown. Stems 0.05-0.1. It isn't represented in the National Museum; perhaps a Nolanacea?

Province of Coquimbo.

?2. P. Cumingiana Remy, Gay V, page 50.

Plant glandular-hairy. Stem straight, much branched. Leaves desconicidas ( ). Flowers numerous, racemose or paniculate on horizontally extended peduncles. Calyx with the divisions linear. Corolla with tube 5 times as long as the calyx; the broad limb horizontally extended. Filaments hairy. Capsule unknown. It must (may?) be a Nicotiana.

In Chile.

+3. P. minima (Phil.) R., (Nicotiana ? minima Phil. Linnaea XXXIII, page 198, the notation of the Catalogue plant vasc. Chil. page 225, that N. minima Phil. = Nierembergia repens R. and Pav. is false.)

Perennial plant with a number of short stems arranged in tufts. Hairy leaves, in thick rosettes, spatulate-rhomboidal,

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very obtuse, slowly attenuated into a petiole, with the margins entire. From 6-8 cm. long. Flowers solitary, on short lateral branches; on the only specimen analyzed some of the little leaves almost in little rosettes on this small branch. Calyx deeply parte in five uneven, linear, reticulate-nerved, obtuse divisions, somewhat hairy at the base; 7 mm. long. Violet colored with other darker colors, hypocraterimorphic with the tube cylindrical, hairy outside; the limb open in five short, folded, triangular semi-orbicular divisions, hairy outside in the middle region. The tube 10-12 mm. long, the limb 8-10 mm. of diameter. Anthers kidney shaped. Filaments hairy toward the base. Grains of pollen with four germ pores in tetrahedrical disposition (as in Nicotiana). Ovary bilocular with various ovules in each cell. Style filiform with the stigma subglobular, lightly bi-parted. Fruit unknown. Cespedes (tufts?) from 0.03-0.04 mm. tall. This species seems close to Nicotiana acaulis Speg., N. Ameghinoi Speg. etc., which are of Argentine Patagonia.

Cordilleras of Valdivia (de Ranco), 1,800 m.)

15. Nierembergia - R. and Pav.

Calyx tubular, 5 teeth. Corolla with the tube long, narrow, abruptly enlarged in the throat like a funnel; its divisions of folded aestivation. Five stamens with the filaments united together, of unequal length. Anthers with the lobes well separated; ovary bilocular. Style filiform with the stigma transversally dilated, shortly bilobed. Fruit a capsule opening in 2 bifid valves. Seeds numerous, polyhedric, reticulate or wrinkled. Perennial plants, generally with the stems spreading, the leaves entire and the flowers solitary, axillary. Ca. 20 species from Mexico to the temperate region of South America; in Chile of a certainty only one species.

1. N. repens R. and Pav. Flor. per. et. Chil. II page 13 tab 123 fig. C. --Gay V page 45; (N. petiolata Remy, Gay V, page 46; Nicotiana minima Mol., not Phil. Catalog plant vasc. Chil. page 225.

Perennial plant with the stem creeping, slender. Leaves alternate, or several grouped in the joints, oblong-spatulate, obtuse, attenuated into a long petiole. Flowers shortly pedunculate; calyx cylindrical, hairy, with five acute lanceolate-linear teeth, shorter than half of the tube. Corolla with the tube very narrow, up to 5 cm. long. The limb 2.5 cm. in diameter, in the shape of a funnel, soft, white, yellow at the bottom, with five violet colored lines outside, corresponding to its five obtuse, rather shallow lobes. The filaments united into a tube up to their apex; of the five anthers two are thicker and placed higher up than the other three. The stigma much higher than the anthers, with 2 broad divisions that in the bud almost reach the upper anthers. Capsule covered by the old calyx (in N. petiolata longer, i.e. more persistent than in N. repens). Seeds polyhedrical, yellowish, very finely reticulated.

From the province of Curico (?) to Valdivia, mainly on the coast, but not lacking in the interior; a prized ornamental species of the plains. January to March.

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Problematical species or those other than of Chile (see Kew. Ind.)

1. N. anomala Miers = Bouchetia anomala (Miers) Loes. Engl. Bot. Jahrb. 29 (1901) page 105, comes from Texas and Mexico and differs from Petunia viscosa Miers = Nicotiana oulophylla Dun.

2. N. calycina Hook. is an Argentine plant.

3. N. frutescens Dun. in Chile; the diagnosis inaccessible in Chile; but certainly it does not deal with a Chilean species because here there is no frutescent woody species of this genus.

4. N. linariaefolia R. Grah. = N. filicaulis Lindl., is a plant of Brazil and Argentina.

5. N. linifolia Miers = Leptoglossis linifolia Benth. and Hook. is an Argentine plant.

6. N. prunellaefolia Dun. = Stenandrium dulce Nees.

7. N. rigida Miers is an Argentine plant.

8. N. subdentata Meyen = Boisduvalia concinna sp., Flora of Chile II page 253.

16. Salpiglossis - R. and Pav.

Tubular calyx, five parted. Corolla with the cylindrical tube broadening out toward the top in an enlarged limb of five divisions. Stamens 5, didynamous, sometimes only two fertile. Anthers with two lobes greatly separated, of lateral dehisence. A staminodia existing or lacking. Style filiform with the stigma enlarged funnel shape, a style resulting in the shape of a cornet; (in the section Reyesia in the form of a spoon). Capsule opening in four valves. Numerous, small polyhedrical seeds. --Herbs annual or perennial with the leaves sinuous or entire. Flowers largely peduncled, sometimes showy. --Ca. 8 species of Peru, Chile and of Argentina; in Chile 4 species, of which three belong to the North.

I. Corollas large, 4-5 cm. long
   A. Leaves entire. The lateral branches converted into spines at the end..... 1. spinescens
   B. Leaves sinuous. The branches not converted into spines at the end..... 2. sinuata

II. Corollas small, of 5-8 mm.
   A. Corollas yellow. Stigma typical..... 3. parviflora
   B. Corollas blue. Stigma in the shape of a spoon..... 4. chilensis

Section Eu-Salpiglossis Wettst. Stamens 4, didynamous; fertile. Stigma typical.

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17. Schizanthus - R. and Pav.

Calyx deeply parted in five linear or spatulate divisions. Corolla zygomorphic, bilabiate; the upper lip (of the open and definitely orientated flower) tri-parted with the central division undivided and the lateral one bifid, the lower lip tripartite, the central division escotada, ahuecada (emarginate? literally scooped out); the two lateral divisions entire. Four didynamous stamens; the two upper ones reduced to staminodias with the anthers aborted; the two lower ones larger and fertile, protected by the ahuecadas (hollowed out?) part of the lower lip; sometimes 1/5 of a staminodia short and without any sign of an anther. Style filiform with the stigma not thick or enlarged. Fruit a many seeded capsule; the two valves bifid.--Plants herbaceous, annual (always?), glandular, hairy, with the leaves alternate, pinnately lobed to bi-pinnate. Inflorescence in cymes with the flowers showy, corollas violet colored, yellow, but rarely white or rose colored. Ca. 16 species in part polymorphic; all of them Chilean species (or at least those of the cordillera and also invading the Argentine territory); from the provinces of the North to Llanquihue; some species are cultivated in Europe as ornamental shrubs.

I. Corolla tube erect. Corolla generally violet colored with the upper lip yellow.
  A. Corolla tube shorter than 1½ times the length of the calyx. (*)
    1. The lateral divisions of the lower lip linear-spatulate, obtuse
      a. Lateral divisions of the corolla shorter than the two middle ones.
        (a) Peduncles during anthesis from 5-10 mm.
          o. Calyx divisions narrowly linear-spatulate
            + Corollas large, up to 2 cm. in length from the insertion to the apex of the upper lip.....1. pinnatus
            ++ Corollas smaller
              x Leaves linear, entire to pinnatifid.2. alpestris
              xx Leaves oblong lanceolate
                z Segments of the lateral divisions of the corolla narrowly linear....3. gracilis
                zz These segments wide.....4. laetus
          oo. Calyx divisions widely spatulate, obtuse.
            + Leaves in the middle of the stem lyrate-pinnatisected.....5. latifolius
            ++ These leaves pinnatisected.....6. floribundus

* Compare S. Hookeri var. calycosus.

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(b) Peduncles very short (from 2-3 mm.) ..... 7. Gayanus 8. humilis

b. All the divisions of the corolla of the same length..... 9. litoralis

2. Lateral divisions of the lower lip sharp, sometimes very short

a. Corolla large, with the central divisions of the upper lip almost rhomboidal; capsule large, from 10-12 mm...10. Grahami

b. Corolla and capsule smaller

(a) Lower lip half of the upper.....11. laciniosus

(b) Lower lip a third of the upper lip.....12. San Romani

B. Corolla tube from double to triple the length of the calyx.....13. Hookeri

II. Corolla tube with the base arcuate. Corolla white

A. Leaves entire.....14. integrifolius

B. Leaves pinnately cleft to bi-pinnatisected

1. Leaves of a linear contour; corolla tube twice the length of the calyx.....15. lacteus

2. Leaves of an oblong contour, pinnatisected; corolla tube thrice the length of the calyx.....16. candidus

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"Solanaceas Argentinas

Clave para la determinacion de los generos"

(Argentinian Solanaceae--Key for determining the genera)

by
Anibal Roberto Millan, Ing. Agr.

Extracto del Boletin del Ministerio de Agricultura
de la Nacion, Tomo XXX, No. 1, 1931

The object of this work is to facilitate the determination of the genera of Solanaceae which grow in Argentina.[1]

For each genus I give briefly its most salient characters, the number of species cited for our country, distribution, most important species and the significance of the generic name. In regard to the bibliography I have only occupied myself with citing the works which permit me to determine our species with the greatest convenience; he who wishes more knowledge about the genus may refer to Dalla Torre and Harms, (Genera siphonogamarum) where he will find the list of synonyms and ample literature.

In Argentina the Solanaceae are represented by approximately 300 species and numerous varieties, distributed among 31 genera.

This family is of great agricultural importance in the species which are sown on a large scale in gardens and small farms; others have a limited cultivation for decorative purposes; some have a local utilization for diverse uses (fuel, material for construction); others are poisonous to livestock, and finally a few are obnoxious weeds to the farmer.

The drawings which illustrate these pages, with one exception indicated, are of specimens collected in this country and belong to the herbarium of the National Museum of Natural History[2] where I have done most of this work.

The numbers which accompany each figure indicate the magnification.

The specimens of the Venturi collection have been classified by Mr. Miguel Lillo who sent me the determination of the respective numbers, to whom I am grateful for this and other kindnesses, as well as to the gentlemen Castellanos, Hassler, Hicken, Hosseus, Molfino, Parodi and Rojas, for the kind cooperation which they gave me.

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1 In the boundaries of the genera and their grouping into subtribes I have followed Wettstein (Planzenfamilien de Engler and Prantl).

2 In addition to these I reproduce some drawings of others without indicating their origin in the description of the illustration. These are not mentioned among the "specimens figured."

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Key to the Sub-Tribes[1]

A. Embryo visibly arcuate (more than a semicircle).

B. Ovary with 2 carpels and with 3-5 irregular locules. Berry completely enveloped by the accrescent calyx.....I. NICANDRA.

BB. Ovary with 2 carpels and 2 locules before and and after anthesis, or with 4 locules after anthesis (Grabowskia); or with 3-5 carpels with 3-5 locules.

C. Anthers basifixed. Connective narrow or a little enlarged, situated between the divisions of the anther or in back of them.

D. Berry or drupe.

E. Corolla tube very short, abruptly dilated in the form of a cup; or corolla tube elongated or almost funnel-shaped. Filaments of the stamens not united at the base. .....II. LYCIINAE.

EE. Corolla rotate or funnel-shaped, with limb almost entire and with lobes broad or 5-parted. Filaments of the stamens at times joined together at the base.....III. SOLANINAE.

DD. Capsulas IV. HYOSCYAMINAE.

CC. Anthers dorsifixed or basified. When they are basified the connective is situated at the back of the anthers, it reaches the apex of the same and is swollen or gibbous. Berry.....V. MANDRAGORINAE.

BBB. Ovary with 2 carpels, with 4 locules in the mature fruit; in each locule a (false) thin wall divides the placenta in 2 equal parts. Capsules..... .....VI. DATURAE.

AA. Embryo straight or slightly curved (less than a semicircle).

B. 5 fertile stamens. Rarely one stamen smaller with filament and another somewhat atrophied. (At times--Bouchetia anomala (Salpiglossidae) has 5 fertile stamens.

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1 For greater clarity of the key I do not mention tribes.

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C. Berry — VII. CESTRINAE.

CC. Capsules — VIII. NICOTIANINAE.

BB. 2-4 fertile stamens. (at times Bouchetia anomala has 5 fertile stamens) — IX. SALPIGLOSSIDAE.

I. NICANDRAE

Herbs. Corolla actinomorfic, bell shaped; 5 stamens.

1. Nicandra Adanson (Fig. 1: a-e)

Glabrous annual, close to Physalis, differing from it principally by the 3-5 loculate ovary and the drier fruit.

The only species, Nicandra physaloides, known as a very poisonous plant, originates in Peru and in our country has become naturalized in the provinces of Tucuman, Jujuy and Salta.

The genus has been dedicated to Nicandro, physician of old Greece.

Specimen illustrated: leg. Hauman, Mus. Nac. No. 2087.

II. LYCIINAE

Trees or shrubs frequently thorny. Leaves simple and entire. Anthers of parallel locules and longitudinal dehiscence. Embryo almost peripheric, very curved and cotyledons semi-cylindrical.

Key to the Genera

A. Drupe of 2 stones (pyrenae). Aestivation imbricate. Corolla short-tubed, infundibular and with wide throat. ..... 2. Grabowskia

AA. Berry with 2 locules.

B. Aestivation imbricate. Stamens without dentiform appendages at the base. Corolla with tube elongated, more or less narrow, almost infundibular; or with tube very short, enlarged abruptly in the form of a cup with the throat (or mouth) generally large..... 3. Lycium

BB. Aestivation valvate-induplicate.

C. Corolla tubular or almost infundibular. Stamens inserted in the lower half of the tube, with dentiform appendages at the base ..... 4. Dunalia

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CC. Corolla almost bell-shaped or almost infundibular. Stamens without dentiform appendages at the base..... 5. Acnistus.

2. Grabowski Schlechtendal (Fig. 1: f-k)

Thorny shrubs, characterized principally by their fruit with 2 pirenas (stones? nutlets?). In our country there have been cited 6 species, distributed in the Formacion del Monte (Forest region) and in the Andean and Patagonian regions.

Grabowskia is dedicated to the German botanist H. E. Grabowsky.

Specimens illustrated: Grabowskia obtusa, leg. Venturi No.1797. G. sp., leg. Castellanos, Mus. Nac. No. 28/344.

3. Lycium Linn. (Fig. 1: l-u).

Shrubs, generally thorny, glabrous or a little pubescent. Lobes of the corolla 4 or sometimes 5, but this character is not fixed. Ovary with 2 locules. In some species with mucilaginous berries, the middle division is reabsorbed, the mature fruit appearing with only one loculate.

It is a very important and very little-known element of the Formacion del Monte. We have about 45 species and 10 varieties.

The name of the genus comes from Lycia, an old country of Asia Minor.

Specimens illustrated: Lycium cestroides, leg. Venturi No. 24 L. sp., leg. Venturi No. 962 (fig. 1: r-t). L. sp., leg. Venturi No. 4904 (fig. 1: u).

4. Dunalia Humboldt, Bonpland & Kunth (Fig. 1: v-y).

Shrubs, unarmed or thorny. The stamen filaments have an erect dentiform or filiform appendage at the base.

In this country we have only 2 species cited for Cordoba and Jujuy.

Dunalia is dedicated to Miguel F. Dunal, of the monograph of the Solanaceae in the Prodromus of De Candolle.

Specimen illustrated: Dunalia achalensis, leg. Rodriguez No. 1342.

5. Acnistus Schott (Fig. 1: z, A - C)

Trees, or shrubs, unarmed or thorny, glabrous or with the young branches shortly tomentose.

It is an element of Formacion del Monte (the forest formation). There have been about 10 species cited for our flora.

The name of the plant comes from the Greek name of a plant today unknown.

Specimens illustrated: Acnitus parviflorus leg. Venteri No. 232. A. Lorentzii, leg. Venturi No. 2915. A. australis var. grandiflorus, leg. Venturi No. 2614.

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III. SOLANINAE

Herbs, shrubs or trees. Leaves entire or pinnate, generally opposite.

Key to the Genera

A. Anthers of longitudinal dehiscence.

B. Calyx of fruit inflated and bearded, completely encircling the fruit.

BB. Calyx of fruit, never inflated..... 6. Physalis

D. Calyx with small pointed teeth. Corolla infundibular with limb 5-parted. Herbs at times with a woody base..... 7. Capsicum

DD. Calyx with broad teeth..... 8. Bassowia

AA. Anthers dehiscing by pores.

B. Seeds with or without sclerous nodules (analogous to those which characterize the fleshy tissue of the pears ..... 9. Solanum

BB. Seeds surrounded by a sclerous pericarp...10. Lycianthes

6. Physalis Linn. (Fig. 2: e-h)
C. G. Nees von Esenbeck, en Linnaea VI (1831) 431.

Annual or perennial herbs, with stem sometimes tall and strong, but not strictly arborescent. Hairs simple or stellate.
In Argentina there are 7 species cited.
The name of the genus comes from a Greek word which means blister, in allusion to the inflated calyx.
Specimen illustrated: Physalis viscosa, leg. Castellanos, Mus. Nac. No. 26/1973.

7. Capsicum (Tournefort) Linn. (Fig. 3: i-l)
H. C. Irisch, a revision of the genus Capsicum with especial reference to our garden varieties, in Missouri Bot. Gard. Rep. IX (1898) 53.

Fruit dry or somewhat succulent, with pericarp fleshy or slightly coriaceous. The middle partition generally disappears for the most part, but there can always be observed remains in the base of the fruit. Annual or perennial herbs, rarely with a woody base; frequently with branches divaricate.
Four species have been given for our temperate regions.
The pepper, (Capsicum annuum) is much cultivated in the whole country.
The name of the genus, of Greek origin, means "hot".
Specimens illustrated: C. microcarpum, leg. Venturi No. 1066 (fig. 2: i-k); leg Dennis (fig. 2:l)

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8. Bassowia Sublet (Fig. 2: m-p)
Witheringia l'Heritier

The Argentine species is close to Acnistus, but it differs fundamentally in the floral characters, the stamen filaments being joined at the base.

Only Bassowia spina alba (sub Witheringia), has been cited and only once for Oran, Salta.

The name of the genus was written Bassovia by Aublet, but Dalla Torre & Harms used the orthography that I have adopted.

According to Pfeiffer (Nomenclator botanicus) the origin of the generic name is not known.

Specimen illustrated: Bassowia spina alba, leg. Lorentz & Hieronymus, X-1873.

9. Solanum (Tournefort) Linn. (Fig. 2: q-y; fig.3: b)

Shrubs, subshrubs, or herbs, unarmed or thorny, at times with leaves and calyx armed; glabrous, stellate-downy or villous, glandular hairy or viscid.

According to those cited we have around 130 species and numerous varieties, disseminated throughout the whole country, the pampas meadows being the poorest region.

Some species we cultivate on a large scale as the potato (Solanum tuberosum) tomato (S. Lycopersicum) and egg plant.

South of the province of Buenos Aires the "chacareros" use the stems of "duraznillo" (S. glaucum) as fuel and to make "los quinchos" with which they enclose their small gardens or make repairs in chicken houses, etc.

The name of the genus comes from the Latin solamen (comfort, relief), alluding to the sedative qualities of some species.

Specimens illustrated: S. quadripartitum, leg. Venturi No. 4936. S. sp., leg. Venturi No. 159 (fig. 2: s). S. sp., leg. Venturi No. 476 (fig. 2:t). S. sp., leg. Osten & Rojas, herb. Osten No. 8275 (fig. 3: b). S. Lycopersicum, leg. Millan.

10. Lycianthes (Dunal) Hassler, en Ann. conserv. bot. Geneve XX (1917) 173.
Solanum (sect. Pachystemon) subsect. Lycianthes, grupo Eulycianthes Dun. in De Candolle, Prodr. XIII, 1(1852)161.

Shrubs with habit of Lycium, at times thorny.

In our country there has been only one species cited, which extends through Jujuy, Salta and Tucuman.

The name of the genus comes from Lycium and the Greek anthos: flower, signifying the flower is as that of Lycium.

Specimen illustrated: Lycianthes saltensis, leg. Venturi No. 2392.

IV. HYOSCYAMINAE

Herbs with leaves entire or lobed. Stamens, 5. fertile.

11. Hyosciamus (Tournefort) Linn. (Fig. 2: a-d)
J. Slim-Jensen, Beitrage zur botanischen und pharmacognostischen Kenntnis von Hyoscyamus niger L. In Bibliotheca Botanica, No. 51, Stuttgart (1901)

Capsule circumcissile in the upper part, with operculum.

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The presence of Hyoscyaminae has been pointed out in the last few years as a nuisance in alfalfa fields in the province of Buenos Aires (Molfino, en An. Mus. Nac. Hist. Nat., XXXIV (1926) 108).

The name of the genus, of Greek origin, has been composed of hus: pig, and kyamos: bean; signifying that the fruit serves as food for pigs.

Specimen illustrated: Hyosciamus niger, com. Molfino.

V. MANDRAGORINAE

Shrubs, trees, at times acaulate herbs, with leaves entire, lobed or pinnate. Stamens, five, fertile.

Key to the Genera

A. Shrubs, subshrubs, climbing or erect herbs.

B. Shrubs--erect, never creeping, corolla "rotate" or bell shaped, never narrow-mouthed; anthers basified, with connective thick or gibbous.....12. Cyphomandra.

BB. Herbs--creeping or erect. Corolla "urceolate" or tubular, always contracted at mouth, anthers dorsifixed, with connection thin .....13. Salpichroa.

AA. Herbs--acaulate or with creeping stems.

B. Corolla bell shaped, hypocrateriform or infundibular, somewhat contracted at mouth, stamens inserted in the upper half of the corolla; filaments straight, never curved inward..... 14. Jaborosa

BB. Corolla bell-shaped or somewhat "rotate"; stamens inserted at the base of the corolla, generally exerted and long, and sometimes curved inward..... 15. Trechonaetes.

12. Cyphomandra Martius ex Sendtner (Fig. 3: A, B, a)

Plants of the warm temperate region of the country for which are cited 3 species.

It is usual to cultivate Cyphomandra betacea, named for its fruits, of oval form and a red color.

The name of the genus is composed of the words cyphos: crooked, and andros: anther; it refers to the thicker and sometimes gibbous connective which characterizes this genus.

Specimen illustrated: C. sciadostylis, leg. Rojas No. 4794, Hort. Parag.

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13. Salpichroa Miers (Fig. 3: c-f)

They are plants of the northern Andes, but Salpichroa Mandoniana extends over the Formacion del Monte (forest formation) and S. organifolia is a weed diffused thru-out the country. The small fruit of this species popularly called "chicken egg" is commonly eaten.

We have 4 species.

Miers created the genus Salpichroa and he himself modified the orthography in Salpichroma to give it the same termination as the genus Iochroma and Poecilochroma. Dunal, altho considering it badly formed conserves it in the Prodromus of de Candolle; but later returned to the original name which is the one unanimously used.

The name is composed of words of Greek origin salpinx: trumpet, and croa: color, referring to the colored flowers in the form of a trumpet.

Specimen illustrated: Salpichroa origanifolia, leg. Rodriguez No. 197. S. Mandoniana, leg. Jorgensen No. 1075.

14. Jaborosa Jussieu (Fig. 3: g-p)
Dorystigma Miers
Himeranthus Endlicher
Lonchestigma Dunal

Perennial herbs with root generally fleshy, stem creeping or clustered, many stems from one root. Leaves dentate or pinnate.

Andean and Patagonian plants. Two species. Jaborosa runcinata and J. integrifolia are distributed thru-out the whole country.

There are 14 species given.

The name of the genus comes from an Arab name which was applied to plants of the genus Mandragora and which Jussieu found similar to the first species of Jaborosa which were described.

Specimens illustrated: J. runcinata, Rodriquez No. 210. J. integrifolia, leg. Millan No. 137. J. caulescens, leg. Hauman No. 290. J. sp., Leg Hauman II - 1912.

15. Trechonaetes Miers (Fig. 3: q-x)

Herbs, acaulate or semi-acaulate, close to Jaborosa.

Six species have been cited for our Andean and Patagonian regions.

The name of the genus is composed of the Greek words treco: dry, arid place, and naetes: inhabiting; referring to the aridness of the place which T. laciniata inhabits, a species which Miers describes en primer termino (first? well?).

Specimen illustrated: T. laciniata, leg. Ruiz No. 400. T. rotacea, leg. Jorgensen No. 1312 (fig. 3: v-w); leg. 318 (fig.3:x).

VI. DATURAE

Shrubs or herbs with leaves entire and often dentate. Flowers solitary and large, erect or pedulous. Stamens 5, fertile. Ovary of 2 carpels, but divided into 4 equal locules by false partitions, capsules armed or unarmed.

16. Datura Linn. (Fig. 4: a-d)

Herbaceous or aborescent plants. Ovary with 2 carpels, but they form 4 locules by false walls which originate on the inner margins of each carpel, partitions which on reaching the center of

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the ovary fold back towards the circumference in the direction of the middle nerve which in its turn has a prolongation which unites with that of the double lamina coming from the center and completes with it a wall which has a placenta on each of its two faces; in the upper part of the ovary the additional walls disappear and there are only 2 cavities (Le Maout & Decaisne).

Four species have been cited. The floripondio (Datura suaveolens) with its great white and pendulous flowers.

The "chamico" (Datura ferox) is very abundant in the fields of the province of Buenos Aires, developing with great vigor in the places that are inhabited or frequented by animals.

The name of the genus comes from tat (picar - pierce) from which the Persians have made tatula and the Arabs datora (Le Maout & Decaisne).

Specimen illustrated: D. ferox, leg. Millan No. 870.

VII. CESTRINAE.

Shrubs or perennial herbs. Stamens 5, fertile. Ovary with 2 equal locules. Berry.

17. Cestrum Linn. (Fig. 4: e-j)

Glabrous, hispid or stellate-tomentose plants with entire leaves.

There are 10 species cited.

Cestrum comes from a Greek word meaning "martillo" (hammer? claw?), referring to the shape of the corolla.

Specimen illustrated: Cestrum sp., leg. Millan No. 228. C. calycinum, leg. Venturi No. 330.

VIII. NICOTIANINAE

Annual or perennial herbs, rarely woody. Stamens 5, of equal or different lengths, all fertile, rarely 1 sterile. Capsule.

Key to the Genera

A. Calyx teeth very unequal, awl-shaped or foliaceous, 2 or 3 of them accrescent and at times becoming spiny in the fruit-enclosing calyx.....18. Solerophylax

AA. Calyx teeth more or less equal, herbaceous or spiny but not modified in the fruit-enclosing calyx.

B. Inflorescence racemose. Herbs, rarely woody plants.

C. Ovary without cyatus. Seeds with ridges..... 19. Nicotiana

CC. Ovary with cyatus. Seeds winged or marginal.....20. Sesseopsis

BB. Inflorescence solitary or nearly so, axillary or terminal.

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C. Shrubs, subshrubs or somewhat woody (fruticulous) plants.

D. Calyx segments awl-shaped and spiny.....21. Pantacantha

DD. Calyx segments herbaceous.

E. Shrubs or subshrubs. Rarely only frutescent, in such instances leaves not imbricate, caducous.. 22. Fabiana

EE. Somewhat frutescent plants, compact-caespitose, leaves persistent.. 23. Benthamiella

CC. Herbs

D. Corolla tube almost cylindrical or enlarged above; filaments inserted in lower half of corolla tube; filaments and anthers free.....24. Petunia

DD. Corolla tube long and narrow, abruptly dilated into a bell or cup. Filaments inserted in upper half of corolla, joined into tube and with anthers free or filaments free and anthers clasped by stigma..... 25. Nierembergia

18. Sclerophylax Miers (Fig. 4: k-o)
Sterrhymenia Griesebach

Small, branched, spreading herbs.
Four species have been cited.
The name of the genus comes from the Greek words scleros: hard, and phylax: carcel (clasp? prison?); referring to the way in which the locules of the fruit remain enclosed by the enlarging and hardening calyx.
Specimen illustrated: Sclerophylax sp., leg. Castellanos, Mus. Nac. No. 26/609.

19. Nicotiana Linn. (Fig. 5)

Occasionally somewhat shrubby plant, generally glutinous and pubescent, rarely subarborescent, glabrous and glaucous.
In our country there are 19 species and 10 varieties. The greater number are found in the Andean region and in the "Formacion del Monte" (forest formation), the species for the most part being closely related. The Austro-Brazilian and Mesopotamian regions have fewer and more characteristic species.
In the temperate part of the country tobacco (Nicotiana tabacum) is cultivated.
The genus is dedicated to J. Nicot, who introduced tobacco into Europe, but not what we designate as the species N. tabacum, but a variety of N. rustica.

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Obs. The genus Pittostigma--the fundamental character of which, I suspect, must be the style divided into two branches, judging from Bentham and Hooker (Gen. plant., II. 2 (1876) 906) who pointed out its close affinity with Nicotiana--was based on only one specimen coming from Mendoza. Later Hieronymus (Bol. Acad. Cord., IV (1851) 58) proposed to remove Philippi's species to Nicotiana, inasmuch as he had observed a case of N. acuminata in which he found the stigma divided into two lobes and also since, according to the Prodromus, N. alata likewise has the stigma 2-3 fidum.

The diagnosis of the only species: D. mendocinum, except for the character of the style bifid, corresponds exactly to Nicotiana longiflora var. acutiflora, which I have checked by examining a fragment of the type (Herb. Hicken), through the kindness of Mr. Fuentes of the Museum de Chile).

In the only flower which is among these fragments the upper half of the style is absent, so that the fundamental character of the genus is still unverified, but even in the event that all the flowers of the plant had their styles bifid, I would consider that the species could not be separated from the genus Nicotiana.

20. Sesseopsis Hassler, in Ann. cons. bot. Geneve, XX (1917) 183, tab. II (Fig. 6)

Genus close to Sessea and to Cestrum. It differs from Sessea principally in the multiovulate ovary, ovules arranged in 4 series, capsule cartaceous membranaceous, separated to the base into two valves, stamens inserted in the upper third of the corolla with short filaments, denticulate at base; cyathus persistent and leaves sessile. It resembles Cestrum in appearance and in flower, but differs chiefly in the fruit which is a capsule (Hassler).

Only Sesseopsis vestioides has been cited; it occurs in Corrientes.

The name of the genus comes from Sessea, a genus of the Solanaceae, and the Greek word ops: appearance, meaning it resembles Sessea.

21. Pantacantha Spegazzini (Fig. 4: p-r)

Erect, branching subshrubs. Leaves spreading or appressed, pointed, linear and spiny.

It is a genus close to Fabiana, but very spiny.

The only species that composes the genus is Pantacantha Ameghinoi, found in Chubut.

The name of the genus is a combination of the Greek words pan: all, and acanthos: thorn; referring to the abundance of these on the plant.

Specimen illustrated: P. Ameghinoi, leg. N. Illin, II--1903.

22. Fabiana Ruiz & Pavon (Fig. 4: s-z)

Small, erect, much branched shrubs, generally viscid.

There are 13 species cited, distributed in the Andean and Patagonian regions.

Fabiana is dedicated to the botanist F. Fabiano.

Specimen illustrated: Fabiana sp., leg. Sanzin No. 765 (fig.4:s). F. imbricata, leg. Millan; leg. Hauman No. 310. F. sp. leg. Castellanos. Mus. Nac. No. 27/215 (fig. 4: y-z).

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23. Benthamiella Spegazzini (Fig. 4: A)

C. Spegazzini, in An. Soc. cient. arg. LIII (1902) 53.
P. Dusen, in Arkiv. Bot. Sv. Vet. VII, 2 (1908) 35.
C. Skottsberg, in Sv. Vet. Handl., LVI, 5 (1916) 295.

Plants lenoso-enanas (woody-dwarf? somewhat woody?) caespitose-compact.
There are 11 species, all Patagonian.
The genus is dedicated to G. Bentham.
Specimen illustrated: Benthamiella acutifolia (det. Spegazzini), leg. C. Ameghinoi No. 114.

24. Petunia Jussieu (Fig. 4: B-G)
R. E. Fries, Die Arten der Gattung Petunia, in Kungl. Sv. Vet. Handl. XLVI, No. 5 (1911) 72 pp. with 7 fig. and 7 pl.

Herbs--generally viscid-pubescent, branched.
There are 8 species cited for our country, occuring from the temperate region to Patagonia.
Petunia is derived from the "petun" (tobacco) of the Brasilians, because of the resemblance to the genus Nicotiana.
Specimens illustrated: Petunia parviflora, leg. Venturi No. 1911. P. axillaris, leg Venturi No. 578.

25. Nierembergia Ruiz & Pavon (Fig. 7: a-f)

Perennial, small, creeping or suberect herbs, generally slender and glabrous and with leaves entire.
There are 15 species cited, distributed espescially in the temperate region of this country, a few of them extend to our plains, Patagonia also being poor.
The "chucho" (Nierembergia hippomanica) is very well known as a plant poisonous to livestock.
The genus is dedicated to the Spanish Jesuit J. E. Nieremberg, naturalist of the 17th century.
Specimen illustrated: N. browallioides, leg. Venturi No. 2924.

IX. SALPIGLOSSIDAE

Herbs or woody plants, 2 or 4 equal or unequal stamens, rarely 5 stamens. Ovary with 2 equal locules.

Key to the Genera

A. Herbs

B. Corolla zygomorphic, clearly 2-lipped with some lobes parted.....26. Schizanthus

BB. Corolla actinomorphic, not 2-lipped and corolla lobes never parted

C. Corolla limb with sinus appendaged (Supplementary lobes)..... 27. Schwenkia

CC. Corolla limb with sinus lacking appendages

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D. 4 fertile stamens with flattened filaments and equal anthers..... 28. Bouchetia

DD. 2-4 fertile stamens. When there are 4 stamens they have filiform filaments and 2 of them have anthers with locules separated and the other 2 anthers with locules united .. 29. Salpiglossidae.

AA. Woody plants

B. 4 stamens. Flowers large..... 30. Brunfelsia

BB. 2 stamens. Flowers very small.....31. Saccardophytum.

26. Schizanthus Ruiz & Pavon (Fig. 7: g-l)
C. Reiche, Flora de Chile, V (1910) 398.

Erect annual herbs, glandular-viscid when small. Leaves generally pinnately dissected with the segments incised-dentate.
In our country there is cited only Schizanthus Grahamii for Mendoza and Neuquen.
The name of the genus comes from the Greek words schizein: to part, and anthos: flower; referring to the parted petals.
Specimen illustrated: Schizanthus Grahami, leg. Gerling 10--II--1900.

27. Schwenckia Linn. OFig. 7: j-m)
J. Miers, Illust. South Am. pl., II (1849-57) tab. 63.

Herbs or subshrubs, glabrous or rarely pubescent-hispid, generally delicate.
For our country only Schwenckia americana has been cited, which comes from the Paraguayan-Brazilian region and extends through Chaco, Formosa, Misiones and Corrientes.
Schwenkia is dedicated to J. T. Schwenk.
Specimen illustrated: Schw. Americana, leg. Hauman. 25-11-1917.

28. Bouchetia

Perennial herbs, viscid, suberect. In our country there is Bouchetia anomala subsp. staticifolia, an element of the Paraguayan-Brasilian flora from the north central region to the north of the province of Buenos Aires.
Bouchetia is dedicated to the French botanist D. Bouchet.
Specimen illustrated: B. anomala subsp. staticifolia leg. Castellanos, Mus. Nac. No. 26/568.

29. Salpiglossis Ruiz & Pavon (Fig 7: t-x)
Cyclostigma Philippi
Septoglossis Bentham
Reyesia Clos

Annual or perennial herbs, erect, viscid-pubescent. Three species are cited which are found in the Andean and central regions.
The name of the genus comes from the Greek words salpinx:

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trumpet and glossis: tongue, referring to the form of the corolla and the appearance of the style.

Specimens illustrated: Salpiglossis tenui, leg. Ruiz No. 108. S. sp., leg. Baez, Mus. Nac. No. 25/1558.

30. Brunfelsia (Plumier) Linn. (Fig. 7: g-z, A)
J. A. Schmidt, in Flora bras., VIII, 1 (1862) 255.

Shrubs or subshrubs, glabrous, flowers generally large. There are only 2 species cited, occurring in Misiones, Chaco, Formosa, Santa Fe and Corrientes.

The genus is dedicated to O. Brunfels, physicist and botanist of the 16th century. Linne wrote Brunfelsia.

Specimen illustrated: B. australis, leg. Riemel, 1901.

31. Saccardophytum Spegazzini (Fig. 7: B)

C. Skottsberg, in Sv. Vet. Handl. LVI, 5 (1916) 297.

Small woody plants, compact, tufted, densely branched. Leaves small, appressed. Genus intermediate between Solanaceae and Scrophulariaceae.

There are only 2 species known, both from Patagonia.

The name of the genus has been composed of the name of the Italian mycologist to whom it is dedicated and the Greek word phyton: plant.

Specimen illustrated: Saccardophytum Azorella, leg. and det. Skottsberg, 21--XII--1908.

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PANICULATA GROUP + N. rustica
+ N. Arenfsii

Palca + Tarma have both rustica + paniculata
Vilcabamba has rustica
Yauyos has paniculata
Urcos + Huambutio have both glauca + Raimondii

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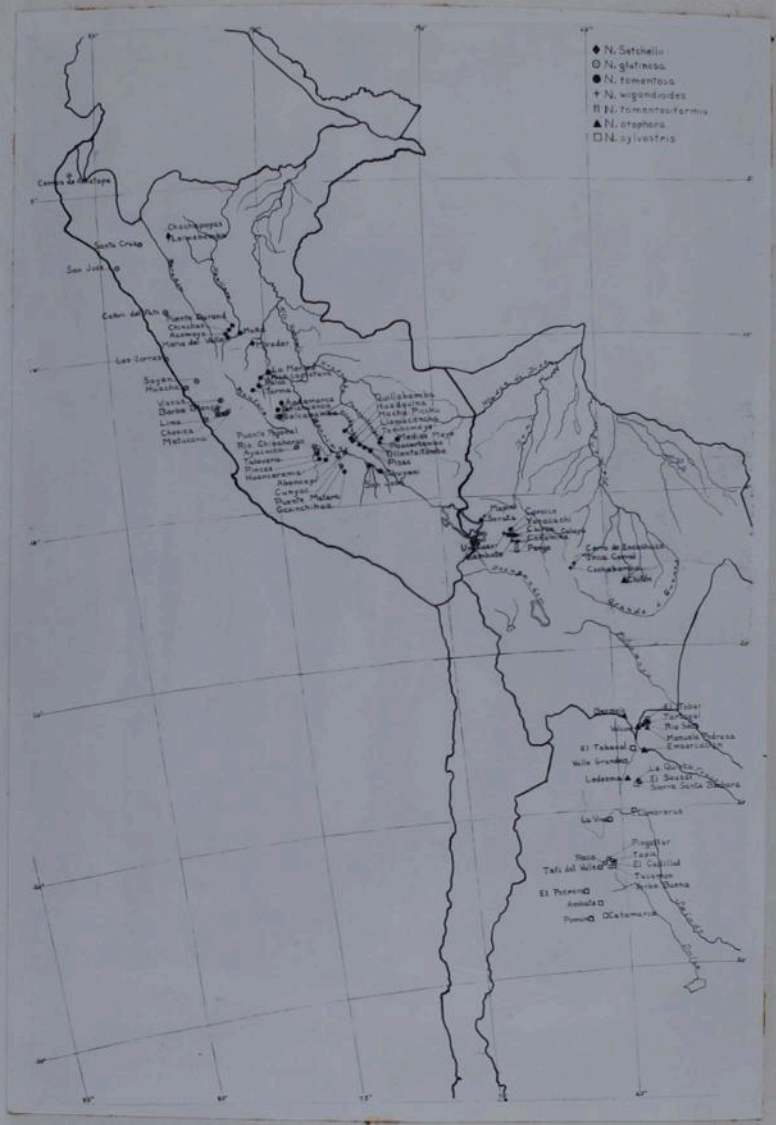
TOMENTOSA GROUP + N sylvestris



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Dear Dr. Goodspeed:

If you find opportunity, could you take corolla measurements on any sheets of Nicotiana in Chilean or Argentine herbaria. In general, previous notes read simply "typical acuminata". As the range of the species is about 25-90 cm. in corolla length it seems important to have sufficient data in every part of that rage before drawing conclusions as to whether there is a grandiflora var. (Comes rarely defined one. But Graham's Petunia acuminata on which Hooker based his Nicotiana acuminata does not coincide in measurement with Hooker's measurements!), whether there are any geographical correlations in the polymorphy of the species, whether Argentina has as great a variety as Chile, whether the large flowered forms are of restricted distribution, whether the size range is continuous from 30-90 cms., or can be broken into logical units, etc. The expeditions gave a good qualitative picture of the polymorphy but there were so very few sheets of large flowered forms these could not be related to the rest.

Thank you for your good letter. We're "plugging along."

Sincerely yours.
Helen-Mar Wheeler

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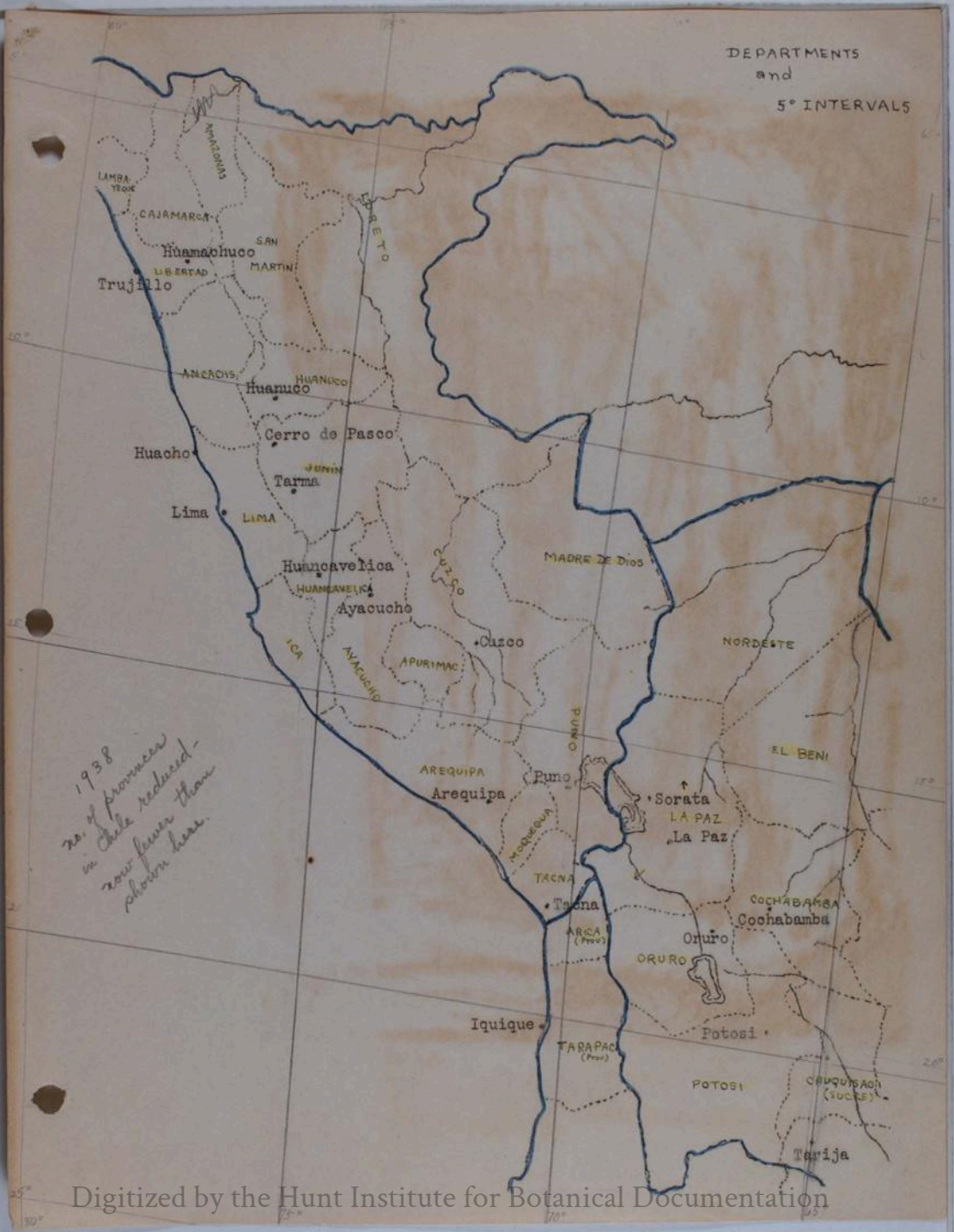

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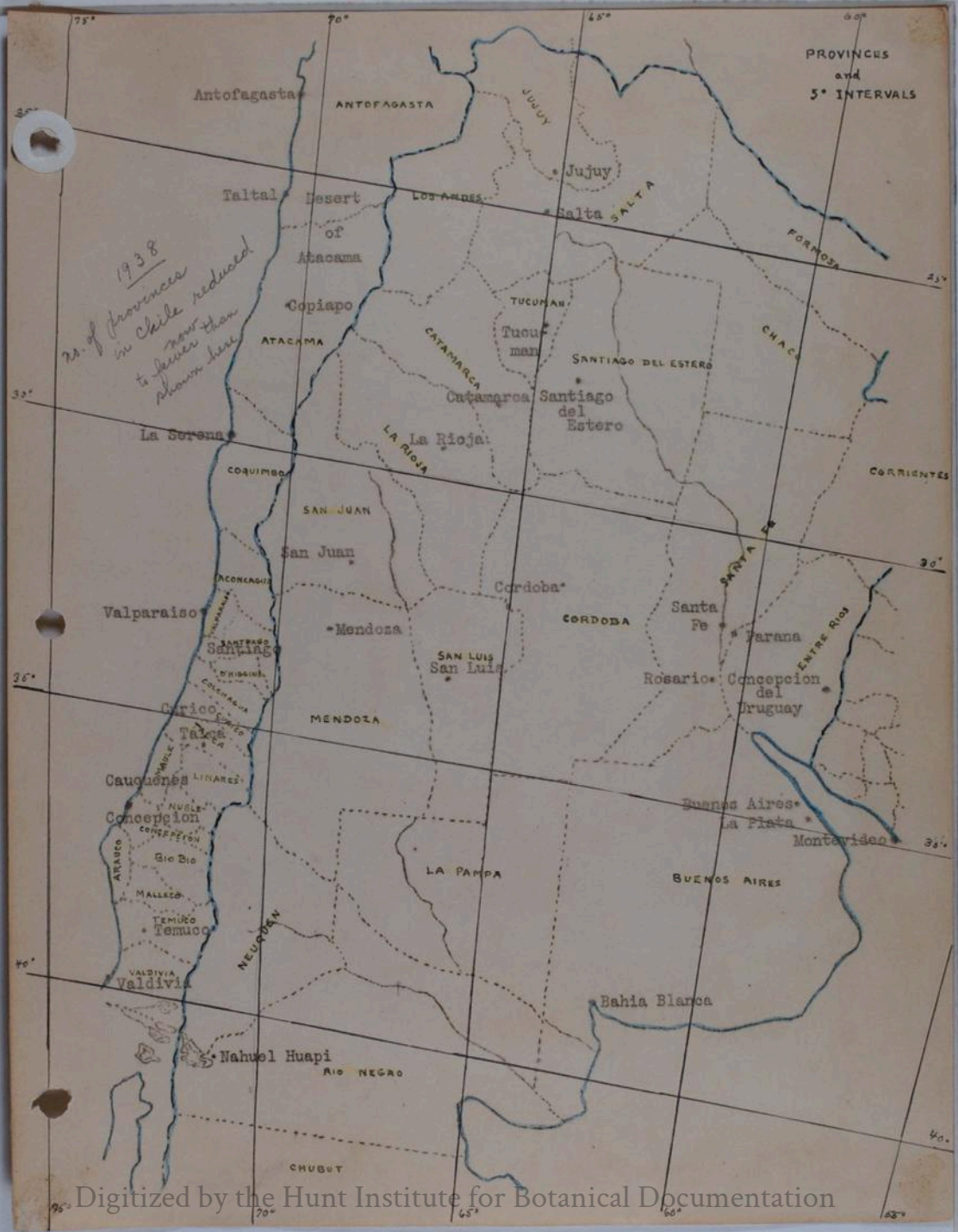

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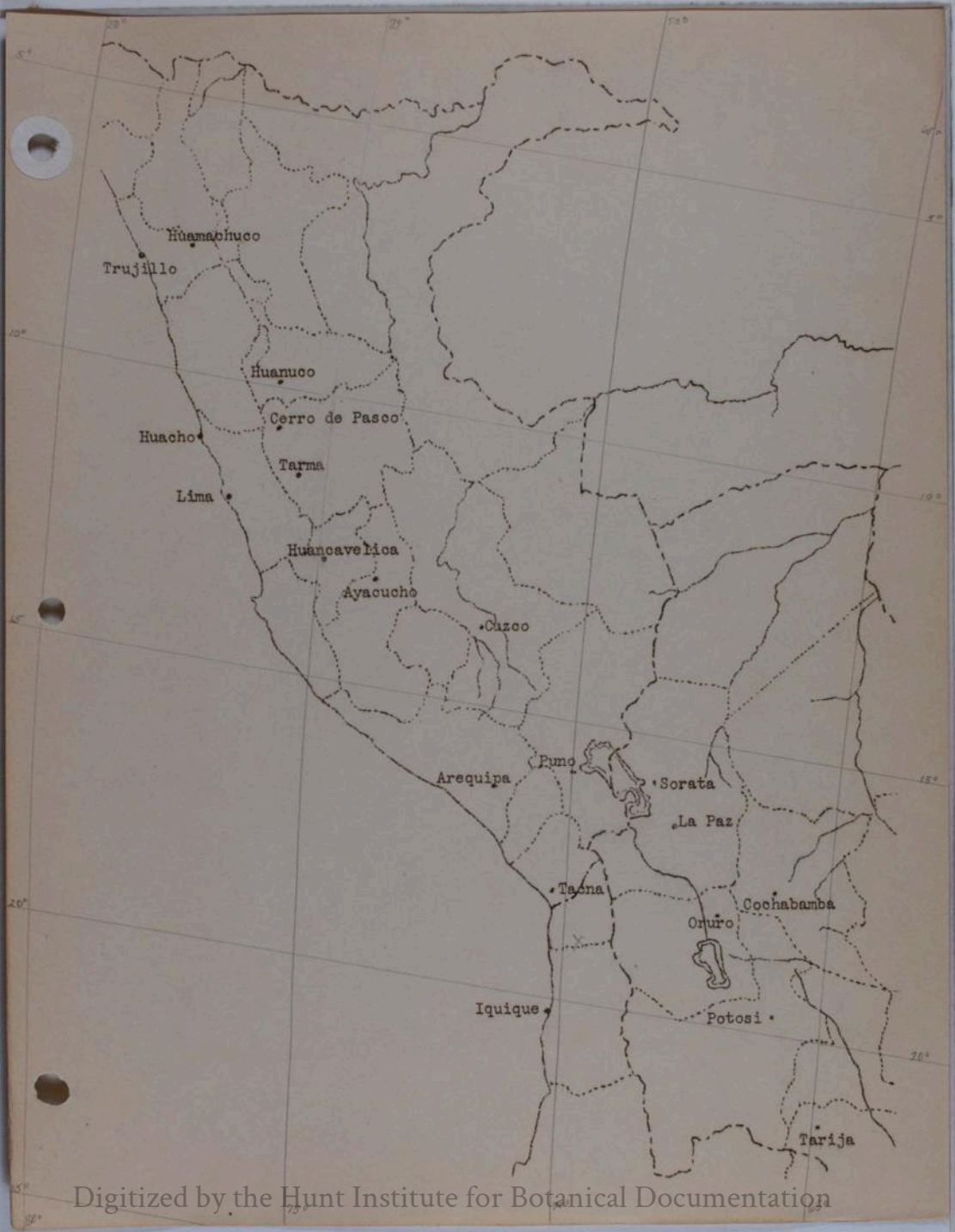

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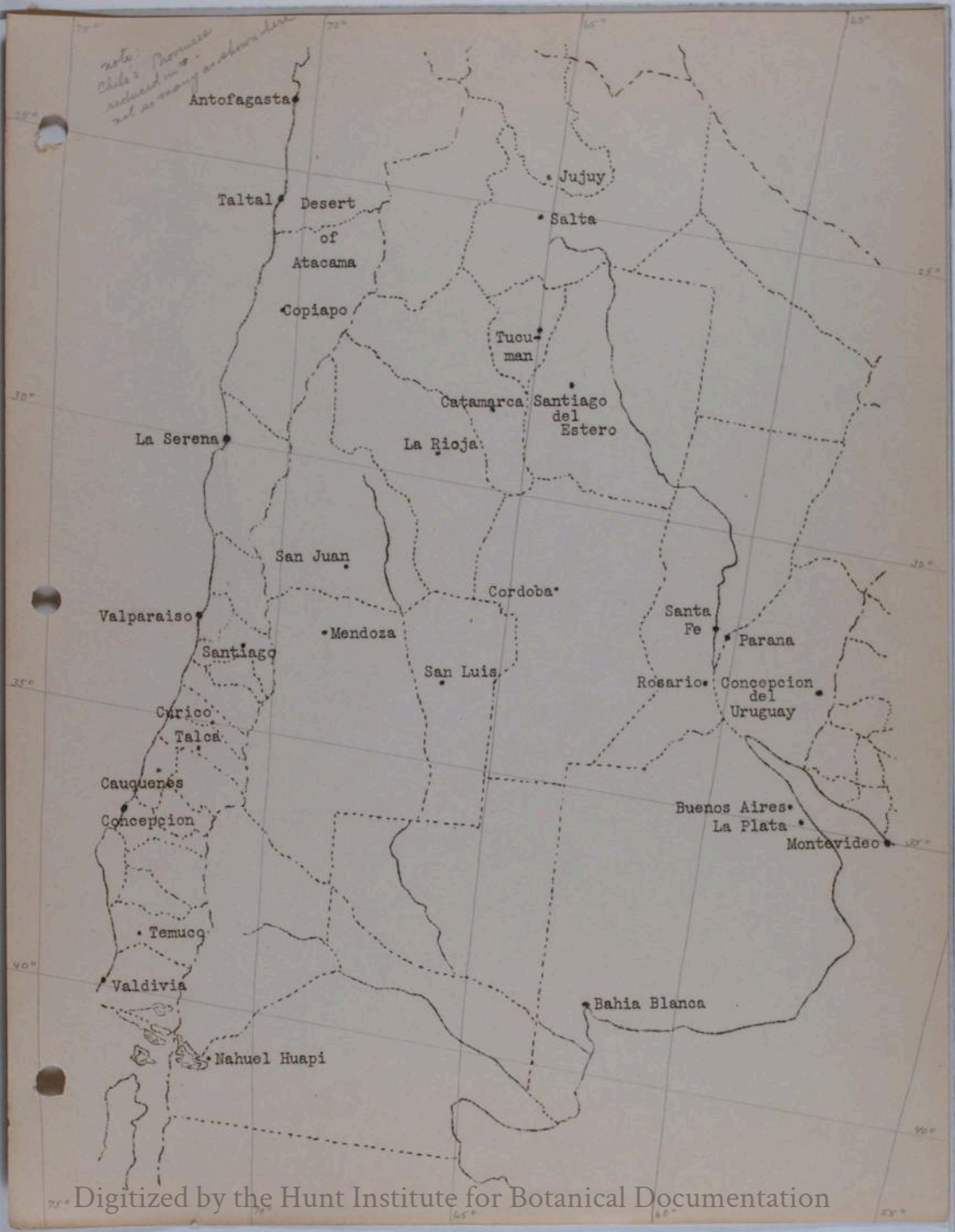

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Of particular interest

Argentina- Jujuy, Salta, Tucuman

1. This region not only includes the type localities of "N. Friesii" (= otophora) and N. sylvestris, but nearly covers the range of the two species, with otophora dominant in more northerly, sylvestris dominant in more southerly localities. It is therefore a logical place to expect N. Tabacum to arise by hybridization of the two. A thorough canvass of all three species here might be significant - especially if otophora (which we have never grown) can't be found in Southern Bolivia.

1942 I have otophora + seeds from this region now

2. N. glauca seed from Jujuy: Humahuaca, sandy soil near river bank, 2500-3000m., coll. Dec. 22, 1935 gave a population with (probably a large proportion of) tetraploids as well as other cytologically aberrant plants. Very broad corolla tubes and spreading lobed corolla limbs were striking morphological characters in this group; indeed it is possible that broad corolla tubes may distinguish tetraploid glauca plants. The extent of distribution, relation to diploid strains, and whether other Nicotiana species are nearby would be helpful. (N. pampasana was coll. at 3200m. 5 Km. N. E. of Humahuaca: Quebrada de Celato, Mar. 13, 1936, sand dune at edge of dry wash; and undulata at 3600m. alt. 20 Km. W. of Humahuaca Mar. 13, 1936 at head of rocky gulch, near abandoned hut)

1942 Had pure Southern Jujuy strain on 2nd self

3. There should be a great deal of longiflora and glauca in this area, whatever may be its significance.

4. More collections of Cavanillesii of the glabrous stem and leaf (with more ovate blade) "var. albiflora" type would be of interest. The best example of this has been lost by both T.H.G. and R.E.C. and only a few plants of more intermediate nature came out as segregants in seed collections from Mendoza on the last expedition. It is reported from Tucuman: Tiopunco (1650m., March); Calalao del Valle (1600m., Feb.); Trancas: Las Arcas (2000m., Feb.)

5. Any information on the intergrading or ecological preferences of preferences of Cavanillesii vs. pampasana would be helpful. (The latter, for example, is reported for Salta: Guachipas, the former in Tucuman:) They give fertile hybrids on crossing. Trancas.)

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Of particular interest

Argentina - Mendoza

1. The slender-tubed pampasana which more nearly corresponds to the type of the species was collected in Jan. beyond station Alto Verde, among spiny shrubs in sandy pasture at 780m. alt. Seed was scant and poor so this strain was lost to U.C.B.G.; nor is it represented by any other cultures. Cavanillesii was collected near Alto Verde at the same altitude. Any information as to whether they were intergrading would be helpful.

2. N. Spegazzinii, a corymbosa-acuminata like species is listed for Mendoza: Punta de Vacas (Feb. 27 and March) type; and Rio Salado, Jan. The last expedition was in Punta de Vacas early in January and found only pure corymbosa. Isn't it possible that at that altitude Spegazzinii is a later plant than corymbosa as well as perhaps being a rarer plant. Whether Rio Salado (the Salado River is the eastern border of Mendoza) is a lower locality or an earlier one, I don't know.
Both seed of Spegazzinii (never grown in U.C.B.G.) and its relation (distribution, habitat, etc.) to acuminata and corymbosa are needed. It looks like a hybrid of the two.

1942 - Need more data & seed

3. N. corymbosa var. deserticola, a very slender-leaved corymbosa has been collected in arroyo Las Mangas (1900m., Jan.) and Tres Esquinas (Jan.)
It is not represented in U.C.B.G.

1942 → calling this N. linearis; distribution of decided interest

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Of particular interest

Argentina - Cordoba

1. Comes cites glauca var. decurrens, a plant with leaf blades wavy-margined and decurrent on the petiole in a slender wing, from Cordoba: El Totoral. There is no decurrent glauca in the U.C.B.G. Millán hasn't seen any and thinks it might be an ecological variation.

2. Millán cites Cordoba: Rio Primero (Tipo!) and Cordoba: Capital (July) for var. breviflora of N. longiflora. It would be of interest to have these by way of comparison with the breviflora from Rio de Janeiro. Is there any plumbaginifolia in the vicinity which might have crossed with longiflora to produce the breviflora type?

3. Variety albiflora of Cavanillesii (glabrous stem and leaf, ovate or ovate-lanceolate leaf blade) occurs in Los Cocos (Nov.); between El Salto and Los Sauces; and between rio de la Puerta and rio San Gregorio. This strain in its most typical form has been lost in U.C.B.G.

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Argentina - Patagonia

Of seven species known to occur in this region three are not grown in the U. C. Bot. Garden. Two of the three (Ameghinoi and acaulis) are endemic to Patagonia and one (Spegazzinii is of discontinuous distribution with Patagonia probably the center.

1. Cavanillesii appears limited to the extreme north
2. acuminata extends S. to northern Chubut
3. (petunioides pampasana) extends S. to Golfo San Jorge
4. **Spegazzini** in the Territory of Chubut (one collection)
5. Ameghinoi begins at Golfo San Jorge and extends S. to Lago Argentino
6. acaulis has been collected from only two widely separated localities: subsaline places near Rio Chubut and very arid localities near Rio Santa Cruz in the vicinity of Monte Leon
7. corymbosa is probably more or less continuous from the extreme north to the extreme south but may exhibit very interesting modifications.

1942 - This was not found or not sepd.

1942 - have acaulis now.

1942 well represented now

The relation of Ameghinoi and acaulis to pampasana, to each other, and to corymbosa is of special interest; and the relation of Spegazzini to corymbosa and acuminata.

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Of particular interest

Bolivia

1. The extent of variation and of distribution in members of the tomentosa group: glutinosa, tomentosa, and especially wigandioides, tomentosiformis and otophora. So far wigandioides and tomentosiformis are represented by single collections in U.C.B.G., and otophora not yet obtained. Are all five members of this group ecologically separated or are they more closely interrelated?

2. Especially in S. Bolivia, or in close proximity to any of the above species, N. Tabacum.

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Of particular interest

OF PARTICULAR INTEREST

Northern Peru

1. Seed of N. thyrsiflora ✓

2. More collections of N. tomentosa (both from the type locality "Rinconada", environs of Muna, Dept. Junin and from as many other places in Northern Peru as is convenient. A single collection from Acomayo, Dept. Huanuco (A-091, B-125) is the only population growing here. This is insufficient to treat of "typical tomentosa" adequately, especially since it looks as though Macbride had a point when he distinguished between northern and southern Peruvian forms of "tomentosa". Both very tomentose lvd. and slightly tomentose lvd. forms would be interesting too.

Still of interest — Have had but 2 typ. N. tomentosa collections

3. Ecological relation of N. rustica to N. paniculata - undulata

Southern Peru - Coastal

1. Extent of distribution and variation within N. Knightiana - especially in relation to paniculata and solanifolia. Recollection of Knightiana from near Mollendo, Prov. Islay, Dept. Arequipa to determine whether longer flrd., more yellow-green corolla types which came out in the sowing from the original seed were strays or have some significance.

} not strays the 2 met

2. Comes has named a var. grandiflora of glauca from Peru: Islay (corolla to 53 mm. long!). It might be interesting to check up on this at the same time as (1.) ?

3. Northernmost locality for N. solanifolia; its relation to other members of the paniculata group. Extent of variation in N. solanifolia.

4. N. rustica and its relation to paniculata, solanifolia and other members of the paniculata group.

Southern Peru - Interior

1. tomentosa - the collection from Huancarama, Dept. Apurimac has proved especially variable morphologically and perhaps also chromosomally. Other collections in this department might be helpful.
Forms with large spreading inflorescences, subtruncate corolla limbs (subcircular), or very tomentose under surface of mature leaf are of interest.

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Of particular interest

Southern Peru - Interior

1. tomentosa - the collection from Huancarama, Dept. Apurimac, has proved especially variable morphologically and perhaps also chromosomally. Other collections in this department might be helpful.
Forms with large spreading inflorescences, subtruncate corolla limbs (subcircular), or very tomentose under surface of mature leaf are of interest.
Collections from the previous expedition were largely from the city of Cuzco north (?) in Dept. of Cuzco. Ones from S. of Cuzco and also in the Dept. of Puno should not duplicate.
The wigandioides-like stiff, silvery stem hairs on the collection 12 Km. W. of Tambomayo, Rio Tambomayo, Dept. of Cuzco have been striking. The leaves of this population stand out stiffly. Is there any significance?

2. Does glutinosa ever extend into tomentosa regions or is it ecologically barred ?

3. How extensive is the distribution of N. Benavidesii ? What is its relation to N. Raimondii and N. glutinosa ? Is it ever found near N. rustica ?

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PERU

I. HUANUCO NORTH TO THE BEND OF THE MARAÑON IN DEPT. AMAZONAS

The southern part of this area embraces not only the most northerly localities known for N. tomentosa, but the type form of this highly variable species. Both have significance. The type has large inflorescences with stiffly horizontal branches andflowers with more or less circular border to the corolla. The leaves tend to be white-tomentose on the under surface. The original collection was made near Muña, before 1800. The U.C. expeditions have found the same form in Acomayo and Puente Durand, localities close to Muña. The extent of the area which the type form covers in any direction is not known, except that it presumably belongs to northern rather than to southern Peru. Does it end abruptly? Does it merge into other expressions of this polymorphic species? Seed and specimens anywhere in the Huanuco-Amazonas region are desired. This species is usually not shade tolerant. It occurs on the edge of forests, where the air is humid, and, as in deep valleys, it is sheltered against winds. While it usually has been found in somewhat drier regions, it occasionally has been collected in the Ceja de Montaña where the air is very damp (Medias Mayo, 2550 m.), or where it is distinctly tropical andwet (Tambomayo, 3300 m.; La Merced, 700 m.). 700 to 3300 m., incidentally, is the range of its collected altitudes. You may have to look closely for seed, as it frequently doesn't set well. It would not be easy to spot in the more tropical situations, Dr. Stork believes. This is one reason why there may be few collections there. It may not always be in bloom.

The gap between N. tomentosa in Dept. Huanuco and N. Setchellii in Dept. Amazonas may be due only to lack of botanical exploration. We don't know what it means. Do the two species meet? overlap? Are there new species of this general group which no one has yet discovered? (N. Setchellii was mistaken for the common tobacco of commerce, N. Tabacum, when first collected.) What, if any, are the environmental differences in habitat of N. Setchellii and N. tomentosa? There are no data available on the habit of N. Setchellii, even regarding the single locality in which it was collected. What soil? amount of light? nature of terrain? with what associated? kind of region? altitude? The type and only locality yet known for N. Setchellii is "along the trail between Chachapoyas and Leimebamba on second day out from Chachapoyas, Dept. Amazonas. It was collected July 12, 1940, but in Berkeley blooms continuously, save in the very coldest part of the year. Even if out of bloom, the compact old inflorescences, with their large capsules crowded by convergent orientation and mussy with persistent withered corollas, would be characteristic.

Leaf-shape variation in N. Setchellii, in light of the more sessile leaning, is of interest. Maximum heighth, age plants attain, success with which they colonize a situation , and the range of variability, in fact, in any character -- all these are unknown. Seed, specimens, detailed notes are needed.

It is barely possible that some petiolate species, bridging the vegetative distinctions between N. tomentosa and N. glutinosa, as N. Setchellii bridges the flower distinctions, will be found. In general, N. glutinosa lies to the westward, in lower, drier, more open situations than N.tomentosa (100-2400 m.are the recorded altitudes for N. glutinosa). It is not a denizen of the forest, but rather an associate of cactus in arid, hot regions. Throughout northern Peru it tends to work inward along the coastal watercourses; yet to the south, in Dept. Apurimac, it is Andean. Wherever found, color of flower is

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Of interest 1942

of some interest (especially lemon yellow or dark red; salmon pink is the common shade of border). Beyond that, it is not N. glutinosa itself (which will be found to vary from a single depauperate stalk to a coarse stout plant), unless it extends the range of its mapped distribution (especially eastward) but any glutinosa-like Nicotiana which would be of real significance. This could be either a primitive 12-paired form or a stable hybrid between N. glutinosa and N. tomentosa, N. Setchellii, or some such subarborescent species.

Two members of the PANICULATA GROUP and the amphidiploid, N. rustica, involving two species of the same group, occur in this general region. Collections of N. thyrsiflora, N. paniculata, and N. rustica are of interest wherever they extend the mapped distribution.

N. thyrsiflora, of foxglove or mullein-like habit, is a species known from but three collections, all in the same neighborhood, and two of the three by the U.C. collectors. They are: (1) Between Huamachuco and Angasmarca, Prov. Santiago de Chuco, Dept. Libertad, alt. 3800-3900 m. (2) 2 km. south of Tres Cruces Pass, on trail Huamachuco-Angosmarca, alt. about 3800 m. Black soil containing heavy portion of white limestone rock fragments. Deeply washed-out ravines and gravel washes. Steep, SW facing hillside. (3) Dept. La Libertad, Prov. Santiago de Chuco. Inca Corral, N. of Cachicadan, rich soil in abandoned habitations. Alt. 3500 m. (4) Dept. Cajamarca, Prov. Hualgayoc. From Hualgayoc NW, about 1 hour by horse, "Tajon Valley" in clay gravel mixture, among other shrubby growth of 2 or 3 m. 2800-3500 m. alt. Dr. Stork, who made the two latter collections, reports N. thyrsiflora is found on exposed hillsides in good soil amongst large boulders -- wherever deep enough soil has formed to anchor the plants. The localities were pasturage for goats and burrows, high plateau country approaching the frost line and separated by high, rough mountains. Probably N. thyrsiflora does not need much water, only about what Eucalyptus requires. One would expect it to occur more frequently in Cajamarca, yet it has not been reported. We don't really know what its distribution is. Seed and specimens should be taken wherever found.

The point in the matter of N. rustica is to determine, if possible, whether the plant is always a weed of roadsides, towns and the like, or whether there is any evidence of it being strictly a part of the natural flora. Secondly, any variation in habit, form of inflorescence, size of flower and capsule, dusty grey-green, versus clear yellow greenness of herbage, is of interest in vigorous specimens. (Depauperate plants all tend toward the crowded inflorescence and small flower.) Are all Peruvian N. rusticas of the laxly branched, grey-green herbage type? or can marked differences be found. Seed and specimens should document findings.

Otusco is the most northerly known station for N. paniculata. Any northern or eastern extension of range is of interest and highly probable. Altitudinally, this is a tolerant species: 25 m. - 3200 m. Does it appear to be associated with man's activities in its spread?

II. ICA

Any N. glutinosa south of Lima should be collected. No coastal collections have ever been made in southern Peru. N. glutinosa will stand a large amount of clay in the soil but no humus. As in northern Peru, it might be expected along or near watercourses, often in cactus country. What is the connection between the southern Andean situations and the northern coastal ones, if any?

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Coastally, N. paniculata tends to seek out lomas, where perennials begin to be able to hold on, part way between the open sandy desert and the more protected sandy, gravelly quebradas (or in those parts of quebradas where it is sufficiently open). If lomas are few and far between in the Ica region, N. paniculata may be likewise rare or missing. However, it should be borne in mind that altitude is no barrier to N. paniculata, if the inner country be worked.

How far north does N. Knightiana, the larger-leaved, robust paniculata-like species with broader, pubescence-whitened corolla tubes and dark bottle-green corolla limbs, extend? It, too, seeks lomas. At present Atiquipa is the most northerly station known. You may find it intergrading with N. paniculata.

III. MOLLENDO-TITICACA-N. CHILE.

How far south does N. Knightiana extend?

Is there any suggestion of a N. solanifolia-like plant? N. solanifolia appears to be restricted to a coastal fog-belt band in Chile, from Aguada de Miguel Diaz to Coquimbo, yet there is N. Benavidesii in the Apurimac country of Peru, with a flower exactly like N. solanifolia, save for the exserted stamens, and N. cordifolia on the Juan Fernandez Island of Mas Afuera, hundreds of miles east of Valparaiso, Chile, with its floral counterpart in the Urubamba Valley of Peru. Inasmuch as today there seem to be isolated remnants of a one-time continuous, large area, lookout should be kept both for present-day coastal species extending range and for any new, as yet undiscovered, links in the PANICULATA GROUP in either coast, transition, or Andean situations.

Both N. undulata and N. glauca probably will be found. N. undulata usually occurs at 3000-4000 m. altitude. It is characteristic of the cold, dry, lower puna where there is some shrubby vegetation, requires plenty of drainage, but frequently seeks flat locations rather than hillsides. Fumes from mining operations seem to have no deleterious effect on it. As a species, it has been quite thoroughly studied from other localities and is not expected to yield a great deal. Yet we do not have cultures of it from this region. The growth habit should be noted particularly in taking specimens. Is it forming low clumps or erect plants of some heighth?

In the case of N. glauca lookout should be kept for large-flowered forms. Millán reports a collection from Islay (near Mollendo) supposed to have flowers 53 mm. long. This is out of all proportion, as ordinary N. glauca has flowers 25-40 mm. long. What does it mean? Exceedingly broad-tubed flowers (10-12 mm. broad) are always of interest. N. glauca has not been reported from many places in Peru. Its distribution and relative amount anywhere in Peru is of interest.

IV. LIMBANI AND ADJACENT BOLIVIA

Except for six plants found late in November close to the road and houses in Limbani, Dept. Puno (Prov. Sandia) at an altitude of 3400 m., nothing is known of this region. These six plants were N. Arentsii. The fact that the natives called them Gamasairi shows they recognized them as a kind of tobacco for sairi=tobacco. N. Arentsii is a natural hybrid of N. wigandioides and N. undulata and clearly shows the characters of both species in appearance. The conditions

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in Limbani, humus and rock soil in the Ceja de Montaña, suggest the warmer subtropical habitat of N. wigandioides rather than the cold, dry situations of N. undulata. N. Arentsii appears to be annual, but perhaps in a milder winter than that of Berkeley it would survive. Unlike many Nicotiana species, it may not bloom continuously, once started. More collections of N. Arentsii from other localities, to show both geographical and morphological range, are wanted, as well as extensive notes on habitat, number of plants found -- in fact, anything which will add to the scant knowledge of the species, and especially seeds. The geographical relation to the parental species, N. undulata and N. wigandioides, needs definition by close lookout for the three species and their collection.

N. wigandioides is in itself highly interesting. It has been collected only in Bolivia, and nothing is known of its morphological variation. There are no descriptions of its habitat, save that it is more or less subtropical and at altitudes of 760-3200 m. Even the altitudes are in some cases confused, feet and meters being associated with the same number on different sheets of the same collection or region. Everything, and especially seed, is wanted.

Are there other species yet to be discovered in this area? In drier parts, N. glutinosa should always be kept in mind as a possibility. N. tomentosa and Any tomentosa group species, especially N. tomentosiformis and N. otophora, should be looked for. Are there more, new Nicotiana species pocketed in this region? N. Arentsii was never suspected until found.

Lookout in southeastern Peru and adjacent Bolivia should be kept for either N. longiflora or N. plumbaginifolia, weeds with long, very slender-tubed trumpet-shaped whitish or lavender flowers, with star-shaped limbs, which close during the day. One to many wiry stems arise from a flat rosette of leaves, to a height of one or two feet. These plants can stand high rainfall and some shade, although they do not need either.

CHO

If, by any chance, you reach northern Chile, please keep in mind low, greenish-white flowered annuals whose salverform or trumpet-shaped flowers close during the day and open with waning light. Mostly they are desert types, CAVANILLESII or CORYMBOSA GROUPS of any altitude and flower size, the leaves most frequently lanceolate and short petioled. None has yet been reported from coastal Peru, yet there is always a chance.

If you go NW of Limbani into the headwaters of the Paucartambo you are on the fringe of the N. Raimondii + N. Benavidesii country & might find them or their relatives. If it be dry enough. You should also find N. tomentosa.

V. IN GENERAL

1. Common native names and uses of the species so wanted.

2. Commercial tobacco - Nicotiana Tabacum - wherever it is not associated with habitations. It is a natural hybrid of some member of the TOMENTOSA GROUP and an Argentine species.

3. Records of where in Peru you see N. glauca, N. glauca appears recent and Argentinian. It is possible it cannot stand much moisture and is largely spreading along roads? But its origin is unknown and its relation to other members of what appears to be essentially a Peruvian group of species is not at all clear.

4. Duplicates (4 sets?) of Nicotiana collections are important.

5. Seed taken where a specimen is collected should bear the same number.

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Of particular interest

Uruguay

(1) While any collections longiflora, bonariensis and alata would be helpful from Uruguay, alata from as many places as possible is perhaps the most important.

(2) Although Forgetiana is supposed to have been collected in Rio Grande do Sul: Tubarao, it is barely possible that a red bonariensis might be picked up in Uruguay. It would be worth looking for.

(3) Is there any evidence of hybridization between any of the three species: alata, longiflora, and bonariensis?

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Collecting Dates for Nicotiana spp.

Argentina-Jujuy-Salta-Tucuman

otophora - June, July
sylvestris -Oct., Feb., March
undulata - March
pampasana - Nov., Dec., Jan., Feb., March
Cavanillesii - Jan., Feb., March
longiflora -Oct., Nov., Dec., Jan., Feb., March
glauca - Aug., Oct., Nov., Dec., Jan.

Argentina-Mendoza

corymbosa - Jan., Feb.
Spegazzinii - Feb., March
Cavanillesii- Oct., Nov., Dec., Jan., Feb., Apr.
pampasana - Oct., Nov., Jan., Feb.
longiflora - Nov., Jan.
glauca - Oct., Nov., Dec.

Argentina-Cordoba

Cavanillesii - Oct., Nov., Dec.
longiflora - July, Oct., Nov., Feb., April

Argentina-Patagonia

Mrs. Mexia says Dec. - Jan.
for S. end of S. America

corymbosa - Dec., Jan., Feb.
Spegazzinii - Dec., Feb.
Ameghinoi - Oct., Feb., March, April
acaulis - ?
Cav. or pampasana - Jan., Feb.
acuminata - Feb.

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Collecting Dates for Nicotiana spp.

Bolivia

tomentosa - Oct., Nov., Dec., April
tomentosiformis - July 15
? right determin? glutinosa - Aug. March (no definite mo. stated)
wigandioides - June, Sept., Oct., Dec., March
otophora - ? March, June to October
undulata - Feb., March, April
glauca - May

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Collecting Dates for Nicotiana spp.

North Coastal Chile

Aug. 20 to Oct.- Nov. if good yr.,
if little rain shift 2 wks. earlier

rustica (extreme N) - when ?
undulata(" ") - when ?
solanifolia (littoral) - Sept.,Dec.,(Sept.,-Oct.)
longibracteata - Jan.
acuminata (low cordilleras) - Oct.
caudigera - Oct.
pampasana - Jan.,Feb.
corymbosa - Jan.,Feb.

Central Chile

Sept. Oct. Nov. low altitudes
Over 2800 m. Jan.-Mar. 15
with abundant flrs. in Feb.

glauca (littoral) - Nov.- Feb.
longibracteata (frigida) (high cordilleras)
- when?
acuminata - Nov.,Dec.,Jan.,Feb.
Cavanillesii (low cordilleras)- Jan.,Feb.
pampasana (high meadows) - Jan.,Feb.
corymbosa (littoral & interior) - Sept., Dec.,
Jan.,Feb.,March

Southern Chile

Nov. - March, preferably Feb. & March

linearis (corymbosa) - (cordilleras of Talca)
corymbosa (littoral & interior) - Sept., Dec.,
Jan.,Feb.,March

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Collecting Dates for Nicotiana spp.

Northern Peru

Weberbauer says
Jan. - May

thyrsiflora - July, Nov., Dec.
rustica - May, Nov.
glutinosa - May, June, Sept., Dec.
tomentosa - April, May, June
paniculata - April, June
undulata - May, April, March, Jan.

Southern Peru-Coastal

Weberbauer says
Jan. - April for Central Peru
Jan. - March " Southern "

(Dept. Lima) glutinosa - April, May, June, March
solanifolia - April
undulata - March
Knightiana - November, Sept.
paniculata - Jan., Oct., April

Southern Peru-Interior

Weberbauer says
Jan. - Apr. for Central Peru
Jan. - March " Southern "

tomentosa - April, June, July, Sept., Oct., Nov., Jan., Feb.
Raimondii - July, Oct.
undulata - Dec., Jan., Feb., March
rustica - June, Sept., Nov., Dec., Jan., March.
Benavidesii - Nov., Feb., May
glauca - July
glutinosa - Nov., Jan., March

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Collecting Dates for Nicotiana spp.

Uruguay

Oct.-Dec., preferably Sept.-Nov.
according to Herter, who also gives:

alata - Sept.-Nov.

bonariensis - Sept.-March

glauca - Sept.-May

longiflora - Oct.-April

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Copy of letter from
Dr. W. Herter
Montevideo, Uruguay

Dear Sir:

I beg to acknowledge receipt of your air mail letter of the 14th inst., in which I note your plans regarding another expedition to South America; I am going to report this news in the next number of our journal. In Vol. III No. 4/6 p. 208 I have briefly reported about your first expedition. I expected to hear more about this from Mr. James West (Prince Egon von Ratibor) who paid me a short visit in the Botanical Gardens; unfortunately, however, he did not return for his proposed longer visit.

As far as Nicotiana are concerned, I shall be pleased to place all the available material at your disposal. I am sorry to say, that I have lost part of my collection. I had loaned it, including the Unica to Russia, although this is quite contrary to my usual habits. I have never seen the plants again, nor have I heard of them, although they promised to return the collection immediately. Since that time I have collected very little new Nicotiana material. I can procure for you seeds of the 3 common varieties N. bonariensis, glauca and longiflora, but I am afraid that you are not very interested in them. N. alata I found only rarely. In regard to the other species I know but little; I am not acquainted with the history of N. Forgetiana.

In our local Botanical Garden, which for the passed 10 years has not been regarded as such a garden, and which has lately been turned into a pleasure park, after all the fences were removed, only trees are grown. There are none of the Nicotianas.

Regarding the best time for collecting Dikotyledons in Uruguay, the winter months (May - August) are not very suitable. At the beginning of spring everything begins to bloom, but musquitoes, Gnitzen (must be a local term for some kind of a pest) and ticks are very tormenting. The most suitable time for collecting is when the plants are in blossom (Oct. - Dec.) The dry and hot summer (Jan'y, Feb'y) is less suitable. In the autumn (March, April) heavy rains fall, and all kinds of plants grow again. The above mentioned pests are not so numer-

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ous, however, I have been terribly bitten lately (middle of April) but the cool temperature is more agreeable. Evidently, you do not like high temperatures (neither do I) and so I believe that the best time for you to come to Uruguay would be in Sept. - Nov.

A short article of mine regarding the street flora (Strassenflora) in Vol. IV. No. 3/5 of the Revista will give you some information regarding the length (period) of vegetation. Below I state the acme (Bluetezeit) of the Nicotiana, as I have observed it. Further north the vegetation is about 3 - 4 weeks earlier. The plants are quite different in certain parts of the country, but the climate is generally the same everywhere (precipitation in the south 1000 mm, in the north 1400 mm, temperature in the south 16°C, in the north 18°C.

I shall be very glad to see you again. I hope the authorities will give me a vacation, so that I can place myself entirely at your disposal.

Acme:

N. alata	Sept. - Nov.
N. bonariensis	Sept. - March
N. glauca	Sept. - May
N. longiflora	Oct. - April

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Altitudes at which Bolivian and Peruvian Nicotiana species have been collected.

N. Arentsii	3400 m
N. Benavidesii	2000-2400 m
N. glauca Grah.	~~up to 3500 m.~~ 3 m-3600 m
N. glutinosa L.	~~1300-3000 m.~~ 100-2400 m
N. otophora Griseb.	~~500-3600 m.~~ 600-1600 m
N. paniculata L.	~~3300 m. (1000-2300 m.)~~ 15 m-3200 m
N. plumbaginifolia Viv.	450-600 m.
N. Raimondii Macbr.	~~3000 m.~~ 2745-3100 m
N. rustica L.	~~1500-2450 m.~~ usually 2000-3000 m; Chile 550 m; Ecuador 1500-2800 m.
N. solanifolia Walp. ??	~~3000-32000 M.~~ 10-600 m
N. thyrsiflora Bitt.	~~3800-3900 m.~~ 2800-3900 m
N. tomentosa R & P.	700-3300 m.
N. undulata R. & P.	~~3000-4000 m.~~ 2800-4200 m
N. tomentosiformis Goodsp.	1300 m.
N. wigandioides Koch & Fint	~~2300-3800 m.~~ 760-2800 m

Subarborescent species--centers of distribution

N. glauca Grah. Northern Argentina?
N. thyrsiflora Bitter - Northern Peru, Dept. Libertad
N. tomentosa R. & P. - Andes from Central Peru to Northern Bolivia
N. tomentosiformis Goodsp. -(Canamina) La Paz, Bolivia
N. wigandioides Koch & Fint. - Yungas and Cochabamba, Bolivia
N. otophora Griseb. - Southern Bolivia and adjacent Argentina, also Valle de Chilon, Dept. Santa Cruz

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1935-36 Expedition Collections of Nicotiana
Argentina-Jujuy-Salta-Tucuman

glauca 04317	Argentina	Prov. Jujuy near town Humahuaca - along river banks from Tupiza in S.Bolivia Rosario de la Frontera in Argentina. Dec. 22, 1935, Alt.2500-3000m. Sandy soil near river bank"Palan-Palan".	M.
longiflora 04322	Argentina	Prov. Tucuman Aconquija to forest; roadside and along edge of cultivated fields Tucuman to Racas. Dec. 25, 1935, Alt.675m."Sacha-Tabaco".	M.
glauca 04326	Argentina	Prov. Tucuman Aconquija near Tucuman. Dec. 25, 1935,Alt. 675m. road village to forest.	M.
sylvestris 04336	Argentina	Prov. Tucuman Road Tucuman to Racas Tapia. Dec. 27, 1935, Alt. 680m. along streambeds in sand.	M.
glauca 04349	Argentina	Prov. Tucuman. Along Rio Lulie, near R.R. bridge. Dec. 28, 1935, Alt. 760m. sandy flat of river.	M.
Cavanillesii 04359	Argentina	Prov. Tucuman R.R. between Tucuman and Cordoba;station of Taco Rato along R.R. Dec. 31, 1935, Alt. 600 m.	M.
longiflora 6124	Argentina	Prov. Jujuy; outskirts of Jujuy. Feb. 25, 1936, Alt. 1200m. roadside.	W.
longiflora 6158	Argentina	Prov. Salta outskirts of Salta. Mar. 2, 1936, Alt. 1185 m.	W.
pampasana 6300	Argentina	Prov. Jujuy, 5 km. N.E. of Humahuaca, Quebrada de Celato. Mar. 13, 1936, Alt. 3200m. sand dune at edge of dry wash.	W.
undulata 6323	Argentina	Prov. Jujuy 20 km. W. of Humahuaca. Mar. 13, 1936, Alt. 3600m. head of rocky gulch, near abandoned hut.	W.
glauca 8365	Argentina	Prov. Jujuy Dept. San Pedro along Rio San Pedro above La Mendieta, open sub-tropical woodland. Feb. 16, 1937, Alt. 800 m.	W.

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1935-36 Expedition Collections of Nicotiana

Argentina-Jujuy-Salta-Tucuman

sylvestris Argentina Prov. Salta Dept. Anta Sierra La Lumbrera
8376 along private road of Ultramar Oil
Co. leading off from Lumbreras Auto
road 30 km. N. N.E. of Lumbreras.
Feb. 19, 1937, Alt. 750 m. red silty soil
little humus "Tabaco del Campo"
"Sacha tabaco" "Tabaquillo". W.

longiflora Argentina Prov. Salta Dept. Anta banks of Rio las
8393 Cañas Sierra La Lumbrera ca 39 km.
N. E. of Lumbreras margin of woods.
Feb. 20, 1937, Alt. ca 780 m. damp sandy
soil. W.

glauca Argentina Prov. Salta 5 km. above Standard Oil Co.
8400 Camp at Tartagal.
Feb. 23, 1937, Alt. ca 470 m. "Palan-
palan." W.

glauca Argentina Prov. Salta Quebrada of Rio Tartagal
8401 right bank 5 km. above Standard
Oil Co. Camp at Tartagal 5 M .
above river in bushy pasture.
Feb. 23, 1937, "Palan-palan." W.

longiflora Argentina Prov. Salta Standard Oil Co. Camp at
8429 Tablillas W. of Vespucio Station
on F.C.C.N.A.
Feb. 24, 1937, Alt. 450 m. W.

otophora Argentina Prov. Salta Dept. Governador Ovejero
8457 about 2 km. N.E. of La Quinta. at
N. base of Cerro Santa Barbara about
40 km. S.S.W. of Yuto Station on
F.C.C.N.A. side of ravine.
Feb. 27, 1937, Alt. ca 550 m. in deep silty
brown soil with little humus quarter
shade "Sacha tabaco" "Tabaco del
Campo." W.

Argentina-Mendoza

Cavanillesii Argentina Prov. Mendoza Rio Seco, W. of Mendoza.
04361 Jan. 4, 1936, Alt. 800 m. sandy dry
river bed. M.

Cavanillesii Argentina Prov. Mendoza Cerro de la Gloria W. of Mendoza.
04369 Jan. 4, 1936, Alt. 820 m. arid hillslopes. M.

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1935-36 Expedition Collections of Nicotiana

Argentina-Mendoza

longiflora 04378	Argentina	Prov. Mendoza Challao; N. of Mendoza. Jan. 4, 1936, Alt. 820 m. along streambeds and adjacent fields. M.
acuminata 04397	Argentina	Prov. Mendoza Villavicencio, N. of Mendoza. Jan. 5, 1936, Alt. 1800 m. rocky canon near water springs. M.
acuminata 04604	Argentina	Prov. Mendoza Dept. Las Heras road Mendoza to Uspallata Valle del Toro. Jan. 8, 1936, Alt. 2440 m. M.
Cavanillesii 04615	Argentina	Prov. Mendoza Dept. Las Heras; pampa at Uspallata. Jan. 8, 1936, Alt. 2440 m. sandy waste. M.
corymbosa 04618	Argentina	Prov. Mendoza Dept. Las Heras; Puento del Inca. Jan. 8, 1936, Alt. 2745 m. waste land. M.
Cavanillesii 04620	Argentina	Prov. Mendoza. Near station Alto Verde. Jan. 12, 1936, Alt. 780 m. roadside among shrubs and weeds common in colony. M.
Cavanillesii 04621	Argentina	Prov. Mendoza. Near station Alto Verde; Jan. 12, 1936, Alt. 780 m. roadside among shrubs and weeds. M.
pampasana 04622	Argentina	Prov. Mendoza Dept. Las Heras beyond station Alto Verde. Jan. 12, 1936, Alt. 780 m. among spiny shrubs in sandy pasture. M.

Argentina-San Luis

Cavanillesii 04358	Argentina	Prov. San Luis Station of Villa Mercedes along R.R. Jan. 1, 1936, Alt. 600 m.

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1935-36 Expedition Collections of Nicotiana
Central Chile

Tabacum 3931	Chile Prov. Coquimbo. Nov. 22, 1935, Alt. 10m. waste ground near houses in town.
acuminata 3949	Chile Prov. Coquimbo. 1 km. S.E. of Illapel. Nov. 25, 1935, Alt. 610m. dry bed of Rio Illapel in sand and gravel.
Tabacum 04401	Chile Prov. Aconcagua near Valparaiso, Cerro Alegre near small stream in gully. Feb. 2, 1936, Alt. M.
acuminata 04402	Chile Prov. Aconcagua Laguna Verde S.of Valparaiso. Feb. 2, 1936, Alt. 100m. roadside on arid hillside. M.
acuminata 04405	Chile Prov. Curico Road Curico to Argentina beyond Los Quenes; along Arroyo Puerto in Andean foothills. Feb. 13, 1936, Alt. 124m. sandy soil. M.
acuminata 04407	Chile Prov. Curico Cordillera Peteroa-Planchon Canon Rio Claro. Feb. 15, 1936, Alt. 900 m. Sandy soil, small colony. M.
glauca 4523	Chile Prov. Valparaiso. Between Vina del Mar and Concon. Nov. 8, 1935, Alt.3m. sandy banks near beach.M.
glauca 4532	Chile Prov. Santiago Tiltil along ditches on outside of town. G.
acuminata 4534	Chile Prov. Santiago Tiltil in a sandy wash along creek. G.
corymbosa 04624	Chile Prov. Aconcagua Caracoles. Jan. 15, 1936, Alt. 3000 m. gravel R.R. bed at station.M.
corymbosa 4993	Chile Prov. Aconcagua, El Juncal. Jan. 9, 1936, Alt. G.
corymbosa 4996	Chile Prov. Aconcagua Portillo. Jan. 9, 1936 Alt. G.
corymbosa 5163	Chile Prov. Valparaiso Center of ridge of Cerro de las Vizcachas, W.of summit,mountain flat. Jan. 15, 1936, Alt. 2000m. sandy loam. W.
acuminata 5173	Chile Prov. Valparaiso Agua Santa 10 km. W. of Vina del Mar. Jan. 10, 1936, Alt. 150m. semi arid,rolling country;flats and hillsides. G.
corymbosa 5242	Chile Prov. Aconcagua Portillo; Transandine R.R. Feb. 5, 1936, Alt. 2800 m. W.

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1935-36 Expedition Collections of Nicotiana

Southern Peru-Coastal

paniculata 04010 — Peru Dept. & Prov. Lima. Road Lima to Army Rifle Range. Oct. 8, 1935, Alt. 215 m. roadside in dry soil. M.

paniculata 04025 — Peru Dept. & Prov. Lima Destrito Lurigancho; Campoy; foothills of Andes; cultivated fields by roadside. Oct. 12, 1935, Alt. 700 m. same species found dwarfed on arid hillside 500 feet higher. M.

paniculata 04028 — Peru Dept. & Prov. ~~Peru~~ Lima Distrito Lurigancho; Campoy. Oct. 12, 1935, Alt. 1000 m. among rocks on arid hillside. M.

glutinosa 04090 — Peru Dept. Lima Roadside Chosica to Matucana. Oct. 20, 1935, Alt. 1950 m. arid, rocky vally floor. M.

Knightiana 04161 — Peru Dept. Arequipa Prov. Islay; near Mollendo; hills near ocean near a trickle of water. Nov. 16, 1935, "Tabaquilla". M.

tomentosa 4524 — Peru Dept. Arequipa Arequipa Nov. 29, 1935, Alt. 2375 m. G.

paniculata? 8207 — Peru Dept. Arequipa Hills 8-10 km. E. of Mollendo on auto road to Arequipa. On R. R. further S. Jan. 24, 1937, Alt. 50-150 m. W.

paniculata 8213 — Peru Dept. Arequipa Prov. Arequipa Quiscos Station S. Peruvian R.R. Jan. 26, 1937, Alt. 3052 m. dry canyon slopes gritty soil and among rocks. W.

Southern Peru-Interior

glutinosa 3680 — Peru Dept. Apurimac (Ford of Rio Pampas, 3 km. west of Hacienda Airobamba. Oct. 31, 1935, Alt. 1840 m. Coarse gravel of dry river bed - "Tabaco". W.

tomentosa 3736 — Peru Dept. Apurimac Talavera roadsides. Nov. 3, 1935, Alt. 2900 m. "Tabaco Cimarron" W.

tomentosa 3762 — Peru Dept. Apurimac. About 5 km. N.W. of Huancarama on trail to Pincos. Nov. 6, 1935, Alt. 3200 m. densely wooded hillside near bottom of valley. "Huerala8-cistu". W.

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1935-36 Expedition Collections of Nicotiana
Southern Peru-Interior

Raimondii 6496 — Peru Dept. Cuzco Huambutio; riverside banks and waste ground about village. July 6, 1936, Alt. 2900 m. W.

tomentosa 7104 — Peru Dept. Cuzco Prov. Paucartambo, along Rio Tambomayo about 12 km. N. of Tambomayo on trail to Pillahuata. July 25, 1936. Alt. 1700 m. Opener part of middle zone of montana forest, just below lower limit of fog belt. W.

tomentosa 7172 — Peru Dept. Cuzco Prov. Calca near Pisacc; mouth and lower part of steep narrow ravine. S. side of Vilcanata Valley. Sept. 5, 1936, Alt. ca 3000 m. localized in sheltered parts of slopes bordering valley. W.

undulata 7173 — Peru Dept. Cuzco Prov. Calca, Ruins of Intihuatana Pisacc. Sept. 5, 1936, Alt. 3300 m. W.

tomentosa 7180 — Peru Dept. Cuzco Prov. Convencion Dist. Sta.Ana. Quillabamba. Canyon - affluent of Rio Urubamba 2 km. above its mouth. Sept. 25, 1936, Alt. 1000 + m. W.

tomentosa 7181 — Peru Dept. Cuzco Prov. Convencion Santa Maria Common in Urubamba Valley between Santa Maria and Quillabamba. Sept. 24, 1936, Alt. 1180 m. dense riverside brush formation savannah type. W.

tomentosa 7182 — Peru Dept. Cuzco Prov. Convencion Quellomayo. Sept. 24, 1936, Alt. 1300 m. riverside open rock and clay slopes, box canyon. W.

tomentosa 7183 — Peru Dept. Cuzco Prov. Convencion Huadquiña. Sept. 23, 1936, Alt. 1500 m. open river valley savannah forest. W.

tomentosa 7184 — Peru Dept. Cuzco Quebrada de Aguas Calientes above La Maquiña (Machu Picchu station). Sept. 26, 1936, Alt. 2100 m. damp, narrow, heavily wooded gulch. W.

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1935-36 Expedition Collections of Nicotiana
Southern Peru-Interior

Benavidesii 3797	Peru Dept. Apurimac. On trail from Pacachacas Bridge to Abancay, 3 km. from bridge. Nov. 8, 1935, Alt. 2200 m. on gentle, dry, slopes and waste ground "Ccamasay."	W.
Benavidesii 3848	Peru Dept. Cuzco Rio Limatambo near confluence with Apurimac. Nov. 11, 1935, Alt. 2300 m. gravelly flats.	W.
Raimondii 4521	Peru Dept. First Station below Cuzco on Manchu Picchu R.R. Oct. 25, 1935, Alt. 3050 m. rocky hillsides not below 2745 m. in Cuzco region.	G.
tomentosa 4525	Peru Dept. Cuzco Ollantaytambo. Oct. 25, 1935, Alt. 2745 m. along river bank in boulders.	G.
tomentosa 4526	Peru Dept. Cuzco, Ollantaytambo. Oct. 25, 1935, Alt. 2745 m. rocks along river bank.	G.
tomentosa 4527	Peru Dept. Cuzco. Along R.R. 150 m. up from Machu Picchu bridge. Oct. 25, 1935, Alt. 2285 m. rich soil among rocks.	G.
tomentosa 4528	Peru Dept. Cuzco Ollantaytambo. Oct. 25, 1935, Alt. 2440 m. among rocks along river.	G.
tomentosa 4530	Peru Dept. Cuzco Ollantaytambo. Oct. 25, 1935, Alt. 2840 m. good soil on cliffs above R. R. line.	G.
Raimondii 6480	Peru Dept. Cuzco. Ruins of Ollantaytampu; waste ground around ruins. June 25, 1936, Alt. 2800 m.	W.
rustica 6481	Peru Dept. Cuzco. Ruins of Ollantaytampu; waste ground around ruins. June 25, 1936, Alt. 2800 m.	W.
glauca 6495	Peru Dept. Cuzco Huambutio; riverside banks and waste ground around village. July 6, 1936, Alt. 2900 m.	W.

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1935-36 Expedition Collections of Nicotiana
Southern Peru-Interion

tomentosa 7185 — Peru Dept. Cuzco. Trail to ruins of Machu Picchu. Sept. 26, 1936, Alt. ca 2300 m. open shrub formation. W.

tomentosa 7186 — Peru Dept. Cuzco. Ruins of Machu Picchu. Sept. 26, 1936, Alt. ca. 2500 m. W.

tomentosa 7187 — Peru Dept. Cuzco. Llamacancha on R.R. Cuzco to Machu Picchu 20 km. S.E. of Machu Picchu. Sept. 26, 1936, Alt. 2400 m. Also in Ollantay Valley. W.

tomentosa 7188 — Peru Dept. Cuzco. Tancacc on R.R. Cuzco to Machu Picchu. Sept. 26, 1936, Alt. 2600 m. open temperate xerophytic brush and grass formation. W.

tomentosa 7189 — Peru Dept. Cuzco. Ollantaytambo. Sept. 26, 1936, Alt. 2800 m. open xerophytic riverside brush formation. W.

Tabacum 7190 — Peru Dept. Cuzco Prov. Convencion Huadquina. Urubamba valley from 3000 m. down. Sept. 23, 1936, Alt. 1500 m. semi-cultivated. W

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1935-36 Expedition Collections of Nicotiana
Northern Peru

Tabacum 04098	Peru Dept. Huanuco Road Huanuco to Muña, Chulque. Nov. 3, 1935, Alt. 1600 m.	M.
Tabacum 04109	Peru Dept. & Prov. Huanuco. Road Huanuco to Puente Duran; Chulque; plantation of Indian"Tabaco". Nov. 4, 1935, Alt. 1600 m.	M.
tomentosa 04110	Peru Dept. & Prov. Huanuco Acomayo, near native huts. Nov. 4, 1935, Alt. 2020 m. rocky ground "Tabaco Macho."	M.
rustica 04111	Peru Dept. Huanuco Acomayo. Nov. 4, 1935, Alt. 2020m. rocky waste land around village "Tabaco Shaire."	M.
Tabacum 04131	Peru Dept. Huanuco, Mirador road Acomayo to Chinchao rain forest of Central Andean Cordillera "Tabaco Shaire". Nov. 5, 1935, Alt. 2400 m.	M.
tomentosa 04144	Peru Dept. Huanuco Road from Mirador to Chinchao. Nov. 6, 1935, Alt. 2300 m. wooded gulch in Central Andean Cordillera.	M.
Tabacum 04159	Peru Dept. & Prov. Huanuco Village of Chinchao, in Central Andean Cordillera. Nov. 6, 1935, Alt. 2200 m.	M.
Tabacum 04160	Peru Dept. Huanuco Road Mirador to Chinchao Central Andean Cordillera. Nov. 6, 1935, Alt. 2300 m.	M.
Tabacum 8082	Peru Dept. La Libertad. Hacinda Chiclin 20 km. N. of Trujillo. Nov. 24, 1936, Alt. ca. 100 m. semi-cultivated "Tabaco".	W.
rustica 8084	Peru Dept. La Libertad Huamachuco; streets, corrals, waste places in & about town. Nov. 26, 1936, Alt. 3200 m. "Canchaillu".	W.
thyrsiflora 8179	Peru Dept. La Libertad Prov. Santiago de Chuco ca 2 km. S. of Tres Cruces Pass on trail Huamachuco-Angasmarca; steep S.W. facing hillside. Dec. 1, 1936, Alt. ca 3800 m. black soil containing heavy portion of white limestone rock fragments. Deeply washed-out ravines & gravel washes.	W.

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Distribution of Nicotiana Spp.
in Argentina, Bolivia, Chile, Peru
and Uruguay
compiled from herbarium sheets
(not including U.C.B.G. 1935-36 Exped.)
(U.C.B.G. collections in separate list)

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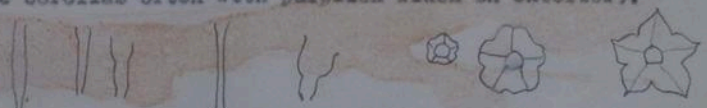
Genus Nicotiana

Mostly herbaceous annuals, few dm. to over 2 meters, occasionally somewhat woody, suberborescent in form and several meters high; frequently pubescent and sticky.

Leaves with or without petiole, varying widely in size, shape and texture.

Inflorescences generally extensive, loosely branched, though sometimes congested.

Flowers open all day and odorless, or vespertine and sometimes fragrant. Calyx: tubular, 5-parted, the teeth never extending below the middle, occasionally more points. Corolla most frequently greenish yellow, yellow or white, less frequently with bright pink or red predominant (white corollas often with purplish flush on exterior).



Stamens 5, commonly as long as corolla (occasionally longer or shorter), not necessarily all equal in length, attached to corolla anywhere from base to top of corolla tube. Pistil usually set on a small pale yellow to orange disc which frequently appears to be part of the ovate or conic, greenish (or purplish) 2-celled ovary; style erect, whitish (rarely colored), frequently about as long as the corolla tube; stigma occasionally obconic, usually thick discoid, green, with crease on upper surface.

Capsules at least partially enclosed by calyx, sometimes completely; generally oval or elliptic, thin-walled, dehiscent, in upper part of capsule 2 valves separating from each other and each valve usually splitting, until effect is that of a capsule with 4 teeth at its upper, open end.

Seeds light to very dark brown, tiny, numerous, roundish, oval, or oblong, sometimes distinctly reniform.

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Nicotiana

Corolla tubular, limb green, greenish yellow or yellow..PANICULATA GROUP
(N.paniculata, N.Knightiana, N.solanifolia
*N.cordifolia, N.Raimondii, N.Benavidesii,
N. glauca) + N.rustica (amphidiploid species)

Corolla either not tubular or limb not green, greenish yellow or yellow

Thick stemmed, stout, ± perennial, sometimes arborescent; flowers not closed during day

Flowers large and showy

Corolla nearly salverform and white.....

Flowers pendant.....N.SYLVESTRIS

Flowers not pendant.....N.TABACUM

Corolla sharply differentiated into tube, swollen throat (generally much swollen and gaping), and limb; seldom pure white.....TOMENTOSA GROUP +some strains of N.TABACUM
(N.tomentosa, N.tomentosiformis, N.glutinosa, *N.otophora, N.wigandioides)

Flowers small, not particularly showy.....N.UNDULATA (paniculata group)
(undulata corolla limb more star shape, dingy in color; habit of plant variable)

Medium or slenderstemmed plants; flowers closing during day (except Langsdorffii which stays open)

Cauline leaves present, all sessile, frequently decurrent.....ALATA GROUP
N. alata, N.bonariensis, N.longiflora, N. plumbaginifolia, N.Sanderae, *N.Forgetiana, N.Langsdorffii

Cauline leaves not all sessile, sometimes absent

Plant an inch or two high, flowers solitary

Stem present.....*N.MINIMA (corymbosa group?)

Stem absent.....*N.ACAULIS (related to Cavanillisii group?)

Plant more than an inch or two high, flowers not ~~xxxxxxxxxxxx~~ solitary spaced along leafy stem or definitely grouped into inflorescences

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Nicotiana (key continued)

Corolla tube over 20mm long

Inflorescence sharply defined, short, ± obliquely forked and brush like....N.CAVANILLESII (Cavanillesii grup)

Inflorescence not always sharply defined at base, extensive, "racemose" to complexly "paniculate".....ACUMINATA GROUP (N.acuminata, N.caudigera)

Corolla tube 20 mm lor less

Calyx 10-14 mm long, teeth short, broadly triangular, mucronate.....*N.FRIGIDA (related to N. corymbosa and to N.acuminata?)

Calyx less than 10mm long, teeth not mucronate (except paniculata, 6-12 mm.)

Rosette not formed.....N.PAMPASANA (Cavanillesii grup)

Rosette formed, its leaves not necessarily persistent

Rosette leaves strongly crisped.....*N.AMEGHINOI (related to Cavanillesii group?)

Rosette leaves not strongly crisped

Corolla tube about 20mm long

Inflorescence naked....*N.SPEGAZZINII (related to N. acuminata and to N.corymbosa?)

Inflorescence leafy or at least strongly bracteate*N.COQUIMBANA (corymbosa group)

Corolla tube 8-16 mm long (capsules in tight heads or spaced along stem. (N.corymbosa, N.Miersii) CORYMBOSA GROUP

* = not grown in U.C.Bot. Garden

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acaulis Speg. "In aridissimis secus Rio S. Cruz, prope Monte
≠Petunia humifusa Leon, anno 1882 (C.S.) et in subsalsis secus Rio
Speg. 1897 Chubut, Dec. 1899 (N. Illin)."

acuminata (Grah.)Hook. "The plant was raised in the Royal Botanic Garden, Edinburgh, in 1828, from seed transmitted to us by Dr. Gillies ---- from Mendoza."

alpina Poepp. (corymbosa)

var. patagonica Speg. "In australioribus secus Rio S. Cruz (C.A.,C.S.)" Published 1902

var. deserticola Speg. "In parte boreali secus G. San Jorge (C.A.) et secus Rio Chubut (N. Illin). Published 1902

Ameghinoi Speg. "In aridis saxosis loco Karr-aik vocato prope Lago Argentino aest. 1898 et inter S. Julian et Rio Deseado, vere 1899 (C.A.) nec non secus Rio S. Cruz, Febr. 1900 (F. Silvestri).

deserticola Speg. (pampasana) "In aridissimis saxosis secus Golfo de San Jorge, aest. 1899 (C. A.)."

glauca Grah. "The plant was raised in 1827 from seeds communicated without specific name, to the Royal Botanic Garden, Edinburgh, by Mr. Smith at Monkwood whose son sent them from Buenos Aires."

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NICOTIANA SPECIES

(If there is not a sheet describing it, it may be considered equivalent to or close to the name in parenthesis. Certain of the more unusual species are only described in T.H.G.'s Notebook)

acaulis Speg. (= corymbosa Remy?)
acuminata (Grahm.) Hook.
alpina Poepp. (corymbosa Remy?)
Ameghinoi Speg.
andicola Ph. (= corymbosa Remy?) andicola H.B.&K. (=rustica L.?)
angustifolia R. & P. (= acuminata Hook.?)
brachysolen Ph. (= undulata R. & P.?)
cardiophylla Ph. (= solanifolia Walp.?)
caudigera Ph.
Cavanillesii Dun.
chilensis Millan (=undulata R.&.P.?)
cirrhoides Miers (= acuminata Hook. var.?)
Collae Ph. (= Miersii Remy?)
copiapina Ph. (= acuminata (Grah.) Hook.?)
coquimbana Ph. (corymbosa group)
cordifolia Ph.
corymbosa Remy
crispa Cav. (= Cavanillesii Dun.?)
crispa Ph. (= pampasana O. Kuntze?)
deserticola Speg. (=pampasana O.Kuntze?)
Friesii Damm. (= otophora Griseb.?)
floribunda Ph. ("Waddingtonia" floribunda) (corymbosa group)
frigida Ph.
glauca Grahm.
glutinosa L.
heterophylla Ph. (=acuminata (Grah.)Hook.?)
Leguiana Macbr. (= tomentosa R. & P.?)
linearis Ph. (= corymbosa Remy?)
longibracteata Ph. (=frigida Ph.?)
longiflora Cav.
lychnoides Remy (= corymbosa Remy?)
mendocina Ph. (= Cavanillesii Dun.?)
mendogensis Speg. (= corymbosa Remy?)
Miersii Remy
minima Ph.
modesta Ph. (=acuminata (Grah.)Hook.?)
monticola Dun. (= corymbosa Remy?)
multiflora Ph. (= small flrd. acuminata Hook.?)
noctiflora Hook (= Cavanillesii Dunal?)
oligantha Ph. (=acuminata Grah.) Hook.?)
otophora Griseb.
oulophylla Dun. (= corymbosa?)
pampasana O. Kuntze
paniculata L.
parviflora Ph. (=Miersii Remy?)
parvula Ph.
pauciflora Remy (=acuminata (Grah.)Hook.?)
Pavoni Dun. (= rustica L.?)
Philippi Millan (=pampasana O.K.)

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petunioides Griseb. (=pampasana O.K.?)
plumbaginifolia Viv.
Raimondii Macbr.
rustica L.
sanderae artificial hybrid between alata and Forgetiana
scapigera Ph. (= corymbosa Remy?)
solanifolia Walp.
Spegazzinii Millan
sylvestris Speg. & Comes
tenella Cav.
thyrsiflora Goodsp.
tomentosa R. & P.
tomentosiformis Goodsp.
uspallatensis Ph. (= acuminata Hook.?)
undulata R. & P.
wigandioides Koch & Fint.

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N. acaulis Speg.

Petunia humifusa Speg. (1897, no. 291) (non Dun.)

Plant lacking stem, perennial, small, sometimes only 25 mm. (ca. 1 in.) high. Root strong and "pivotante" (fusiform). Radical leaves in rosette, 60 x 10 mm., or 2¼x3/16 in. (in one very robust specimen examined), spatulate-lanceolate, more or less glabrous, margin thick, crisped and 18 mm. (3/4 in.), almost glabrous, which arise from the center of the rosette. Calyx more or less glabrous, 7-11 mm. (ca. ¼ - ½ in.) long, teeth unequal; triangular or lanceolate. Corolla covered with soft hairs and viscid, more or less funnelform, 15-22 mm. (5/8 - 7/8 in.) long, limb with obtuse lobes. Stamens almost the same length, inserted 10 mm. from base, reaching to mouth. Ovary semicylindric.

This little plant "de tipo acentuadamente patagonico" (meaning?) has been collected in Santa Cruz and Chubut.
--After Millan.

Millan cites Santa Cruz; Monte Leon as Spegazzini's type locality. Apparently the only specimen Millan studied, however, was Chubut: leg. N. Illin, 1899.

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N. acuminata (Grahm.) Hook.
(N. Berteriana Dun.)

Herbaceous viscid plant sometimes reaching 15 dm. (4½ ft.) the few-leaved basal rosette of leaves conspicuous in the young plant but ephemeral. Older plants generally with a symmetrical shoot system of a central stem, 4-5 arcuately ascending main branches from base and above these alternate lesser branches. Stem rather slender. Leaves clearly petioled, sometimes reaching 25 cm. (10 inches), frequently less, blade ovate acuminate, triangular, or lanceolate, shape, width and prolongation of apex variable, surface flat or ruggose, Inflorescence almost unbranched (racemose) or much branched (panicle), generally rather long. Flower generally more or less vespertine, odorless. In type description "calyx 3/4 inch long, corolla 2 inches". Calyx rather distinctive in that the 5 fairly long, unequal teeth are very slender, linear and blunt and as Hooker puts it "run down and form so many ribs to the glandular pubescent, and almost colourless tubular portion." Corolla salverform, white, striated with green or purplish on outside, variable in width, generally more ample than extremely slender (i.e., broader than N. longiflora, narrower than N. rustica, limb lobes blunt, slightly emarginate. Stamens unequal, two longer, subexserted, three others included, all inserted below the middle of corolla tube (as depressions on outside of tube indicate.) Pistil about as long as shortest stamen. Capsules ca. 11 mm. (nearly 1/2 in.)long, elliptic ovate, blunt, dehiscent, Seeds fairly numerous, rather large for Nicotiana, brown (often metallic caste), ruggose.
Described from seed sent by Dr. Gillies from "Mendoza".

Largely a species of the central provinces of Chile but appearing to occur from Copiapo, Chile to northern Chubut, Patagonia. Extremely interesting in distribution (recurs in California), lack of hybridization with other species, and especially in its extent of variation in leaf, inflorescence and flower. Note, incidentally, that Graham gives corolla as 2 in. long, Hooker from same type stock-- 3 in. long, and 1-1½ inch not infrequent in var. multiflora(=N. multiflora Ph.), and especially in its relation to the corymbosa group.

Old plants not infrequently lose their larger leaves and show only smaller, very narrow pointed ones, giving a very different aspect to the plant.

Cf. also N. oligantha Ph., N. pauciflora Remy which appear to belong to N. acuminata.

Mus. Hist. Nat. Santiago Prof. Ph. "Nicotiana Berteroana var Ph. Cuesta Nicolle Chamarcillo, Nov. 1886 - ordinary acuminata"
Nicotiana Berteroana, Dun. var, Salto de los Tinieblas Oct 1887 - same

acuminata also occurs in San Juan, Saile Echegaray

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N. alata Link & Otto (N. affinis hort.)

Coarse, viscid, potentially perennial herb to a meter or a meter and a half (3 -4 1/2 ft.) high. Stems few, 10-20 mm. in diameter at the base, narrower above, clothed with leaves and little branched up to the relatively short axillary "racemes" and subsimple terminal inflorescences. Basal leaves forming a few-leaved, rudimentary rosette, 25 x 13 cm., broadly spatulate, apex obtuse, base faintly auriculate; cauline leaves with large prominent auricle extended basally into a long, stem-decurrent wing, petiolar region short, indistinct, broadly winged, leaf apex acute to acuminate, margin wavy, surface puckered; uppermost leaves usually less decurrent, strictly sessile, slipperform to obcuneate-acuminate, bracts inconspicuous, small, subulate. Flowers vespertine, fragrant. Calyx 1/4 - 1/3 the length of corolla tube, nearly tubular, conspicuously ribbed, segments slender and about as long as calyx tube. Corolla tube 70 - 90 mm., long, ca. 5mm. wide to 20 mm. from mouth, then slightly broader, pale greenish; limb with greenish or rose and greenish flush on exterior, chalky white within, to 65 mm. across, patent, lobes deep, ovate. Stamens inserted 20 mm. below mouth, 4 extending to it, 5th shorter, anthers purple. Capsules 10 mm. long, broadly ovoid-obtuse, about half covered by calyx, dehiscent. Seeds numerous, grey-brown, nearly elliptic, ca. 0.5 mm. long.

Argentina Entre Rios: Concepcion del Uruguay, April, Oct.
Misiones: Posadas, especially around Bompland, Sept., Oct., Nov.
Puerta Pampa, April
Puerta Denis, July
Santa Ana, Aug.
Cerro Cora, Oct.
Apostoles, Jan.
Corpus, Nov.
Between Santa Ana and San Ignacio, Nov.

Uruguay Salto: Salto - This is one of the earliest flowers of Salto, growing out of crevices of rocks - a splendid night flowering spp. of dry rocks.
Minas: Arequita, Lavalleja (listed by Herter)
Also the depts of Tacuarembo, Rio Negro, & Flores are listed by Herter.

Brasil Santa Catherina: Rio Uruguay

Type locality indefinite: "Die Samen dieser Pflanze erhielt der Garten vom Herrn Sello im Jahre 1827 aus Brasilien." "Habitat in Brasilia australi."

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N. alpina Poepp. = N. corymbosa

Nicotiana alpina Poepp. = N. monticola DC., Prodr. XIII, 1°, p. 564 -- Comes, Monogr. Nicot., p. 31 -- N. corymbosa Remy, Gay, Fl. chil. V. p. 57 -- Collomia patagonica Speg., Plant. Pat. austr., n. 267.

Hab. Non rara in aridis fere totius Patagoniae, per ann. 1882-900.

Obs. Species distinctissima etsi statura pubescentia etc. sat variabilis; formae v. varietates sequentes distinguendae:

a) patagonica (Speg.): statura humillima (15-100 mm alt.) simplex v. parce ramosa, foliis omnibus angustissime linearibus fere filiformibus (10-25 mm long. = 0.5-2 mm lat.) floribus minimis (8-10 mm long.) tota dense glanduloso-subvelutina. In australioribus secus Rio S. Cruz (C.A., C.S.).

b) deserticola: statura elatiore (25-50 cm alt.) plus minusve ramosa, foliis radicalibus subrosulatis anguste linearilanceolatis utrimque longe attenuatis petiolatis (7-10 cm long. cum pet. = 5 mm lat.), caulinis linearibus (3-8 mm long. = 1-3 mm lat.) floribus capitato-congestis majoribus (12-15 mm long. = 1.5 mm diam.), tota patentim laxeque hispida parce viscosa. In parte boreali secus G. San Jorge (C.A.) et secus Rio Chubut (N. Illin).

- Anales de la Sociedad Cientifica Argentina
Tomo LIII Primer semestre de 1902
pp. 175-176

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N. Ameghinoi Speg.

Scapose, powdery-pubescent perennial herb 10-30 cm. high and becoming viscid above. Leaves in a basal rosette, 5-10 cm. long, blade strikingly "plicato-crispato sinuata (fere pinnatiloba)", oblong or subspatulate and attenuated into a slenderly ribbonlike patiole. Stems one to several, simple or branched. Flowers few, at first in terminal "heads", later the inflorescence becoming more racemose. Calyx cylindric-campanulate, 8-10 mm. long, teeth linear, unequal, nearly half as long as tube. Corolla 18-20 mm. long (2-3 x calyx), white or yellowish-white, tube cylindric-funnel form, slender within the calyx and especially immediately above the ovary, limb lobes short, acute. Stamens inserted on corolla tube about 1/3 from its base, slightly geniculate at insertion, extending to mouth. Stigma slightly if at all exceeding anthers. Capsule ovate-elliptic, 12-14 mm long. Seeds numerous, ovate-reniform, slightly more than 1 mm. long.

Chubut: Comodoro Rivadavia, Dec., March.

Santa Cruz: Deseado; in arid rocky locations in a place called Karr-aik near Lago Argentino, summer; between San Julien and Rio Deseado.

Appears to belong in the corymbosa group, although its crisped leaves are suggestive of N. pampasana. A very distinct species, carefully described by Spegazzini, not grown in Univ. Calif. Bot. Garden.

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N. andicola Ph.
(N. corymbosa Remy?)

Described where?

Have Macbride photo #3022 of this "728. Nicotiana andicola Ph., Desert Atacama, A. Philippi" apparently in Philippi's hand. See no reason why this is not corymbosa var. typica, but have no information beyond photograph. It seems very similar to U.C.B.G. corymbosa (collected Valle de San Francisco, Fierro Carrera, 2800 m., Andes de la Cordillera de Santiago, Chile, coll. Looser 1/28/30) with exception of not showing any flowers very close to base of plant.

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N. angustifolia R. & P.
(= N. acuminata (Grahm.) Hook.)

Nicotiana with lanceolate leaves, upper ones linear acute, panicle diffuse, corolla very slender, limb plicate. Plant herbaceous, viscid, annual. Root fusiform, slender, fibrous, white. Stem erect, branched above, terete, paniculate. Branches long, terete. Leaves alternate, entire; lower petiolate, lanceolate, very acute; upper subsessile, linear, acute. Flowers terminal, paniculate--racemose diffuse. Pedicels axillary and terminal, short. Calyx divisions linear-lanceolate, unequal. Corolla limb creased, white. Tube 3x longer than calyx, greenish. Habitat in neighborhood of Concepcion ("Conceptionis"--Latin) Chile Flowers in February and March. Common name: Tabaco Cimarron.

--After Ruiz and Pavon

This appears to be N. acuminata save for the corolla being described as "angustissimis". The confusion with something like N. bonariensis appears to be due to a mix up in specimens? What grows around Concepcion, Chile?

Angustifolia R. and P. You saw several collections from Concepcion, thought they were certainly acuminata

Digitized by the Hunt Institute for Botanical Documentation

M. Benavidesii Goodsp.
(paniculata group)

Soft-woody perennial to 3 m. high intermediate between solanifolia and Raimondii in habit, leaf and flower. Stem moderately viscid, older portions developing thin corky-layer soon fissuring. Leaves large, strictly petiolate, blade 30 x 30 cm., conspicuously, broadly cordate with basal lobes accentuated and apex retuse. Inflorescence long, columnar axis and numerous floriferous laterals. Flowers pendent, odorless, always open. Calyx a light green cup 8-10 mm. long, 6-7 mm. wide, teeth short, triangular. Corolla light greenish yellow, broadly tubular (35-45 mm. long, 10 mm. wide) with narrow, faintly lobed limb. Stamens equally inserted on corolla at about the top of the ovary, and extending beyond the mouth of the corolla. Stigma likewise exserted. Capsule rotund oval, acute, 10-15 mm. long, dehiscent. Seeds numerous, dull brown, angular, ca. 0.6 mm. long.

Type collected on U.C.B.G. 1935-36 expedition, J. West, Nov. 8, 1935, 3 km. from bridge on trail from Pachachacas Bridge to Abancay, Dept. Apurimac, Peru. Alt. 2200 m. "Lining road, on gentle, dry slope and waste ground. 'Conmasayu.'" Also collected by Mr. West Nov. 11, 1935, Rio Limatambo, near confluence with Apurimac, Dept. Cusco, Peru. Alt. 2300 m. "Gravelly flats," and by C. Vargas C., Hda. "Sisal," quebrada de Marcahuasi, Prov. Anta, Dept. Cusco, Peru. Alt. 2400 m.

The three collections listed are the only ones there are of this species. Any additional information especially ecological and distributed data which might bear on the relationship to Raimondii, solanifolia, and even glutinosa (which it strikingly resembles in leaf characters) would be helpful. The range of the species is as yet unknown.

Digitized by the Hunt Institute for Botanical Documentation

N. bonariensis Lehm.
(N. viscosa Lehm., N. tristis Sn.)

Sticky, erect or spreading herb usually less than 1 meter high, with strong tendency to crown- and root-sprout. Stems usually slender, few or many, much or little branched. Basal leaves in symmetrical, many-leaved rosette, spatulate, petiolar region long or short; cauline sessile, narrower, lanceolate, acute or acuminate, base more or less auriculate and semi-clasping; bracts linear-lanceolate, relatively large and conspicuous. Flowers vespertine. Calyx about 1/3 as long as corolla tube, tubular, teeth rather slender, the 2 longer about equalling calyx tube. Corolla greenish purplish outside, white within, tube 15-30 mm. long, subcylindric (a little flattened), contracted within calyx, then somewhat exceeding calyx in width, finally bulging slightly immediately below mouth; limb spreading to 30 mm. across, deeply cut into ovate lobes. Stamens inserted on corolla 8-10 mm. from base of tube, 2 barely exserted, 2 included, 5th slightly the shortest, anthers purple. Capsule ovoid, ca. 10 mm. long, included, dehiscent. Seeds rather numerous, dull grey-brown, spherical, ca. 0.5 mm.

Argentina	Entre Rios:	Concepcion del Uruguay, Oct.	
		Eastern bank of the Uruguay	
		Capital Federal: Dock Sur, Aug., Oct., Dec.	
		Isla Maciel	
		Misiones: Posadas, Bonpland, "campina" near the river Yabebiry, Jan.	
Uruguay	Dept. ?	Paso de la Arena	
	" "	Rosario Oriental, Oct.	Minas (Lavalleja)
	" "	Carrasco, Nov.	Colonia
	Colonia,	Oct., Dec.	San Jose
		Toledo, amongst the stones	Artigas
		Paso de la Arena	Cerro Largo
	Montevideo:	Montevideo, April	Soriano
		Punta Brava, Oct.	
		Atahaualpa, Nov.	
		Colon, Oct.	
		Independencia, granite boulder, Dec.	
	Maldonado:	Rincon del Diario, sandy country.	
Brazil	Rio Grande do Sul:	Porto Alegre	
	Parana:	Serrinha, sandy places, crevices of rocks, Dec., April	
		Calmon, sunny ground at the edge of the woods, March	
		San Joas, Feb.	
	Sao Paulo:	Movia, Jan.	

Type locality of N. bonariensis and N. viscosa simply "Bonaria."
N. Tristis, Montevideo.

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N. brachysolen Ph.
(- N. undulata R. & P.?)

Do not have description (Phil.: Viaje a la prov. Tarapacaca p. 62, #279) but cf. Reiche's (p. 384-5), Reiche's is probably a paraphrase.

Type locality: Tarapaca (Calcahuay) according to Comes:

Reiche adds "provinces of Tacna to Atacama. The specimens from Torona (Prov. of Tacna) are like N. undulata R. & P."

T. H. G. has no notes nor photographs of this species.

Digitized by the Hunt Institute for Botanical Documentation

N. cardiophylla Ph. = N. solanifolia

(Type from "Prope Caldera l. d. Quebrada de la Leonia detexit orn. Guil. Geisse.)

The plant does not appear to be glutinous. The lower leaves according to the information given by Senor Geisse, reach a foot in length; the larger of the specimen of the museum reaches 12 cm. in length and 9 cm. in width and is attached to a petiole 9 mm. long. The calyx is 10 mm. long, its teeth are slightly unequal; the corolla is 44 mm. long and 13 mm. wide (dry, pressed), the lower part of the corolla is white (pale?) in the young flowers, its base inclosed in the calyx is narrower and then broadens abruptly. The stamens are inserted on its base; they are slightly unequal and are, like the style, as long as the corolla. It resembles N. solanifolia much, but is not viscid, and all the leaves are distinctly cordate, and the calyx and corolla lack pubescence.

Johnston collected fairly near type locality and believes it to be solanifolia.

Viscidity should be checked. Would expect to find hairs on stems of inflorescence if there is stickiness.

Digitized by the Hunt Institute for Botanical Documentation

N. caudigera Ph. = pauciflora

(Plant described from the upper flower-bearing part of the stem and loose lower leaves.) Somewhat glabrous, annual? Radical leaves , cauline leaves petiolate, petiole 21 mm. (¾ in.), blade 15 cm. (6 in.), its base wedge-shape, apex acuminately drawn out, nerves 7 on each side of midrib. Flowers racemose, bracts linear, sessile. Calyx 20 mm. (¾ in.) long, its divisions very slender linear, almost longer than the tube, glandular pubescent, viscid. Corolla 46 mm. (1¾ in.) long, 3-4 times as long as calyx, glandular puberulent, somewhat greenish, tube 6 mm. (¼ in.) wide, cylindric, limb infundibuliform, lobes very obtuse. Stamens do not reach to the mouth. Capsule as large as calyx.

--After Philippi.

In the Atacama Desert at a place called "La Guardia", 2000 m. elevation, coll. Franc. At San Roman called "tabaco del campo."

Phillippi says the acuminate prolongation of the leaves suggests N. cirrigera Miers (cirrhoides?), but that it seems distinct inasmuch as the lobes of the corolla of Miers species are "longissime cuspidatos."

In considering whether Johnston's collection (near Potrerillos, ca. 1680 M., dep. Chanaral, Prov. Atacama) and Werdermann's (Dep. Copiapo, Prov. Atacama, alt. ca. 3000 m.) belonged to N. caudigera, the "limb infundibuliform" was taken in conjunction with "Stamens do not reach the mouth." A limb pressed erect would appear in infundibuliform (funnelshape) and hide the actually exserted stamens. The type sheet or a collection from Philippi's locality as above cited would be very helpful in making a positive determination of the Univ. Calif. Bot. Garden strains derived from Johnston's and Werdermann's collections.

8/25/47 - „Santiago: Museo Hist. Nat.
"Nicotiana Bonteroana, Dun. var.; Salto, Nov. 188" is quite obv. pauciflora

Digitized by the Hunt Institute for Botanical Documentation

N. Cavanillesii Dun. (Cavanillesii group)
"N. crispa Cav., N. noctiflora Hook." (corayuyo, lagana de perro, tabaco cimarron)

Plant 40-125 cm. (1.5-4 ft.) high. Stems glabrous or glandular-pubescent. Leaves sometimes reaching 12 cm. nearly 5 in. in length (petiole included), characteristically petiolate although uppermost sometimes sessile, blade elliptic-ovate, ovate, lanceolate or linear-lanceolate, plane, or margin undulate or crisped, glabrous or on lower surface glandular-pubescent. Inflorescence usually not exceeding 15 cm. (6 in.), tending to branch by forking. Calyx about 8-14 mm. (5/16-9/16 in.) long, teeth short. Corolla 28-45 mm. (1-1¾ in.) long, limb spread about 25 mm. (1in.), coloring variable, sometimes with pink to violet flush, sometimes nearly white throughout, usually some green on exterior of tube and limb, tube moderately slender, limb lobes obtuse and more or less notched. Stamens extending to mouth of tube, one slightly shorter and its filament commonly less geniculate at insertion than the others. Capsule about 8 mm. long, elliptic, dehiscent. Seeds rather dark brown, ovate-triangular or subreniform, ca. 0.8 mm. long.

Three varieties have been recognized: var. typica Millan: leaves lanceolate, margins undulate, corolla white inside, exteriorly somewhat greenish, tube 28-43 mm. (1 1/8 - 1 6/8 in.) long. It occurs in Mendoza, southern and eastern San Luis, La Pampa and Rio Negro, collections having been made in October to March.

Variety noctiflora, Millan (N. noctiflora Hook.): leaves lanceolate, margins undulate-crisped corolla whitish within, exteriorly greenish-purplish, tube 23-28 mm. (5/8 - 1 1/8 in.) long. It has been collected in Santiago del Estero, San Juan, and Mendoza, from October to December.

Variety albiflora Comes: leaves ovate or ovate-lanceolate, obtuse, margin plane or occasionally undulate, corolla white within exteriorly somewhat greenish, tube 45 mm. long. It is widely distributed in the center of the Formacion del Monte (forest region) in Salta, Tucuman, Catamarca, La Rioja, San Juan, Cordoba and San Luis.

The question whether var. noctiflora is distinct from typica has been raised, inasmuch as appearance and development of pink to purple coloring is influenced by temperature.

Field data on the polymorphy in habit; leaf; corolla size, color, and shape of limb is of interest, also the relation of short-flowered forms of var. typica to N. pampasana O. Kuntze.

Digitized by the Hunt Institute for Botanical Documentation

N. chilensis Millán = N. undulata

Viscid-pilose plant. Leaves petiolate, blade 11 x 3 cm., lanceolate, margins strongly crisped, petiole 5 cm., somewhat flattened. Inflorescemce racemose. Calyx pilose, strongly 2-lipped, lower lip of short triangular lobes, upper lip obtuse, longer than half the length of the corolla tube. Corolla tube semi-infundibuliform, 13 mm. long, narrowed at mouth; limb sinuses extending about half way in, lobes oval or apiculate, 4 mm. long. Capsule oval.

--after Millan.

Distinguished from N. undulata and N. Pavoni by the deeply crisped leaf margins.

Collected in Napa (Prov. Tarapaca) in February.

Species based on a piece of an inflorescence and two leaves. The difficulty in distinguishing "Pavoni" from undulata in dried condition, fragmentary nature of the only collection, and significance of anything which might throw more light on the relationship of "Pavoni" (rustica) from undulata, make the recollection of this plant in its type locality of some interest, even though there is a fair possibility it may turn out ot be a variety of undulata. Millan cites the type as "Tarapaca: Napa, leg. Philippi, II-1885" (Museo Nacional, Santiago, Chile).

cirrhoides Miers You saw type at Brit. Mus., said exactly as Miers illustrates it

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N. copiapina Ph.
(N. Berteroana Dun.)

Nicotiana Berteroana D. var.? an sp. distincta N. copiapina vocanda? N. 2-3 pedes alta; foliis inferioribus..., floralibus breviter petiolatis, lineari-lanceolatis, longe acuminatis; racemis terminalibus paucifloris; calycis glanduloso-pubescentis laciniis tubum superantibus, lineari-subulatis, obtusiusculis, magis minusve inaequalibus, 19-20 mm. longis; corolla 6-7 cm. longa, parum puberula, tubo basi angusto, vox ampliato, demum diametri 7-9 mm., limbo infundibuliformi-ampliato diametri 11 mm. lobis brevissimis, very distant; the pedicels of the lower fruits measure 15 mm. The capsule, 11-16 mm. long, opens with 4 teeth. The calyx lobes are scarcely unequal in the flower, they are much more unequal in the capsule, then the tube of the calyx is a transparent membrane with 5 green nerves.

It differs from N. Berteroana by its much larger flowers, the corolla of that species, according to the complementary description of Dunal which follows the diagnosis, being three times the length of the calyx, which measures 5-5 lines -- 9-11 mm., making the tube of the corolla 27-33 mm., whereas the corolla of our plant has a length of 60-70 mm.

--After Philippi.

Type locality: Near Bandurrias in province of Atacama, Quebrada del Molle, collected Guill. Geisse

Philippi says: I have believed for a long time that the Nicotiana described below might be a variety of N. Berteroana, but it is perhaps a distinct species. Compare the two descriptions.

The branches almost always have three flowers, the two lower are N. Berteroana -- N. Berteriana Dun. -- N. acuminata (Grahm.) Hook.

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N. coquimbana Ph. (corymbosa group) = N. Miersii

Slender-stemmed annual 20 cm. (8 in.) high. Radical leaves reaching 75 x 18 mm. (3½ x ¾ in.), rosulate, crowded, oblong, apex rather acute, base narrowed into a short petiole, cauline leaves linear-acuminate, lower ones sometimes with crisped margins, upper ones measuring 11 x 1 mm. Inflorescence paniculate, its branches long and slender, pedicels short. Calyx 8 mm. (3/8 in.) long, corolla 19 mm. Capsules not described (immature on type).

--After Philippi

Type from near Paihuano (Prov. Coquimbo Reiche gives as location for this town), collected by Felix Peralta.

Philippi says: It differs from N. scapigera Ph. (Viaje al Des. Atac.) in the shape of the radical leaves and the paniculate inflorescence; from N. corymbosa Remy in the stem "sencillo" (slender?) at the base, the narrow, sharply pointed leaves, the lack of axillary flowers; from N. modesta by the same characters.

A sheet in the British Mus. bearing the name "Coquimbana" in Philippi's hand, T. H. G. noted as "probably a member of corymbosa group, small plant, def. rosette, upperleaves very narrow and flrs. somewhat corymbose." (No name of collector? no place?) This wasn't photographed. N. coquimbana is not discussed by Millan. Note lack of corolla color, stamen insertion, capsule, etc., in original description.

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N. cordifolia Ph.

Woody; stem about an inch thick, covered with dense tomentum of very short hairs. Leaves with petiole reaching about 55 mm. (2¼ in.) and canaliculate; blade ca. 125 x 115 mm. (5 x 4½ in.), cordate, suborbiculate or ovate-orbiculate, scarcely acute, whitish on under surface, covered with very short tementum which in the upper leaves occupies only the veins. Inflorescence paniculate. Calyx 8 mm. (5/16 in.) long, velvety, teeth extremely short. Corolla ca. 25 mm. (1 in.) long, densely pubescent, dark violet, limb very short, lobes blunt, rounded. Capsule included in calyx, bivalvate. Seeds "granulata" (meaning?).

1. or yellow!

--Philippi

Philippi says it differs from N. solanifolia, which is coastal in the Atacama Desert, in the pubescent flower, form of the calyx, corolla 3 times as long as calyx, bivalve capsule, etc.

Type locality: "Masafuera" according to Philippi. Skottsberg gives a fuller location for this endemic of Masafuera: Coast cliffs close to the landing place near Q. de las Casas (bl. 10/2 17, no. 1220); Q. de las Vacas, on the canyon wall, not far from the entrance, scattered specimens; Q. Angosta, in the gorge; Q. del Varadero, numerous fine shrubs near the entrance; along the shore of Tierras Blancas, not uncommon.

Sheet signed by Phillippi already photographed (Macbride).

Blooms almost all year (though only a little in April, May, June, and none in July.)

'Very short tomentum' is similar to velvety character of N. Raimondii as is also habit + flower.

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N. corymbosa Remy

Plant 7-22 cm. (3-8 in.) high. Stems erect, branching from base, canaliculate, viscid puberulent. Basal leaves numerous, long petiolate, oblong, subacuminate, obtuse, hispid, margins undulate-crenate, upper leaves fewer and shorter petiolate. Lower flowers solitary or axillary at base of the plant, others forming a corymb of 3-6 at the end of the branches and somewhat inclined. Calyx tubular, covered with glandular hairs, teeth unequal. Corolla small, tube narrow, twice as long as calyx and very slightly pubescent, limb short. Capsule with 2 bifid valves, included in calyx.

Various specimens of this plant were found in Andean pastures. They have oval, quite entire leaves and a few branches. They are found in October in the cultivated cordilleras of Santiago up to 2600 yards (7800 ft., ca. 2900 m.) elevation, and the higher up they are, the "pequenas" (smaller? or possibly fewer?)
--After Remy

"(Mus. Paris) 5 sheets all = types or cotypes and all of same general type but showing great var. in size and habit although main morphol. chars. may be much the same--cf. Millan's fig. and discussion."
--T.H.G. notes

Millan gives the corolla length as 9-11 mm. He recognizes two varieties:

(1) Leaves oblong lanceolate and obtuse...var. typica Millan

(2) Leaves narrow, lanceolate or linear...var. deserticola Speg.

var. typica (N. alpina Poepp., N. monticola Dun., N. scapigera Phil.)

Plant more or less viscid and branched. Radical leaves rosulate, entire, little undulate, obtuse, oblong lanceolate, up to 7.5 x 3 cm. (3 x nearly 1¼ in.) with short hairs although on first sight appearing glabrous, upper leaves smaller, more sessile. Scapes pilose. Inflorescence conglomerate and few flowered. Calyx 4-6 mm. (ca. ¼ in.) long, cylindric, viscid pubescent, teeth lanceolate, unequal. Corolla 9-11 mm. (at most ½ in.) long, greenish, tubular, slightly pubescent; limb viscid with lobes obtuse and plicate. Capsule oval, 7 x 5 mm. (5/16 x 4/16 in.), equalling or exceeding calyx. As capsule matures and increases in size the calyx teeth become more triangular. --San Juan, Mendoza, Rio Negro, Chubut, Santa Cruz, Chile (Prov. Coquimbo)

var. deserticola Speg. (N. lychnoides Remy, N. linearis Phil., N. alpina Poepp. var. patagonica Speg., Collomia patagonica Speg.)

Plant 10-50 cm. (4-20 in.) high, viscid, pilose or wooly. Stem simple or branched. Radical leaves rosulate, 12 x 10 cm.

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N. corymbosa Remy

var. deserticola Speg. (con't.)

(4½ x 4 in.), lanceolate linear and acuminate, tapered into long petiole, ciliate, cauline leaves few, much shorter and narrower. Inflorescence conglomerate, bracteate. Calyx cylindric, narrow, pilose, with erect, greenish, lanceolate, plane, unequal lobes. Corolla tubular, to 11 mm. (½ in.) long x 1.5 mm. wide, with very short hairs; limb lobes obtuse, very small, erect and plicate. Capsule oval, smaller than calyx.

Mendoza through all of Patagonia

Concerning the delimitation of these two varieties and the species in general, note that Millan adds 'When the inflorescence becomes looser, but (the plant) always with oval lanceolate leaves it (var. typica) passes through intermediate forms to become N. Spegazzinii. On the other hand with lanceolate leaves narrow to linear it becomes N. corymbosa var deserticola to N. Miersii.

Digitized by the Hunt Institute for Botanical Documentation

N. crispa Cav.
(N. or Central American?)
San Blas

264. Nicotiana crispis foliis lanceolato-linearibus, crispis, villosis, glutinosis, petiolatis: paniculâ dicothoma.

The branch which Don Luis Nee brought from the neighborhood of San Blas in the northern part of America is cylindrical, slender, rigid and hairy, with alternate branches, ultimately forked, which support the "aborquilladas" (curled up?) panicles: the leaves are commonly lanceolate-linear, sometimes shorter than in the preceding species, undulate and crisped on the margin. The calyx is villous, the tube of the corolla an inch and a half and the limb smaller; it flowers in March.

(original description - Spanish translated - of Cavanille of his crispa which is Dunal's Cavanillesii, recognized by Millan). What species grows in San Blas? (Is this the San Blas near Panama?)

8/19/35. I have the feeling I have seen this listed as Mexico: San Blas, but can't seem to locate it.

Digitized by the Hunt Institute for Botanical Documentation

N. deserticola Speg.
(= N. corymbosa sensu Millan) (= petunioides (Grieb.) Millán pampasana O.K. ?)

410. Nicotiana deserticola Speg., n. sp.
Diag. Didiclia, rustica perennis, ramosi-cauligera, decumbenti-erecta, ramis confertis fastigiatis glabris sed pilis crassis aculei-formibus laxissime adspersis, foliis radicalibus evanidis caulinis confertis erectis lanceolato-linearibus utrimque attenuato-acutatis inferis ve petiolatis superis sessilibus, glabris v. laxe pubescenti-hispidulis margine grosse undulato-subsinuatis atque spinuloso-ciliatis, pedunculis elongatis simplicibus v. ramosis deorsum laxe foliatis sursum nudis apiceque pauciflori, floribus patentibus, brevissime v. longiuscule pedicellatis, pedicellis erectis glanduloso-puberulis basi et saepe ad medium bracteolis linearibus obtusiusculis ornatis, calycibus subcylin-draceo-campanulatis hispidulo-glandulosis 5-dentatis, dentibus late triangularibus subobtusiusculis, corollis obconoideo-sub-hypocrateriformibus duplo calyce longioribus tenuiter puberulis albo-virescentibus, limbo 5-angulato, capsulis...desideratis.

Hab. In aridissimis saxosis secus Golfo de San Jorge, aest. 1899 (C.A.).

Obs. Species precedentibus valde affinis, ad N. noctifloram Hook. accedens, ad omnibus tamen bene distincta; facillime cum N. pampasana OK. (Rev. gen. plant., III, 2, p. 223) conjungenda, sed descriptio hujus speciei a Cl. OK., l. c., data nimis manca et sine speciminum comparatione nil certe eruendum erit.

N. deserticola Speg. 2.

Radix cylindracea longissima (15-25 cm. long.= 2-4 mm. crass.) fusco-ochroleuca simplex parcissime barbellata (an turiones rhizomatis profundissimi?) apice sensim in caule simplici (an semper?) producta; caules teretes basi decumbentes sursum arcuato-adscendentes (20-50 cm. long.= 2-3,5 mm. crass.) a basi dense ramosi, virides pilis paucis albis brevibus conoideis subaculei-formibus hinc inde laxissime adspersi, ceterum glab-errimi; ramuli fastigiati alterni erecti simplices v. parum ramulosi (15-20 cm long.= 2-2,5 mm crass.) virides, deorsum teretes sursum obsolete angulatosulcati, plus minusve, ut caules, piloso-aculeati, glabri; folia lineari-lanceolata utrimque longe attenuata (25-75 mm long.= 3-9 mm lat.) apice obtusiuscule acutata, basi cuneato-sessilia v. breviter aut brevissime petiolata, margine grosse obtuseque e sinuato crispato-lobulata, acie saepius dense ciliato subspinulosa, injuventute utrimque puberulo- glandulosa per aetatem ad epiphyllum laxe grosseque hirsutula ad hypophyllum subglabrata viridia, crassiuscule membranacea. Flores horizontaliter patentes ad apicem caulis v. ramorum ramulorumque saepius pauci (2-3) rarius laxissime subracemosi (5-9), axi inflores-centiae plus minusve elongata atque nuda (3-7 cm long.) v. foliis subbracteiformibus paucis (1-3) ornata erecta, pedicellis erectis 4-12 mm long.) dense hirsuto glandulosis basi bracteola lineari v. lanceolata obtusiuscula puberula fultis, longioribus ad medium bracteola altera minore ornatis, unifloris; calyces cylin-draceo-subcampanulati (10 mm long.= 5 mm diam.) grosse 5-dentati, dentibus late triangularibus (3 mm long. et lat.) obtusiuscule

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acutati pallide virides, sinubus acutis subalbescentibus extus densiuscule hirsuto-glanulosi; corollae cylindraceo-obconicae (20 mm long.= 6 mm lat. ad faucem), tubo in parte calyce tecta abrupte valideque angustato (2 mm diam.) atque glabro, in parte exerta, praecipue marginem versus, dense hispifulo-puberula, ex albo ochroleuca (in sicco), limbo vix evoluto 5-angulato sed non v. vix lobato, intus glabra, staminibus 5 faucem attingentibus sed non exertis, filamentis e tertium inferum tubi exsurgentibus, basi valide geniculatis ibique albo-puberulis, deorsum in lineolis puberulis productis, ceterum glabris; ovario conoideo (3 mm long. = 2 mm diam.) glabro viridi stylo glabro stamina aequante apice leniter clavulato subimperspicueque subdidymo coronato.

- Anales de la Sociedad Cientifica Argentina
Tomo LIII Primer semestre de 1902
pp. 179-180.

Spegazzini, Carlos: Nova Addenda ad Florain Patagonicam
Pars Altera

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Nicotiana (or Waddingtonia) floribunda Ph. = N. Miersii

FLORULA ATACAMENSIS by Dr. R. Philippi - page 41 1860

Waddingtonia Ph. n. g.

Calyx tubulosus, persistens, profunde quinquefidus. Corolla exacte tubulosa, breviter quinquedentata, aestivatbne valvata. Stamina quinque, imo tubo corollae inserta, inclusa; filamenta capillaria; antherae cordato-bilobae, longitudinaliter dehiscentes; Ovarium biloculare, multi-ovulatum, placentis dissepimento adnatis, stylus erectus, stamina aequans, stigma capitatum, simplex. Capsula calyce inclusa, bivalvis, valvis apice bifidis, a dissepimento solutis. Semina plurima, minima, valde rugosa. Inspice Tab. V. fig. E. Apex rami, magn. nat.; 1, flos nondum apertus, magn. nat.; 2, corolla aperta, magn. nat.; 3, calyx fructifer apertus, magn. nat.; 4, stylus; 5, capsula, magn. naturali. Habitu ad Nicotianam accedit, a qua corollae aestivatione valvata discrepat.

a Fabianis corollae tubo perfecte cylindrico neque sensim ampliato, et valvulis capsulae a dissepimento solutis nec non habitu differt.

FLORULA ATACAMENSIS by Dr. R. Philippi - page 41 1860

Waddingtonia floribunda Ph.

W. annua, pubescens, glutinosa; caule erecto, ramosissimo; foliis lineari-lanceolatis; floribus subracemosis, breviter petiolatis, bractea filiformi florem plerumque superante fultis; calyce quinquefido, laciniis lineari-subulatis; accrescente, demum ovato; corollis calycem semes vel sesquies aequantibus; capsula calyce inclusa.

Prope Chanaral bajo 26°36' lat. m., c. 4200 p.s.m. inveni. Caulis 13 poll. altus; folia 9-14 lin. longa, 1 - 2-1/2 lata; pedunculi 1-1/4; calyx fructifer 4-1/2 lin. longus.

Cordoba Oct 15/42 - "Wadd. flor. Ph. corymbo" - one of the cotypes? or "equiv. material" - this spec. in poor condition - it is certainly of the miersii type rather than the corymbosa type.

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N. Forgetiana Hort.

Place of origin unknown? of Brasil? Introduced by Sander and Sons of St. Albans, through their collector, Mr. Forget. One of the parents of N. Sanderae.

An annual herb, 2-3 ft. high, branching from the base, and apparently differing from N. bonariensis chiefly in that the limb of the corolla is reddish on both sides.

The color of the flower and the fact that this species has never been recollected (with the possible exception of a sheet from Santa Catharina: Tubarao det. as "Forgetiana?") makes it of particular interest.

N. angustifolia R. & P. ??

A light collection from Santa Catharina (left bank of the Itajahy) with light violet, zygomorphic flower, and possibly belonging to N. bonariensis, is of interest because it was determined as N. angustifolia R. & P., a sp. confused and little known. Other collections: Prov. Minas Geraes (St. Hilaire coll.); Prov. Rio de Janeiro (and also vic. city of Rio de Janeiro).

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N. frigida Ph. (corymbosa group?)

Low plant, few leaved and few flowered. Leaves narrowly lanceolate, acute, radical leaves tapering into a petiole ca. 16 mm. long, blade ca. 28 mm. long and almost 6 mm. wide, length of petiole decreasing in cauline leaves until upper ones nearly sessile. Flowers solitary, terminal and axillary, on pedicels half as long as calyx. Linear bracts at base of axillary flowers. Calyx 12 mm. (½ in.) long, tubular, "angulato-plicato" (angled-plicate), teeth short, triangular, slightly unequal. Corolla greenish, tube ca. 16 mm. (5/8 in.) long, 4 mm. (3/16 in.) wide, limb lobes broadly triangular, somewhat acute. Mature capsule not seen.

Near Riofrio (24 50' lat. m., 10800 p.s.m.) (Is 10800 misprint?). Larger specimens (stem 16 cm. (6¼ in.) long, leaves 8 cm. (3 in.) pedicels 13 mm. (½ in.) calyx in fruit 13 mm.) of this species were collected by Sr. Villanueva in the Atacama Desert.

--After Philippi

Apparently neither type nor any other specimens of this species seen by T. H. G. Not discussed by Millan.

cf. also N. longibracteata

N. frigida important to recollect

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N. glauca Grahm. (paniculata group.)

(Tree tobacco, carallanta -Bolivia, palan-palan or balan-balan Argentina)

Soft-woody, evergreen shrub or loosely branched "tree" 3-6 meters (10-20 ft.) high, easily recognized by its slender branches, glaucous bloom, and the short clusters of bright yellow tubular flowers at the very tips of the branches. Leaves petiolate, pointed, in shape elliptic, ovate, lanceolate or even triangular, firm in texture, ribbed on under side, the largest 15-40 cm. (5-16 in.) long (petiole included). Flowers 30-50 mm. (1 1/4 - 2 in.) long; calyx about 1/3 as long as corolla, glabrous or minutely pubescent; corolla commonly yellow (may dry darker), sometimes brick red, minutely pubescent, limb spreading or somewhat concave; pistil and the 5 stamens ca. as long as corolla tube and inserted on corolla near upper end of calyx. Capsule erect, elliptic, dehiscent, walls thin but slightly woody. Seeds numerous, dull brown, oblong or oval-oblong. ca. 1/2 mm. long.

Virtually cosmopolitan, especially frequent in N. Argentina; probably fairly common in Peru, reported from the Urubamba Valley, Peru; La Paz, Bolivia, 3550 m. alt. Tolerates sea level to 3550 m., likes sun and well-drained soil (often sand), frequently found about towns, especially against walls and fences.

Of interest; variation in color and shape of corolla tube, limits of its climatic tolerance, distribution in relation to the tomentosa group, transitional forms between it and the tomentosa group or between members of its own (the paniculata) group.

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N. glutinosa L. (tomentosa group)
(Tobaco cimarron--Peru)

Stout, sticky herb 1.5-2 m. (4-7 ft. high) with many or few stems and spreading or nearly columnar habit, leafy in the lower third or half, then the leaves gradually giving way to long, distantly forked racemes coiled at the very tip as fern fronds do. Leaves reaching 20-40 cm. in length (7-15 in.), petiolate, blade broadly heart-shaped with base tending to turn up. Flowers 25-35 mm. (1-1/2 in.) long, with large, deeply 5-parted calyx, and a greenish yellow to pink or red corolla with short tube, tipped, gaping cup-like throat and 5-lobed limb. Stamens inserted on base of corolla, a little unequal in length, soon oriented to rest against the back (upper side) of the tube and throat but scarcely if at all exserted. Capsule broadly ovate, at least a cm. long, frequently dehiscent only enough to produce a hole at the apex, the long segments of the persistent calyx now very conspicuous. Seeds brown, often nearly black, oblong, less than 1 mm. long, very numerous.

Type locality is "la valee de Lima", but the U. C. Bot. Garden strain from Lima is a much taller, larger-leaved plant than the strain which has become established in most botanical gardens. Apparently extends from Bolivia to northern boundary of Peru?? There is no verification of report it reaches Bolivia
Following collections Have been made:

?? Bolivia, Larecaja prov., 2600-2800 m., August
Peru Rio Chillon near Viscas 1800-2000 m. June open, rocky slopes.
" Chancay
" Ayacucho, 3000 m.

Peru Matucana, 2600 m., latter half of April, R. R. embankment.
" Santa Cruz, 1300-2000 m., end of May open, grassy formation.
" Amotape hills along streams

Variation in habit and height as well as in other characters of some interest, whether it is found growing beside other members of the group or has a different ecological preference, and particularly its relation to otophora.

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N. heterophylla Ph. = acuminata

Stem densely glandular-pubescent, 60-70 cm. high, branched; leaves reaching 15 cm., more or less glabrous, rather long petiolate, ovate, base truncate, lower leaves obtuse, upper ones acute, uppermost becoming acuminate; calyx glandular-pubescent, its teeth unequal; calyx 12 mm. long; corolla 33 mm. long (2½ times the length of the calyx), strictly tubular, scarcely narrowed basally, sparsely glandular-pubescent, lobes rotund, short.

-After Philippi.

In the province of Valdivia, where it is rare.

Philippi says this differs from N. Berteriana (acuminata?) in that the base of the leaf blade is truncate " i no cuneiforme en medio" (meaning it is , not ?

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N. Knightiana Goodsp.
(paniculata group)

Subpulverulent pubescent leafy annual or limited perennial to 2 m. high and when fully developed 1.5m in diamter. Stem to 2 - 3 cm. in diameter, ridged, branches assurgent. Leaves with cordate, rotund-ovate or elliptic blade to 30 cm. in both breadth and length, petiole somewhat shorter than blade. Inflorescences 50 - 75 cm. long, complexly paniculate with obvious central axis and numerous shorter branches, frequently viscid. Flowers odorless, always open. Calyx a light green cup 9 mm. long with short, broadly triangular teeth. Corolla tube 25 mm. long, broadly elavate, about 6 mm. wide, actually pale yellow green but whitened with short silky hairs; limb rather narrow, ascendant at first, later ± horizontal, faintly notched into 5 broadly obtuse, almost truncate, frequently mucronate lobes, dark green marked with lighter green. Stamens equally inserted on corolla tube just above apex of ovary, like the pistil extending to within one or two mm. of corolla mouth. Capsule oval, 8 mm. long, commonly not exceeding calyx. Seeds numerous, dark brown, about 0.4 mm. long, oval or angular oval.

Only collection: U. C. B. C. 1935-36 expedition, Ynes Mexia, Nov. 16, 1935, near Mollendo, Prov. Islay, Dept. Arequipa, Peru. Alt. about 40 m. Hills near ocean, near a trickle of water. A small colony in partially cultivated soil. "Tabaquilla."

The species suggests a large, vigorous N. paniculata with the silvery pubescence of stem and under surface of leaf accentuated, the corolla tube broad and unusually whitish, and the corolla limb dark bottle green. The inflorescence is intermediate between N. paniculata and N. solanifolia.

In addition to more information on its range and further collections, the question of whether it naturally hybridizes with N. paniculata and shows intermediate forms in the field is of particular interest.

cf. distrib. map photo for paniculata group. This extends the distribution

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N. Langsdorffii Weinm.
(Petun)

Erect, viscid annual to at least 1 m. (3 ft.) high. Primary stem of only moderate thickness (1 - 1.5 cm. towards base), giving rise to slender, oblique laterals from the ground up, the lowest nearly as well developed as the original axis. Basal leaves few, frequently not persisting, sometimes reaching 30 x 12 cm., ovate-obtuse, petiole short, its distinct wing broadening to a subauricular insertion; upward the leaves progressively smaller, more sessile and conspicuously decurrent on the stem; uppermost leaves and lower bracts little or not at all decurrent on the stem, sessile, narrower, more pointed, at length obcuneate. Terminal inflorescences seldom over 40 cm. long, loosely, obliquely branched and eventually forked, axillary ones shorter and little branched, bracts soon tiny and inconspicuous, ultimate floral pedicels weak, causing both buds and flowers to hang pendent. Calyx ca. 1/3 as long as corolla tube (tube used in most inclusive sense), subglobose, teeth short, 2 longer than rest. Corolla somewhat resembling N. glauca and, like it, not vespertine, bright green-yellow, tube 15-25 mm. long, relatively broad, contracted within calyx, below corolla limb abruptly, conspicuously bulged; limb suberect — a shallow, broad-based funnel, scarcely lobed. Stamens inserted on base of corolla, one slightly shorter than tube, 2 as long, a little longer, anthers purple, the only Nicotiana species with pollen blue. Capsule ovoid, ca. 8 x 6 mm., blunt, half covered by calyx, dehiscent. Seed rather numerous, nearly elliptic, yellow brown, ca. 0.5 mm. long.

Argentina Misiones: Iguazu, Aug. Jan.
Puerto Aguirre, Sept., Jan.
San Zevier, Jan.
Woods along the Rio Uruguay

Brazil Parana: Tamandare 875m.
Curityba, Nov.
Pithaes (or Pinhaes ?)
Villa Velha, Nov., in shade.

Sao Paulo: Sao Paulo?
Minas Geraes: Pentra Marianna
Rio de Janeiro: Organ Mts. (Serra dos Oragaos)
Itatiaya, Sitio de Ramos, Feb., 2000m.

Type locality indefinite: "In Brasilia Langsdorrff, qui semina cum D. Weirmann communicavit."

Two varieties of N. Langsdorffii have been named, both white-flowered, white-pollen forms, which, as their names "longiflora" and "grandiflora" suggest, have flowers several times the size of the typical. Although not so distinct from N. Langsdorffii in habit, they give every evidence of having arisen as segregates from crosses with N. alata in botanical garden culture. Any evidence of the intercrossing of these species in the wild to produce such forms would be of interest.

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N. linearis Ph. (corymbosa group)
or
N. corymbosa Remy var. deserticola Millán

Glutinous plant 16 cm. (6¼ in.) high, densely clothed with short glandular hairs. Stems 1-7, simple or branches few and successively shorter. Leaves numerous towards base, erect, in rosette, 6 x 4 cm. (2½ x 1½ in.), narrowly linear and tapering, white-hirsute when young. Inflorescences capitate. Calyx 5 mm. (¼ in.) long, divisions linear, obtuse. Corolla tube 10 mm. (nearly ½ in.) long, narrowly tubular, not contracted under limb; limb lobes short obtuse.

Andes of Talca: Cuesta de las Arenas, Feb. (type collected Feb. 1879, Fredericus Philippi).

The inflorescence is that of N. scapigera but the pubescence and the shape of the leaves is very different.
--After Philippi.

Type or cotype photograph from Macbride is a plant very similar to Millan's drawing of N. corymbosa var. deserticola save perhaps the head is better developed in the former. Appears to ba a corymbosa characterized by long, slender, pointed leaves. Note lack of corolla color, stamen insertion, capsule, seeds.

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N. longibracteata Ph.

Plant to 40 cm. high. Stem unbranched. Leaves petiolate, ciliate, entire or undulate, "con estrias" (meaning?), uninerved, shortly pubescent, 12 m. x 2.5 and petiole 5 cm; upper leaves linear, sometimes to 60 mm. x 2.5. Pedicel pubescent. Calyx globose, herbaceous, white, 13 mm. long, larger than the middle part of the corolla, very slightly pubescent, furnished with 5 green nerves, segments triangular, unequal, apiculate. Corolla greenish, funnelform, 19 mm. long, very slightly pubescent, especially the upper part; throat somewhat dilated; limb 10 mm. wide, its lobes obtuse. Stamens inserted 3 mm. from base.
--After Millan

Type from Tarapaca: Incahuasi, 3500 M. apparently.

Millan cites also Antofagasta, Atacama and for Argentina only "el territorio de Los Andes" and says it isn's found in Argentine herbaria.

T.H.G. has Macbride photo 3025 labelled "Nicotiana longibracteata Ph., Tarapaca," apparently in Philippi's hand. He says "Berlin--the type from Tarapaca here is quite interesting" --cf. Macbride photo--the flrs. are somewhat large and the caps. suggest Bigelovii very strongly--it also clearly belongs in the corymbosa group and in leaf shape suggests Millan's var. typica, still as Millan description indicates it is in general a quite large and more succulent corymbosa type and rather distinct morphologically. Millan's description fits this sheet of Philippi's exactly except that the flowers here are too badly dried up to measure size--seed seems extra large (possibly (?) a 4 n?) --on looking at this again it suggests (?) acuminata which has long slender bract-like upper leaves in the inflorescence and this plant has the dark ridges running onto calyx from calyx lobes.

Certainly a very interesting species needing more information from field if possible as it is difficult to place from photograph.

= N. frigida — never been recollected

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N. longiflora Cav. (alata group)
(Flor de sapo, lampara, tardilla, tabaquillo)

Erect plant 7-9 dm. (2½-3 ft.) high, stem slender, more or less tubercled, commonly developing long, ascendent basal branches. Lowest leaves numerous, large (to 45 cm.-18 in.long) spatulate, forming a fairly persistent rosette, other leaves fewer, lanceolate or linear-lanceolate, auriculate, progressively smaller, narrower, and more undulate upward. Inflorescence largely racemose, little branched. Flowers vespertine, salverform, calyx about 1/5 (occasionally 1/3) as long as the corolla, slender calyx teeth as long as the calyx tube; corolla tube 4-12 cm. (1½-4¾in.) long, greenish, greenish-yellow, greyish, or purplish, or a combination of any of these, conspicuously slender, limb white or lavender within and exteriorly tending to assume the coloring of the tube, deeply lobed into a star-like outline; stamens attached to the corolla tube close to its mouth, one generally attached lower than the other four. Capsule ovoid, 11-16 mm. (1/2-5/8 in.) long, dehiscent. Seeds numerous, spheric-elliptical, light brown, about 0.5 mm. long.

Large-flowered forms collected from November to April in Salta, Jujuy, Tucuman, Chaco, Formosa, Corrientes, Misiones, Catamarca, San Juan, La Rioja, Cordoba, Mendoza, Santa Fe, Entre Rios, and Buenos Aires. Var. breviflora Comes (4-6 cm. -1½-2½ in. long) occurs in Cordoba: Rio Primero (type locality) and in near Rio de Jameiro, Brasil.

Aside from breviflora Comes little has been done in naming varieties in this species, although there is reason to believe some rather distinct types exist in certain regions. Millan reports var. oligantha (N. oligantha Philippi) from Lake Nahuel Huapi, but there is some question as to whether this is a longiflora.

266. Nicotiana longiflora foliis inferne cuneatis, oblongis, acumiene producto: floribus solitariis.

The stem is stout, pubescent (villous?) as on the whole the entire plant with some branches; the leaves are alternate, tapering wedge-like into a petiole at the base, prolonged towards the apex, in a very sharp long point. The upper are linear, shorter and almost sessile; the flowers arise solitary and distant at the end of the branches in the axils of the leaves; the peduncle is equal to the calyx, the tube of the corolla 5 X longer, the lobes of this somewhat sharply pointed. It grows in Chile, where it was found by Don Luis Nee.

-From Cavanille. The Latin diagnosis and translation of Spanish description constitutes the original description of N. longiflora. (Note that it was first described as growing in Chile!)

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N. lychnoides Remy (corymbosa group) = N. Miersii
or
N. corymbosa var. deserticola Millan

Plant 13-52 cm. (ca. 5-20 in.) high. Stem rigid, slender at base, covered with soft white multicellular hairs shiny in the dried plant, branches few, fastigiate (parallel to stem). Lower leaves petiolate, oval-oblong, somewhat obtuse, entire, margins somewhat ciliate, upper leaves sessile, linear, obtuse, somewhat hispid. Flowers in terminal panicles and shortly pedicelled. Calyx tubular, glandular pubescent, teeth unequal, long, linear-spatulate, obtuse. Corolla small, scarcely exceeding the teeth of the calyx, of dirty white color, somewhat hispid. Capsule "Ahuevada" (dehiscent, inflated?) and entirely covered by the calyx which exceeds it by ½.

"Es muy commun en los llanos de los Patos, y crece mejor en los lugares que fueren habitabos; tambien se encuentra en los terrenos basalticos cerca de Arqueros por el mes de octubre, pero es mas rara." (Remy)

Remy says this species, whose stem appears to be "meloso" (meaning?) is easily distinguished by its habit which reminds one of Lychnis dioica Linn, by the hairs of the stem and the calyx teeth.

Apparently T. H. G. saw type "Gay, Prov. Coquimbo, Chile" (but no locality, unlike type description.) labelled lychnoides but no photograph or descriptive notes.

Description taken entirely from Remy. Lacks measurements, stamen insertion, etc.

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N. mendocina Ph.
(=N. Cavanillesii Dun. var. typica Millan according to Millan)

(Described from upper portion of the plant.) Annual (?) completely covered with very short glandular hairs. Leaves small (larger to 40 x 6-7 mm. or 1½ x ¼ in., uppermost bracteate) tapered into a short petiole, uninerved, margin often undulate. Slender branches forming about a ten flowered panicle. Pedicels 5 mm. (3/16 in.). Calyx 14 mm. (ca. 5/8 in.) long, teeth unequal and acute. Corolla yellowish (does this mean though merely yellowish in dried state?), apparently glabrous unless observed with a strong lens, tube 35 mm. (1-3/8 in.) long and 4 mm (3/16 in.) wide, the limb, which appears to have been white, 9 mm. (3/8 in.) wide, funnelform, lobes short and rounded. Stamens included, "triplicis longitudinis" (of 3 lengths?), fifth shorter. Capsule 7 mm. (ca. 5/16 in.) long, included in the calyx.

Collected between Mendoza and Los Andes.
--After Philippi

While there seems no reason to doubt this is N. noctiflora Hook. (N. Cavanillesii Dun. sensu Millan), apparently Philippi's type was not seen by Millan nor T.H.G. Where is it?

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N. mendogensis Speg.
or
corymbosa var. typica

"Berlin - 1 sheet of Herzog #807 lab. Nicotiana mendogensis fide Spegazzini, det. Spegazzinii, an steinigen Berghangen bei Puenta Inca (Cordillere) Argentina, ca. 3000 m., II '08.-- it was det. by T.H.G. as corymbosa var. typica and photoed by Macbride as #9988--in the capsules from the sheet note peculiar position of dry corolla on one side of capsule--i.e.; corolla persistent for some time."

--T.H.G.

Sheet referred to includes 1 entire plant and part of another--flowers (corolla ca. 12 mm. (½ in.) long, calyx ca. 4 mm. (3/16 in.) capsules and calyx in fruit ca. 7-8 mm. (3/8 in.) in characteristic heads with linear bracts, largest lf. ca. 9 mm. long.

Millán does not discuss this species.

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N. minima Ph.
(Nicotiana? Petunia? or Nierembergia?)

Tiny perennial plant an inch high! Leaves rosulate, 8 mm. (1/3) in.) x 3 lines (less than 1/6 in.) wide, spatulate, glabrous. Flowers solitary. Peduncles 4 mm. (1/6 inch) long, leafy, leaves crowded towards base of flower, more linear than spatulate, apex rounded. Calyx 6 mm. long, 5 parted to ¼ or 1/3, divisions broadly linear rotundate, easily confused with the upper leaves. Corolla 12 mm. (½ in.) long, pubescent outside, infundibuliform, limb 5-angled, before anthesis folded, corolla white with folds violet. Stamens equal, somewhat exserted, anthers globose, pale yellow. Stigma patelliform 2/3 as long as corolla (meaning stigma?) or "style" omitted by accident?).

In fissures of rocks in the Andes "de Ranco", 1800 m. (5500 ft.), collected by Pearce. (Ranco is in cordilleras of Valdivia according to Reiche.)

Note that Reiche considers it a Petunia but mentions that it may be related to Nicotiana acaulis Speg. and Nicotiana Ameghinoi Speg.

= Cordiera sp.

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N. modesta Ph.
(= N. acuminata (Grahm.) Hook.?) ges

Viscid puberulent annual scarcely 33 cm. (12 in.) high. Lower leaves long petiolate, oblong, middle leaves short petiolate (10 mm. or ca. 3/8 in. long), blade ovate (85 mm. or 3⅓ in. long), base almost truncate, apical end long cuspidate; uppermost leaves sessile, broadly lanceolate from base. Flowfew. Calyx 19 mm. (¾in.) long, teeth awlshape, as long as tube and unequal. Corolla 32 mm. (1¼ in.) long, tube abruptly dilated, then cylindrical, at the throat slightly broader and with a bluish cast, limb little expanded, with very short obtuse lobes. Capsule ca. 15 mm. (5/8 in.) long, the calyx accrescent.

Collected by Senor Vilanueva in the Atacama Desert.
--After Philippi.

Not discussed by Millan nor any sheets of this specie seen. Where is the type? Considering the indefiniteness of the location type sheet appears important. Description reads like a small flowered acuminata.

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N. monticola Dun.
(= N. corymbosa sensu Millan) yes

DeCandolle: Prodromus systematis naturalis regni vegetabilis, Vol. 13:1, page 564. Solanaceae (Auctor Dunal)

N. monticola, caule erecto subsimplici basi puberulo apice pubescentiviscoso, foliis radicalibus longe petiolatis oblongis repandis in petiolum attenuatis obtusis glabriusculis obsolete ciliolatis subtus nervosis, caulinis brevioribus oblongo-linearibus acuminatis in petiolum brevissimum attenuatis, supremis angustioribus sublinearibus pubescentiviscidis sessilibus, floribus racemosospicatis subcongestis in panicula laxa terminali longe pedunculata dispositis, calyce hirsuto-viscido? ovato-tubuloso profunde 5-fido lacinis oblongo-linearibus obtusis duabus longioribus, corolla hypocraterimorpha, tubo supra calycem inflato cylindrico, limbo brevi sub-5-partito. I In montibus, Chilensibus. N. alpina Poepp. pl. exs. Chil. n. 142, diarr. 520 A. Nomen fere ineditum mutavi, quia vox alpina, Alpes Europae nimis indicare videtur. N. humili Link valde proxima si diversa est. Caulis teres, 10-12 poll. altus, herbaceus. Folia redicalia cum petiolo 3 poll. longa, 5 lin. lata, limbo petiolo canaliculato duplo longiore. Caulis apex seu pedunculus, ejusdem ramificationes, pedicelli calycesque pubescentihirsuti viscidi. Flores breviter pedicellati, 4-12 subcongesti, bracteis linearibus nonnullis longioribus suffulti, 6-7 lin. longi.

Pedicelli 1-2 lin. longi. Calyx 2-3 lin. longus, 2 lin. latus, paulo accrescens. Corolla 5-6 lin. longa, extus pubescentiviscosa, luteola?; tubus intra calycem gracilis, conicus, apice calycis contractus, dein inflatus subcylindricus; limbus sub-5-partitus, brevissimus, laciniis ovato-subrotundis plicatis semilineam longis obtusis mucronulatis extus piloso-viscosis untus glabris. Stamina 5, inaequalia, duobus minoribus, uno intermedio. Filamenta filiformia, glaberrima, e tertia tubi inferiore parte nascentia. Ovarium glabrum, lineari-oblongum. Stylus filiformis, albidus, tubi longitudine. Capsula calyce accreto fere tecta, bilocularis, bivalvis, valvis bifidis chartaceis. (v.s. in h. DC.)

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N. oligantha Ph.
(= N. acuminata Hook?) yes

Annual ca. 40 cm. (16 in.) high. Stem erect, little branched, densely villose-hirsute. Leaves petiolate, somewhat acute, lower ovate, 11 x 4 cm. (4¼ x 1½ in.) including petiole of 4.5 cm. or 1¾ in.), upper progressively smaller, narrower, more pointed, petiole shorter, at length linear and subsessile. Flowers 2-7, pedicels short and equal to calyx. Calyx 10 mm. (nearly ½ in.) long, teeth linear, obtuse, a little unequal and as long asthe tube. Corolla tube narrowly cylindric, 5 times as long as calyx, contracted below mouth, limb lobes obtuse, stamens included. Capsules not available.

Near Talca, collected Luis Heribertus Silva.
--After Philippi.

Phillippi says it differs from N. pauciflora Remy im that oligantha has (1) the stem is densely covered with long, fine soft hairs "very villose", not "puberulent"; (2) the corolla has a narrow tube, not (somewhat Broad", contracted a little below the mouth; (3) the stamens are included, not "exserted" as according to the Spanish description of Remy.

Millan considers N. oligantha Ph. a variety of N. longiflora Cav. A sheet so determined by Millan (Gobernacion del Neuquen: Nahuel-Huapi, leg. V. Jacobsen no. 34. 13-II-1903) with single terminal flower and no capsules looks rather acuminata-like but even though photographed, it is hard to say exactly what this sheet determined by Millan is.

In what herbarium is Philippi's type from Talca, cited above?

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leaf auricles not good as characters; they also are common in tomentosa

N. otophora Griseb. (tomentosa group)
("N. Friesii Dammer")
sachatabaco, tabaquillo

A tomentosa-like plant 2-3 m. high differing particularly in having very long calyx segments (at least twice the length of the calyx tube), and the leaf base dilated into decurrent auricles. The calyx and capsule strongly suggest those of glutinosa. The loose panicles may be somewhat like tomentosiformis? The following measurements from the original description: leaves 12-15 in. (30-45 cm.) long, 5-6 in. (12-15 cm.) wide, calyx nearly 1 in. (25 mm.) long, corolla 1 1/2 in. (40 mm.) long.

Type locality of otophora: Tarija, Cuesta colorada, Bolivia, June (Guaro)
Type locality of "Friesii"--Jujuy: Quinta, near Laguna de la Brea, in dense forest, shady place, June. (Argentina)

Other collections in Bolivia are: Bermejo, 1600 m., wooded mountain tops and shady outskirts of forests, Nov., Santa Cruz: Prov. Vallequande, Valle de Chilon, 1600 m.

Not yet reported for Peru.

Collections in northern Argentina: Jujuy: Ledesma, El Sauzal, July; Salta, Dept. Oran, Quebrada del rio Tartagal, 500 m.

1942 -
Compare distribution map of tomentosa group (photo) for later collections. Grown in the Bot. Garden from U.C. Expedition collections, the distinctive features were found to be the inflorescence with its 3-7 obliquely spreading branches which are somewhat thicker than in N. tomentosa and continue to grow until very long, sometimes curving prominently in a kind of S when old + covered with capsules; the long, slender calyx teeth mentioned; and the early rolling back of the corolla border (which withers while the rest of the corolla is fresh and sometimes even before the stamens shed their pollen) Capsules set in profusion and their pedicels often bend. In leaf and habit N. otophora cannot be distinguished from N. tomentosa. The throat of the corolla may be even more sharply differentiated from the tubular part than in many strains of N. tomentosa.

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N. oulophylla Dun. = N. corymbosa
(= N. corymbosa sensu Millán)

DeCandolle: Prodromus systematis naturalis regni vegetabiliis, Vol. 13:1, page 560, 561. Solanaceae (auctor Dunal)

14. N. oulophylla, caule herbaceo tereti e basi ramoso, ramis adscendentibus (p.561) teretibus, foliis inferioribus oblongis repando-undulatis obtusiusculis in petiolum decurrentibus utrinque piloso-glandulosis viscosis supremis similibus sed angustioribus lineari-oblongis acuminatis sessilibusque, floribus paucis bracteis foliaceis suffultis ramoso-spicatis subcongestis in summitate ramorum, ramis floriferis axillaribus, calyce tubuloso-campanulato piloso-glanduloso, viscoso, 5-fido, laciniis linearis obtusis, corolla calyce paulo longiore, tubo inflato ad os subcontracto, limbo parvo 5-lobo, lobis subtriangularibus emarginatis, capsula calyce tecta.

I In prov. Chilensi Coquimbo (Gay, pl. exs. 1839). Herba tota pilosa-glandulosa, viscosa. Folia inferiora cum petiolo 1-1.2 to 1-3/4 poll. longa, 3 - 3-1/3 lin. lata. Petiolus 6-7 lin. longus, supra canaliculatus, suprema sessilia 9 - 13 lin. longa, vix lin. lata. Pedicelli breves, 1 - 2 lin. longi vel nulli. Calyx 3 lin. longus, lin. latus. Corolla 4 - 4-1/2 lin. longa, vix lin. lata, lutea? Capsula glabra, ovata, acutiuscula, calyce accrescente recondita. N. undulatae R. et Pav. valde affinis, sed multo differt: caulibus teretibus, nec angulatis; foliis angustioribus repandis; calycinis laciniis linearibus angustis obtusis subaequalibus; corolla calyce paulo longiore, limbi lobis subtriangularibus (emarginatis?). (v.s. in h. DC.)

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= N. petunioides

N. pampasana O. Kuntze (Cavanillesii group)
"N. Philippii Millan, N. crispa Ph."

As N. Cavanillesii except for having leaves which are always very narrow (linear-lanceolate or at most lanceolate), the corolla smaller, its tube hardly reaching 20mm. (¾ in.), usually 14-16 mm., its limb always only obscurely 5-lobed, possibly seeds slightly larger (ca. 1mm.).

Plants grown from seed collected at 3000 m. (10,000 ft.), Sierra de Zenta, Jujuy, were broadly obconic in habit, not over 4 dm. (16 in.) high, and much branched, the herbage viscid-puberulent and of a peculiar sweetish odor, leaves very wavy, sometimes reaching 9 x 2 cm., (2½ x 1 in.), inflorescences more numerous and less complex than in N. Cavanillesii, flowers vespertine, corolla tube and limb exterior yellowish-green suffused with pink, corolla tube relatively broad for its length (about 5 mm. wide above calyx, slightly narrower at mouth of corolla, much narrower within calyx).

N. pampasana has been collected from Dec.-March in Jujuy, Salta, Los Andes, Tucuman, Catamarca, LaRioja, Mendoza, Rio Negro, and in the Atacama region of Chile. Millan says the specimens from Chile have calyces 8 mm. (5/16 in.) long with broadly triangular calyx lobes, and leaves much crisped, the young leaves quite hairy. Andean specimens have less crisped and less hairy leaves. Specimens from Jujuy, Catamarca and Tucuman have very narrow leaves, shorter calyces, more lanceolate calyx teeth.

There is but scant data on variation in habit, duration of plant, corolla color. According to Millan the species differs from N. Cavanillesii var. typica in having a shorter corolla tube. The relationship to N. Ameghinoi Speg., of Patagonia, appears quite close.

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N. paniculata L. (paniculata group)
(Tabaco cimarron de Lima - Peru)

An erect, inversely pyramidal annual to 1 meter high, leafy in the lower 1/3 or 1/4, above this the leafless, repeatedly branched, spreading inflorescences giving a graceful, feathery aspect to the plant. Stem below dull-puberulent, cool to the touch, above viscid. Leaves petiolate, ovate or heart-shaped, maximum about 23 cm. (10 in.) long, conspicuously lighter and duller on under side. Flower distinguishable from other members of the paniculata group by the more slender, often glabrous, green corolla tube (about 30 mm. or 1 1/4 in. long). Calyx pubescent, about 1/4 as long as corolla tube and inserted on it near top of calyx. Capsule less than 1 cm. long, elliptic-ovate, dehiscent. Seeds oblong, nearly black, ca. 1/2 mm. long.

Said to be common in cultivated places about Lima (valley of Lima the type locality?), also reported from Rio Chillon, Chancay, Tingo, Tarma (2300 m.), La Merced, and Huanuco. It is cultivated in Peru under the name of Verinas. A larger-flowered form with pubescent corolla is listed from S. Bolivia without specific locality.

Its geographical distribution in relation to undulata and to rustica is of interest, also any intermediate forms between it and rustica.

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N. parviflora Ph.
(= N. Meirsii Remy?) yes

Plant 30-45 cm. (1-1½ ft.) high. Stem wooly-villose towards base, glandular puberulent (viscid) towards top. Leaves sessile, lower ones 14 cm. x 2.5 cm. (5½ x 2 inches), oblong, tapering evenly on each side, almost, rhombic, upper ones ovate lanceolate. Pedicel shorter than calyx. Calyx 8 mm. (3/8 in.) long. Corolla 14 mm. (5/8 in.) long.

--After Philippi

Collected near San Felipe of Aconcagua.

Philippi first thought this belonged to N. Miersii Remy but found it differed in the radical leaves withering and not rosulate, cauline broad, even the upper ones broader, ovate lanceolate, and the calyx divisions not ciliate.

It does not seem at all impossible that it might not be N. Miersii, but material from the type locality might be needed, especially since Philippi's description is brief.

(Type was seen in Geneva. Herb. Boissier and carried numerous annotations (micrantha, oulophylla, Nierembergia anomala, Petunia viscosa) but no comment made on it by T.H.G.)

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N. parvula Ph. (corymbosa group)

Plant 11 cm. (2½ in.) high, lower part shortly puberulent, upper densely glandular pubescent. Stem slender, little branched. Radical leaves fallen at the time of flowering but scars indicate they were not numerous. Cauline leaves up to 3.5 cm. x 6 mm., lower ones narrowly oblong obtuse, tapering into a long petiole, upper ones at length almost sessile, slender, linear. Flowers few, almost sessile, solitary in axils of upper leaves and terminal. (Lower flowers appear to have been imperfect.) Calyx 5-6 mm. long, densely glandular pubescent. Corolla 12 mm. long, tube perfectly cylindric, largely glabrous though a few glandular hairs toward the end (upper end?), limb lobes broad, acute.

Two specimens gathered with N. scapigera in the Andes of the province of Talca.

--After Philippi.

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N. pauciflora Remy
(= N. acuminata Hook.?)

Plant 30-60 cm. (1-2 ft.) high. Stem unbranched, slender, erect, puberulent. Leaves petiolate and somewhat hispid, lower ones 2.5-5 cm. (1-2 in.) long and 12-25 mm. (½-1 in.) wide, oval, acute, entire, upper ones reduced and almost linear. Petioles of radical leaves persistent at base of stem. Flowers large (no dimensions given!), solitary, alternate, distant, and 2-9 to a stem. Calyx campanulate, almost as long as pedicel, hirsute, with 5 unequal long linear and obtuse teeth. Corolla 6-7 times longer than the calyx, with tube broad and more or less glabrous, limb "aislado" (meaning?) and its lobes rounded. Stamens exserted. Stigma bilobed. Capsule covered by calyx, two valves bifid and the partition bearing the placenta bilobed at apex. Seeds ruggose.

--After Remy.

It is found in Coquimbo. (City? or province?)

Remy says this species is easily distinguished by its slender stem, the shape of its leaves and the size and small number of the flowers.

Millan groups this and N. copiapina Ph. under Comes N. longiflora var. pauciflora, but the description reads more like an acuminata. A sheet in Paris marked "Gay, Chile" classified as N. pauciflora Remy T.H.G. notes is acuminata

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N. petunioides (Griseb.) Millan (Cavanillesii group)

Plant 20-40 cm. (8-16 in.) high, branched with sparse aguijones (~~stinging~~ hairs?). Stem cylindric. Leaves 30-50 mm. (1½-2 in.) long, ciliate, entire or plaited. Inflorescence terminal, paniculate. Flowers 18-22 mm. (¾-5/8 in.) long. Calyx 7-12 mm. (¼-½ in.) long, campanulate, scarcely pubescent, with 5 hyaline regions, erect unequal, lanceolate teeth 2 mm. long. Corolla tube cylindrical, 4 mm. (3/16 in.) wide, narrower within the calyx, limb erecto (erect?!) 2.5 mm. long. Ovary oval. Capsule small, deeply splitting.

It differs from N. Philippii by its ajuijones (literally needles--meaning stinging hairs?) and its different habit.
--After Millan.

Argentina. Catamarca: Pilciao, January (F. Schickendantz, no. 184, I-1876, type, Universidad nacional de Cordoba); Palos Secos. Oct.-Nov. Chubut-Santa Cruz: Gulfo de San Jorge.

The original description of Fabiana petunioides Grisebach (Grisebach: Symbolae Argentinae, p. 242, 1879) is not in the Univ. Calif. library. Millan's description is very close to N. Pampasana; the type location (Pilciao in Catamarca) is also in pampasana territory. Note that Millan also cites the species from Golfo de San Jorge (border of Santa Cruz and Chubut), which is much farther south and in Ameghinoi territory. Is it a good species? Does it extend so far south?

~~Not grown in Univ. Calif. Bot. Garden.~~

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N. plumbaginifolia Viv. (longiflora group)
(tobacco del monte)

Annual less than a meter high, with one to several, sparsely leafy, sparsely branched, slender, commonly zigzagging-erect stems arising from a persistent, usually few-leaved rosette and terminating in racemes 30-50 (1-1 1/2 ft.) long. Stems roughened throughout by firm tubercles. Leaves tending to twist slightly at the apex, margin frequently ruffled, surface commonly corrugated, rosette leaves spatulate, about 15-20 cm. (6-8 in.) long; leaves of stem decreasing rapidly in size from base of the plant up, lower ones ovate (sometimes broadly-ovate) and contracted below into a more narrow region which might be interpreted as a winged "petiole" and which terminates at the insertion in a slight, clasping auricle upper ones becoming slipperform to at length nearly linear, the corrugation of the blade and the tapering of the apex progressively increased. Calyx not over 1/3 as long as the corolla, cleft to the middle into very slender segments. Corolla tube greenish-purplish,30-40 mm. (1 1/4-1 1/2 in.) long, strikingly slender save for a short terminal expansion or throat, the lavender or whitish limb parted almost to the center into 5 narrowly ovate lobes, closed during the day, expanding and conspicuous at night. Stamens attached in the throat of the corolla on very short filaments, the 5th stamen often slightly lower than the rest. Capsule narrowly oval, 10-12 mm. long, dehiscent. Seeds oval or roundish, brown, less than 1/2 mm. long, numerous.

Collected in Tarpoto, Peru; and in Bolivia in the vicinity of Huachi, head of Beni river (tobacco del monte, 600 m., Aug.), on the Acer river (Aug), and "Patios de Santa Cruz", "Calle de la Cuidad de Santa Cruz" (450 m., April).

A weed which has spread to many parts of the world, espially the West Indies and S. Mexico, but possibly originating in southeastern Brazil. Differences in leaf shape, flower color and flower length, are of interest.

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N. Raimondii Macbride (paniculata group)

Perennial 1-2 m. (3-6 ft.) high, frequently no single main stem but rather 4-6 equivalent, erect leafy shoots terminating in long, narrow, dense panicles of pale yellow tubular flowers. Stems rather woody, fairly slender, and like the under surface and petioles of the leaves, the surface covered with a close, dense, very short-haired indument which makes them pale, chalky green and slightly soft velvety to the touch. Leaves reaching 25 mm. (10 in.) in length, broadly oval or slightly heart-shape, petiolate, upper surface dark and glossy by contrast with the whitish, dull lower surface. Flowers 25-30 mm. long, calyx 1/6-1/7 as long as corolla and its teeth mere points; corolla pale yellow (often reddish brown), tube narrowly obconic, limb a slightly notched, narrow, commonly recurving rim; the 5 stamens inserted on the corolla just below the top of the calyx, extending to just below the mouth of the corolla. Capsules 7-8 mm. (less than 3/8 in.) long, elliptic, erect, dehiscent. Seeds angular oval, brown, less than a mm. long, numerous.

Type from Peru, Urubamba Valley, Cuzco, collected at 3000 mm, in July. Has also been collected in Ollantaitambo. As yet known only from these two Peruvian localities.

Extent of distribution, habitat, relationship to glauca, solanifolia and paniculata are of interest.

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N. rustica L. (paniculata group)
("N.Pavoni Dunal")
tabaco turco

Coarse, erect, branched, leafy annual, few dm. to over a meter high, more or less intermediate between undulata and paniculata, but with considerable variation in habit, leaf and flower from strain to strain. Columnar, pyramidal, or inversely pyramidal, 1-several-stemmed, the original axis frequently the best developed. Stem more or less stout, finely puberulent, grey- to yellow-green, moist to sticky. Leaves petiolate, sometimes reaching 35 cm. (14 in.) in length, narrowly or broadly ovate to oblong, base of blade always oblique. Inflorescence a much branched, rather narrow and usually congested panicle, the numerous laterals oblique to nearly erect, the lower limits of the inflorescence indistinct due to the persistence of sizeable leaves into the inflorescence region. Calyx about half as long as the corolla, its segments triangular, 4 much shorter than tubular portion of calyx, the fifth larger and sometimes equalling the calyx tube. Corolla more or less broadly cylindric-obconic, pale or bright or greenish yellow with spreading 5 scalloped limb. Stamens woolly below, inserted on corolla several mm. from the base and extending almost to the mouth. Capsule broadly, bluntly ovate, 10-15 mm. long, indehiscent, dehiscent by a narrow slit or hehiscent by wide separation of the valves, valves frequently little-notched. Seeds 1/2 to at least 1 mm. long, angularly oblong to ovate, dark brown, numerous.

Collected in the following Peruvian localities: Cutervo; Maria del Valle (2300 m., April 30, along trail); Rio Apurimac; Lima; Chavin; Bombon; Chicoplaya; and the following places in Ecuador: Alausi, prov. Chimborazo (2500 M., July 19); San Antonio and Pomasqui (Oct. 29); Galendan, Rio Choto (1500-1700 m. July); near Vincente, betw. Vulcan & Ibarra (2446 M.)

Frequently considered as an escape from cultivation; is there evidence to support it being a wild plant actually native to Peru? Distribution, intermediate forms between it and either N. paniculata or N. undulata, and extent of variation are of particular interest.

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N. scapigera Ph.
(= N. corymbosa var. typica Millan)

Annual, softly pubescent. Leaves all radical, oblong, obtuse, petiole 16 mm. (nearly 3/4 in.) long, blade 32 mm. (1¼ in.) long and 12 mm. (1/2 in.) wide. Scape 10 cm. (4 in.) high, few flowered, hirsute and glutinous above. Bracts linear, to 24-48 mm, (ea. 1 to 2 in.) long x ca. 1.5 mm. Pedicels very short. Bracteoles below the calyx. Calyx almost 6 mm. (1/4 in.) long, divisions linear, at length triangular. Corolla greenish, twice as long as calyx, tube more or less glabrous, limb glandular pubescent, lobes rotund. Capsule equalling calyx.

Near Agua de Varas, 24°38' lat. m., 9700 p.s.m., not near Puquios 23°50' lat. m. and 11,000 p.s.m.
--After Philippi.

Philippi says it differs from N. monticola Dun. in "pedunculis radicalibus aphyllis" (meaning?), corolla slender tubular, etc.

Agua de Varas is near the SE border of Prov. Antofagasta, Chile

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N. Setchellii Goodspeed (Tomentosa Group)

Massive, large-leaved shrub 2-5 m. high, simulating *N. tomentosa* in juvenile habit and in leaf, but differing in mode of branching, the consummation of a completely sessile leaf in some plants, the shape of the flower, orientation ~~position~~ and length of stamens, and the nature of the old inflorescence. Plant starting as simple, erect, stout-stemmed, with leaves 40-70 cm. long, 20-30 cm. broad. Stem green and viscid, later thinly corky and marked by leaf scars, the early branches forming a crown but sooner or later spreading laterals developing all along the main axis. Leaves more or less auricled, in different plants or strains showing all gradations from oblong-lanceolate and sessile to differentiation into an elliptic blade and short, narrowly margined petiole; commonly glossy on upper surface, dull and ± viscid on lower. Inflorescences numerous, first appearing in the latter part of the first year, then produced more or less continuously thereafter, generally conical with a main axis and about thirty simple, closely spaced, oblique laterals, in age dense and mussy due to the persistence of old corollas on the mature capsules and the crowding of the latter by post-floral bending of the pedicels. Calyx green or reddish, 20-28 mm long, segments narrowly triangular, pointed. Corolla 45 mm long and 40 mm wide, a shortly, broadly stalked, slightly tilted bell with the yellowish color within the throat ending abruptly at the mouth where a finely jagged line of demarcation separates it from the pale pink to deep red of the broad, 5-angled, more spreading border; outer surface of corolla commonly suffused with considerable pink or red. Stamens not long enough to extend beyond corolla, so oriented that their large greenish yellow anthers lie conspicuously massed against the lower side of the bell, a longer or shorter distance from the edge. Ovary pale greenish yellow to dark red-purple. Capsule 15-20 mm long, included in calyx, dehiscent. Seeds numerous, tiny, dull brown.

Collected along the trail between Chachapoyas and Leimebamba on second day's journey from Chachapoyas, Dept. Amazonas, Peru, August 1937.

Habitat, altitude, extent of range, relation to *N. tomentosa* (and to *N. glutinosa*) are of especial interest. The collection cited above is the only one known.

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N. Spegazzinii Millán (corymbosa group?)

Glandular-p[illegible]ose plant 30-50 cm. (12-20 in.) high. Stem simple, erect, cylin[illegible]drical, branched above. Radical leaves in rosette, ovate, semi-[illegible]t, somewhat crisped, (blade?) 35-65 mm, (1-3/8 in. to 2-5/8 in.) 20-40 mm. (¾-1½ in.), petiole 40-80 mm. (1½ to 3-1/8 in.) long, channelled. Cauline leaves few. Flowers small, in multiflorate penicles, pedicels short. Calyx herbaceous, semicylindric, very viscid-pubescent, lobes erect lanceolate and unequal lobes. Corolla glabrous, cylindrical, towards the top curved and gibbous; limb short, lobes oval, emarginate and plaited. Stamens of 3 lengths, more or less the length of the corolla. Style shorter than the stamens. Capsule elliptic, obtuse, about equalling the calyx.

--the specimen from the Salado river (leg. Gerter, no. 138) is intermediate between this species and form of inflorescence sometimes found in N. corymbosa.

Argentina. Mendoza: Punta de Vacas, Feb., March (Type locality); Rio Salado, Jan. Chubut: Valle de las Plumas, Dec., Travesia del Chubut, Dec.

The photograph of a specimen from Valle de las Plumas labelled "typus!" apparently is not the type. The true type is "Mendoze: Punta de Vacas", leg. C. Spegazzini, 27-II-1901 and III-1901." The Las Plumas specimen is so fragmentary--two small pieces of inflorescence--that it gives only capsule and flowers. The flowers seem about 20 mm. long and suggest a rather long-flowered corymbosa.

~~Not grown in Unive of California Bot. Garden.~~

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N. sylvestris Speg. & Comes
(tabaquillo, sacha-tobaco)

Erect, viscid, robust perennial 1-2 m. (3-6 ft.) high. Stems and branches few, stout. Leaves reaching about 60 x 25 cm. (24 x 10 in.), sessile, auricled, elliptic or elliptic-ovate or the uppermost nearly triangular, apex barely acute to prolonged acuminate. Inflorescences short, congested, frequently flat topped, branches short. Flowers directed downward, not closing during the day. Calyx ca. 1/6-1/7 as long as corolla tube, inflated, teeth rather short, broad, acute. Corolla white, to about 90 x 35 mm. (3½ x 1¼ in.), tube moderately slender, above middle gradually and symmetrically inflated to twice its width and then similarly narrowed, limb pentagonal. Stamens inserted in lower half of corolla tube, unequal in length, extending to or near mouth. Capsule ovate, about 18 mm. long, dehiscent. Seeds oblong, light dull brown, ca. 0.5 mm. long.

Collected in Salta --La Vina, valleys of El Tobar and El Tabacal, 1600 m., rio Juramento, 800 m., Quebrada de Escoipe, 1500 m. Tartagal, Feb. Tucuman ---Tapia, 600 m., Oct.; Capital: Duraznito, Dec.; Tafi del Valle: Yerba Buena, 500 m. March Catamarca ---La Pulperia: cuesta de la Musohaca, Feb.; Huillapima, Dec.; Poman, Dec.; El Potrero, Ambato, March. -Humus soil in moist woods.

Of interest: any data on variation in any characters, and any indication of overlapping range of N. otophora or occurrence of natural hybrids between them.

Probably not occurring in Bolivia, yet there is a chance of it

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N. tenella Cav.
(North American?)

265. Nicotiana tenella caule herbaceo, filiformi: foliis sessilibus acutis; radicalibus et inferioribus ovatis; superioribus lanceolatis.

Herbaceous, upwards from a foot in height: its stem very slender, solitary, unbranched: the radical leaves 2 inches long and 1 inch wide, the remaining ones alternate, successively more narrow and shorter; the flowers axillary, solitary and distant. The tube of the corolla very (slender, narrow?), 1-1/2 inches in length, and the divisions of the limb sharp. It is a native of Acapulco, where don Luis Nee found it. It flowers in March.

Kewensis gives this (orig. description of Cavanille - Spanish translated) as = pusilla. But meaning?

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N. thyrsiflora Bitter (paniculata group)

Shrub, scarcely ramified, attaining a height of 3 m. Stem stout, surface appears to be covered with a very short, close pubescence, sticky above? Leaves very crowded, oblique? Reaching at least 18 cm. (7 in.) length, narrow, tapered towards each end, no petiole. Inflorescence seems to be a more or less pubescent, solid cylinder about 60 cm. (2 ft.) long and 6 cm. (2 1/2 in.) wide --a central axis densely clothed with short, oblique or nearly erect flowering laterals. Calyx 10-11 (3/8 in.) long, about 7 mm. wide, its broadly triangular teeth about 1/3 as long as its tube. Corolla greenish-yellow, tube broadly cylindric-obconic, at least 13 mm. long, limb short, 5-scalloped. 5 stamens woolly in lower part, inserted on corolla several mm. above the base and extending almost to the mouth. Capsule broadly oval or roundish, about 12 mm. (1 1/2 in.) long, deniscent.

Only known from: between Huamachuco and Angasmarca (Dept. Libertad, Prov. Santiago de Chuco), Peru, where it grows in small, stony ravines covered with grass and shrubs, also on rocky outcrops in the grass steppe, 3800-3900. Collected along a bridle path there July 6.

Exceedingly interesting species known only from the specimen cited. The narrow, sessile leaves distinguish it from all other members of the paniculata group and the dense, slender-cylindric inflorescence is the extreme of the narrow panicle in this group (N. paniculata being the extreme of the loose, spreading type). The flower is so close to a broad rustica as to be indistinguishable at first sight.

1942:- The shape of the corolla in N thyrsiflora is , in N. rustica it is . Fresh material of the two flowers shows them to be quite different. The anthers of N. thyrsiflora stamens are purple rather than yellow, too. N. thyrsiflora is like a foxglove or mullein in habit.

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N. tomentosa R.& P. (tomentosa group)
"N. Leguiana Macbride" (Tabacco Cimarron)

A several-stemmed, erect, robust, somewhat woody perennial 3-7 meters (10-20 ft.) high, at first clothed throughout with enormous showy leaves, later more arborescent with leaves tending to be restricted to the crown. Leaves reaching a meter (3 ft.) in length and 1/2 meter (1 1/2 ft.) in width, elliptic or oval, base narrowed into what might be considered a winged "petiole", and wings somewhat decurrent down the stem, under surface of young and sometimes even of mature leaves white-tomentose. (As leaves begin to die, often (always?) the decurrent wings abscise from the stem as if by a knife cut and leave prominent diamond scars on the stem.) Panicles erect, 1-2 ft. long and usually broad, the branches few or many, crowded or distant? slender but rigid. Corolla nearly white or upper portion deep pink to purplish-red, may discolor in drying, about 30 mm. (1 1/4 in.)long, the tube, tipped cup, and border sometimes less sharply demarcated than in N. tomentosiformis, the depth of lobing of the limb variable, sometimes very apparent, other times hardly distinguishable; stamens inserted on base of corolla, soon resting against the back of the corolla tube and cup, frequently the filaments pinkish or reddish, always much longer than the corolla, hence conspicuously exserted. Ovaries deep purple but changing to a dark red-brown as the somewhat woody, oblong, dehiscent capsule (15-20 mm. or 5/8-3/4 in. long) matures. (The striking shape resemblance of a maturing capsule to the blunt flower bud is particularly characteristic, the corolla limb lobes being so infolded in such a way as to give no indication of their presence.) Seeds dark brown, oval to spherical, exceedingly minute (not over 1/3 of 1 mm.) and very numerous.

Type locality is "waste places and fields from Muna to Rinconda" Peru. Macbride distinguishes another species, N. Leguiana from N. tomentosa on the following grounds. N. Leguiana belongs to southern Peru and adjacent Bolivia rather than to central Peru, its leaves lose rather than retain a dense white tomentum on the under side, its corolla lobes are not reduced to mere acute points 1 mm. long, and its inflorescence is a congested rather than a diffuse panicle. All these morphological characters cited seem too variable to be reliable, but any field information bearing on this and on the relation of tomentosa to tomentosiformis is decidedly significant. The type locality of Leguiana is: entre Cedrobamba y la Maquina, Valle de San Miguel, Cuzco, 2260-2060 m. alt., collected late in July. Localities where tomentosa or Leguiana (L) has been collected are: Peru-----Muna, 2300 m., end of May, early June; Chinchao; Maria del Valle, 2300 m. Apr. 30; La Merced, 700 m., wooded valley, end of May, early June; Tarma, 2200-2600 m.; Andamarca; Pariahuanca; Ayacucho, 3,000-3300 m.; Aina, betw. Huanta and Rio Apurimac, 750-1000 m., stream bank, May 7; Rinconada; L Ollantaytambo, 2850-2900 m., along streamlet, Apr. 26; L Urubamba Valley, 3000-3200 m., in loose thickets along streams, June;
Bolivia-----L Sorata, Nov.; Larecaja prov. in dep. La Paz, 2600-3000 m.; Achacache; L Coroico, Sept.; Yungas District; Yucca; Pango

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N. tomentosiformis Goodspeed (tomentosa group)

A slightly or quite viscid perennial 3-5 m. (9-15 ft.) high with one to several erect, somewhat woody stems and a crown of ascending leafy branches. Leaves to 1/2 m. (1 1/2 ft.) long, oval to oblanceolate, narrowed towards insertion into what might be considered a winged petiole, wings more or less decurrent on the stem, under surface not white-tomentose. Inflorescence a terminal panicle consisting of a slender central axis and rather long laterals, at first rigid, later the elongating laterals flexuous. Calyx segments about as long as the tubular part of the calyx, Corolla 20-25 mm. long, almost glabrous, light yellowish green in tube and tipped cup, but the narrow, shallowly segmented border bright waxen pink. Stamens inserted on base of corolla, soon resting against the upper side of the corolla instead of remaining evenly spaced conspicuously exserted. Capsule conical ovate, slightly woody, dehiscent. Seeds numerous, brown, oval, minute (less than half a mm. long).

N. tomentosiformis differs from its nearest relative, N. tomentosa in being a less massive plant, smaller-leaved (the decurrent wings are not abscissed from the stem on dying, but merely crumble away), smaller and more glabrous-flowered, smaller capsuled; the inflorescence laterals do not remain straight and rigid but continue to grow at the apex, becoming flexuous as the capsules mature the flower buds do not resemble undehisced capsules for the points of the corolla lobes are conspicuous in the bud.

Extent of distribution unknown. Collected in Canamina, Bolivia, 1300 m. altitude, July. May occur in S. Peru. Possibly subtropical? On one sheet said to occur from Cananuna S. to Pongo. Spelling of Pongo is O.K. but its exact location in Bolivia not found.

Exact distribution, climatic preference and habitat, its relations--both distributional and morphological--to tomentosa are of interest.

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N. undulata R.& P. (paniculata group)
(Tabaco Cimarron de Punas, tabaco del campo)

Coarse, somewhat sticky annual 1/2-2 m. (1 1/2-6 ft.) high, with stout branches from the base, yet with the original, central axis commonly the tallest and best developed. Stems rather thick, fleshy, and like the leaf petioles dulled by a close, moist, velvety indument. Leaves clothing the entire plant and even extending into and obscuring the limits of the otherwise paniculate inflorescence, (leaves) sometimes reaching 30 cm. (12 in.) in length, elliptic or triangular, frequently corrugated, the upper surface dark and glossy. Flowers nodding and often more or less two-ranked, tending to leave the upper side of the laterals bare. Calyx at least half as long as the corolla, 4 of its 5 segments shortly triangular, the fifth so long as to frequently extend to the top of the corolla tube. Corolla dingy cream, tinged with some green or purple, tube 10-15 mm. (about 1/2 in.) long, unless already depauperate the limb more conspicuous than the tube and the lower, less reflexed two of its shallow, somewhat pointed lobes much the largest/ The 5 stamens inserted about 5 mm. from the base of the corolla, woolly in the lower part not reaching the mouth of the tube. Capsule broadly oval, about 8 mm. (1/4-in.) long, dehiscent, commonly hidden by tthe beaked calyx. Seeds nearly black, less than 1 mm. long, oblong, numerous.

The shape of the corolla limb distinguishes this species from all other members of the paniculata group, even rustica. Its relationships to paniculata and to rustica are especially interesting. Does it appear to be hybridizing with either?

Ruiz and Pavon give its habitat as "in frigidis locis Tarmae versus

Bombom tractus, inter Huariaca et Cerro de Yauricocha vicos." Collections have been made in the following localities:

Peru-----Tarma; La Oroya, 4,000 m., June: Cuzco; Puno: Yunguyo, also Puno, 3125 m. pastures and backyards, called "thryathysa (sp.?) locally, end of Dec.; Tacna: Candarave; Viso?, 3,000 m.

Bolivia-----Mapiri; La Paz, 3900 m., Apr.; Palca to La Paz, 4200 m., Feb.; Provinces of Omasuyos and Larecaja, 3500-3900 m.; Achacache (prov. Omasuyos), 3980 m.; Yungas District; Cuchicanchi, 3200 m., grassy ridges; Valle de Chilon (prov. Vallenquande, dep. Santa Cruz); Tarija (Escayache near Tarija), 3600 m., end of Jan.; Machacamarca, 4,000 m.; (extends also into Argentina)

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N. uspallatensis Ph.
(= N. acuminata Hook. according to Millán)

Plant with stem, petiole, peduncle, calyx all densely glandular puberulent. Philippi had only the upper part of the stem (35cm. (1-3/8 in.) long and 7 mm. (5.16 in.) thick, and two lower leaves. Leaves ca. 18 x 10 cm., (7 x 4 in.)(including petiole 3.3 cm. or 1¼ in.), petiolate, less glandular puberulent than the stem, cordate, long cuspidate, cauline shortly petiolate, narrower sometimes with teeth (the teeth that some upper leaves show are large and sharp-pointed, uppermost leaves subsessile, elongate lanceolate. Inflorescence a short terminal raceme, pedicels short. Calyx 18 mm. (¾ in.) long, lobes linear, slender and quite unequal. Corolla 9 cm. (3½ in.) long, almost salverform, seems to have been whitish, limb lobes very short and rotund. Anthers in throat of corolla, filaments almost equal ("tienen casi la misma longitud"). Style as long as stamens, stigma capitate.

--After Philippi.

Uspallata Pass in place called Banos del Inca, Collected Aug. Borchers.

Where is type sheet? Appears to be N. acuminata but a collection from the type locality would help.

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N. wigandioides Koch & Fint. (tomentosa group)

1 -several stemmed, erect, somewhat woody perennial 2-3 m. (6-10 ft.) high, leafy and somewhat branched above but usually losing its lower leaves when in blossom, the large terminal, erect or drooping panicles very showy, all the cream-colored flowers (which face outward in the panicle) appearing to come into anthesis simultaneously. Younger portions of stem and petioles (even leaf blades in younger leaves) glistening white with long straight, soft hairs standing out stiffly. Leaves reaching 40-70 cm. (15 in. to 2 ft.) in length, petiolate, pointed, ovate, under surface more or less pubescent to tomentose. Calyx about 1/3 aslong as corolla tube, its 5 teeth broad, clearly distinguishable, but usually not long; corolla about 15 mm. (5/8 in.) long, commonly a dingy cream, sometimes nearly white, sometimes purple-red tinged (especially in bud) notable in this group for the cup-like throat being reduced to a mere bulge followed by a contraction, and the star-shaped limb broad and flat; the 5 stamens woolly below, inserted near base of corolla, about equal in length, not becoming oriented against one side of the corolla but remaining evenly spaced, and only reaching the mouth. Capsule rotund, less than a cm. long, dehiscent, commonly the two valves remaining nearly entire or only slightly notched. Seeds numerous, brown, oval-oblong, about 0.6 mm. long.

The petiolate leaves, the shape of the corolla, and the sudden burst of bloom, the weight of which sometimes drags down the entire inflorescence and later, as the capsules form, distorts the slender ramifications of this much-compounded panicle, make this species easily distinguishable from tomentosa or tomentosa-like forms.

Collected in Bolivia-Incacorral, 2500 m. (June), and near Cochabamba, 2300-2800 m.

Its geographical range, climatic relations, and parricularly its distribution in relation to otophora or glutinosa on the one hand and tomentosa and tomentosiformis on the other are of significance.

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N. bonariensis Lehm.

very young plant older one resembles
N. longiflora

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N. bonariensis Lehm.

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Nicotiana frigida?
(longibracteata)

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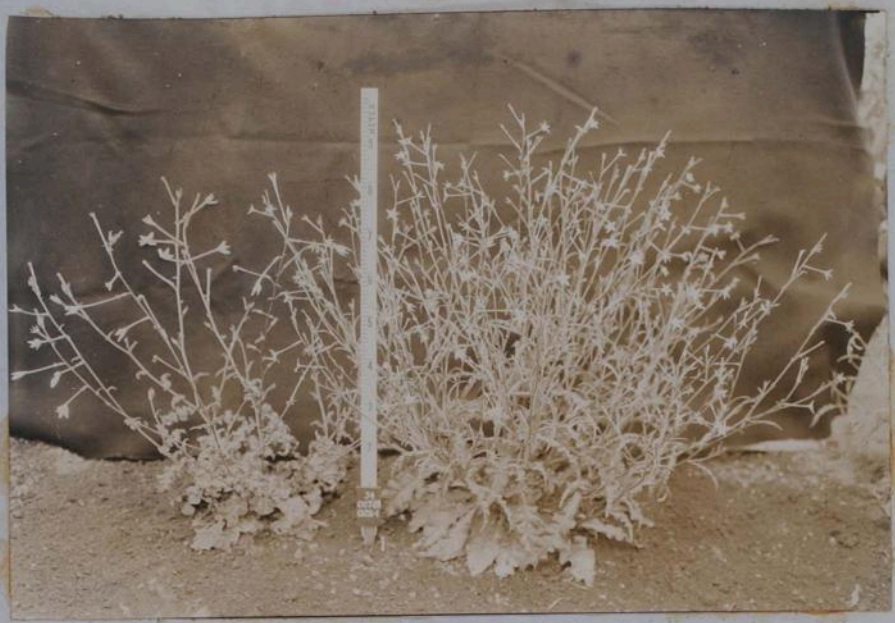

N. longiflora Cav.

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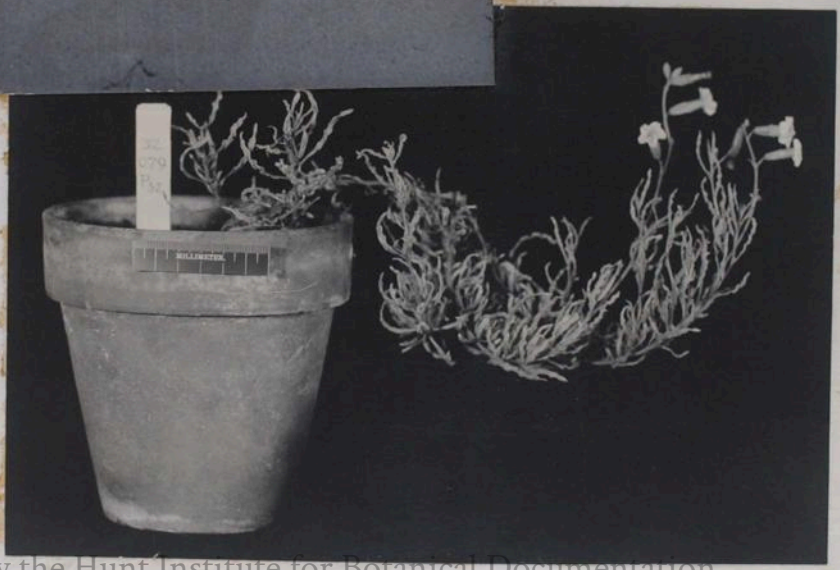

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Buenos Aires:

Dr. Albert Castellanos, Casilla 470: Nov. 2,1936, -agreed to collect seeds of Bromeliaceae - none received

Horticultural Society of Argentina,
1936 President: Dna. Julia B. de Saint

Dr. Forster, German College: Entomologist interested in botany, referred to by West.

Tucumán:

Dr. R. Schreiter -- re. locations of Nicotiana

Dr. Horacio R. Descole, Instituto Miguel Lillo de la Universidad Nacional de Tucuman: interested in exchange of specimens and literature.

Mendoza:

Sr. Dr. Eduardo Carette, Dir. del Museo "Noyano"
December 31,1935, letter from Dr. Molfino:
"If you are going to Mendoza and wish to herborize in that region, Dr. Eduardo Carette, Director of the "Moyano" Museum, a noted naturalist, will be of assistance to you who will be not at all inconvenienced, be assured, in attending you, being at the service of him whose name is written on this....."

(Quinto:?)

Harry B. Fields, Geologist, Ultramar Oil Co.

A. Atrujillo, Engineer, Saladillo Camp of Yacimientos Petroliferos Fiscales, 30km. S.E. of Yuto, F.C.C.N.A.

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Memo from Mrs. Mexia, May 12, 1938:

Tell Dr. Goodspeed that Dec.- Jan. are the best months for the extreme South; that as far as I know the Nicotianas do not grow as far south as the Straits; that the flora in the Straits is much impoverished and the sheep eat up what little is there. Those rivers on the East Coast may be worth visiting, I do not know as I have not been there. Perhaps the sheep do not eat Nicotianas, and I imagine they are little, weedy things down there. The Arctic flora is quite abundant because of the hot summers, but as the summers are cool to cold in the South, as Looser says, the flora farther north continues southward with species dropping out until it becomes poorer and poorer, but without new things supplanting those that drop out.

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Federico Alexander, los Sauces -- (ref. by Duke Banks, said to have Burbank correspondence)

Dr. K. Behn, former President, Sociedad cientifico de Valparaiso

Ruby Paje de Braun, 1 Oriente 548, Vina del Mar

Dr. Manuel Elgueta, Chief, Experiment Station, Santiago

Sr.-Dr. Don Ricardo Latcham
Museo Nacional, Quinta Normal, Santiago -- Your letter to him of September 11, 1936, never answered:

> "I have been in correspondence with Mr. N. Y. Sandwith who believes that he has discovered a new genus of Solanaceae in Southern Chile or Argentina. His question has been the extent to which it is related to certain species of Nicotiana, and particularly to N.minima as described by Philippi. I found certain certain specimens labelled "N. minima" in the collection which Sr. Espinosa was good enough to let me study, but these did not seem to me to agree with the description of the type. Mr. Sandwith now writes me that you were kind enough to send him a photograph of what he believes to be the type, and I wonder whether it would be asking too much of you to let me have a print of this photograph for my records, and also in order that I may be able to help him in his discussion of his new genus."

Dr. Oscar Jensen, Antofagasta -- friend of Dr. Reed.

Father Atanasio Hollermayer, transferred from Trumao to:
Mision Quinchilca on Rio San Pedro or Rio de Valdivia,
Los Lagos, casilla 27, Prov. Valdivia.

Dr. Kurt Wolffhügel
Petrohue, Depto. Puerto Varas, Chile

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Peru

Depto. Libertad

At Trujillo Larco Herrera Hacienda
Sr. Constante Larco, graduate of Cornell, and son of Don Rafael Larco of the Herrera Museum
-West letter of 12/1/36

Huamachuco:

Don Manuel Isaac Flores, ("big man of the town")

Sr.-Prof. Santiago Gastañaduí, Colegio Nacional de San Nicolas.

Cachicadau: Prov. Santiago de Chuco:

Sr. Francisco de Haggenmiller, ~~Prov.-Santiago-de-Chuco.~~
referred to by J.W. - letters written in German - looking for N. thyrsiflora.

Quillabamba

Mr. Bues, German, collector in charge of Tea experiment, (presumably for government)

Lima:

Dr. Teodoro Boza, Eng., Agric. Exp. Sta. of Molina near Lima

C. N. Grifs, "The West Coast Leader"

Cuzco:

Professor Ice de Leon, University of Cuzco

Puno:

Sr. J. Soub, Ministerio de Fomento
Apaido No. 34. (An acquaintance of Mrs. Ynes Mexia; has sent seed of Nicotiana and of Bomarea.)

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La Paz:

Dr. Cardenas, University at La Paz -
ask re. N. tomentosiformis, N. wigandioides, in
Canamina region, - J.W. 1/28/37.

Tarija:

Sr. Alberto Cornejo, Engineer of city water supply,
U. C. Alumnus

Humberto Árce, profesor de ciencias, Tarija Colegio
-A student of Cardenas; J.W. said Cardenas
was not too positive of his value in matter
of assistance.

Mr. Hirsch, a German Jew, teacher in Colegio, owns and manages a
private boarding school, --very helpful.

Mr. Moffatt, Engineer-Manager of large estancia between
Perico and Ledesma

Animas Mine, out of Chocaya (Cie Aramayo de mines en Bolivia)
Mr. Vail
Mr. Claude Artero (formerly U.C.)

Mr. Starbird, Asst. Gen.Mgr. (U.C.Man)
Aramayo Co., Quechis, Bolivia

Paraguay

Asuncion:

Sr. Prof. Dr. Carlow Fiebrig,
Director, Jardin Botanico - fine collection of
orchids and Bromeliads

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THE ARNOLD ARBORETUM
HARVARD UNIVERSITY

JAMAICA PLAIN, MASS., U.S.A.

July 12, 1938

Dear Mrs Locke,

A week ago when Dr. Goodspeed put in at Boston he ask me to write you putting on paper some of my suggestions for the party which will work along the Peruvian and Chilean coast. I was suddenly called out of town next day and could not write this before. Perhaps it is now too late. However, here goes.

In the Lima region the lomas back of Chancay, Chorrillos and Lurin are classic ones and are the type-localities of hundred of species. These localities Chancay to Chorillos and Lurin are the limits of the distinctive Loma flora found about Lima. North and south the flora of the coastal hills (loma flora) changes. I suggest that the men inquire about the auto-busses(camiones) and go up the coast tapping the hills at promising places. Buss travel is cheap - and some times hair-raising with a good reckless Latin as driver. South of Lurin and Chorillos little in the way of material has come from the hills. There may not be the proper conditions for the development of a good loma flora. A scouting trip south towards Pisco might be made and if hills with a good spring flora are found they should be visited and collected thoroughly. Any material from between Chorillos and Pisco would be very desirable. About Pisco there is a very broad coastal plain with the mountains well back from the coast. If the spring flora on these latter could be collected interesting things would be found. However I do not advise any attempt to collect about Ica. If coastal steamers are taken south the men can arrange to be put off at some of the southern ports of Peru. Possibly they can get one of the funny coastal steamers which carry everything and put into every port for a day or so. If they can visit Lomas, Atiquipa, Chala, Ocana, Atico, Camana (all north of Mollendo) and get up on the hills back of the port they can get very desirable specimens. This stretch of coast has a very rich and exciting loma flora and one that needs lots of collecting. There are very many undescribed plants to be found and many of them very lovely and attractive things. Along all the desert coast of southern Peru and northern Chile the men will soon find that all the plants grow in a green belt on the hills where the fog collects and gives moisture. When the boat is approaching a port they should spot the greenest places and after landing hire an auto and rush to the place nearest the selected hills. If they have the auto wait they can get a lot of collecting done in a few hours. If they return to the ship afterwards they can arrange to dry their presses on the grill over the engine-room where bully specimens can be prepared. Possibly they can arrange to be landed in one port and go by auto buss on down the coast. Information can be had in Lima on this point. Loma plants are mostly herbs and can be collected and prepared easily. The flora is rich but the occurence of the species in the green belt is very spotty even in a mile or so of hills. Hence it is desirable to get over as large an area, of apparently uniform loma, as it is possible to do in each locality visited. About Mollendo the lomas have been botanized repeatedly but still turn up new things. I would suggest that if work is done about Mollendo that obvious places (such as the canyons directly back of the town) be avoided and that the lomas north of the port be investigated. If time is available and there is transportation it might be interesting to run out from Mollendo to the port of Islay (a classic locality made famous by the early collections of Meyen) and on up the railrosd to Cachendo where some interesting plants have been collected. South of Mollendo and Islay very little is known of the coastal flora until Arica is reached. The port of Ilo was visited by Feuillee's in 1710 and is one of the oldest botanical localities on the West Coast of So. Amer. Any plant picked up within a few miles of Ilo would be Oh so very desirable! At Arica collecting sould be attempted on the hills and cliffs south of the town (south of the "Morro"), or well up the valley towards Tacna, or(is a road and autos are available) along the coast several miles north of the Arica. Plantsin the valey about Arica have been collected hundreds or times

Oh, a very much more could be said!

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It is a dumb flora and further collections are certainly not needed. Botanizing about Arica, to be worth while, must be done by someone who will get out of the valley north or south of the town, the farther the distance the better. South of Arica the distinctive Chilean flora (flora of the Nitrate Coast) begins. The coast is much more arid and the places where sea-fog can give enough moisture for plants are limited and scattered. The northern outpost is about Pisagua, but that locality has not been botanized by a real collector (the total flora is about 30 spp). The men probably will put in at Iquique and Tocopilla. There are some green areas near by on the hills. These have a rather numerous lot of plants and even large cactus. The trick here is to hire an auto and run out of town to the foot of a promising hill and then climb as high as possible and collect. Naturally the green places (always adorned with large cactus) nearest town are the best known. The men should try to get into places not too obvious. At Antofagasta. the Chimba hills north of the port are good and poorly collected. They can be reached by an auto and should produce a bully lot of plants. Along all this coast the higher one goes in the green belt (up to about 3000 ft where the desert begins again) the better the collecting. The next port south is Taltal where there is good collecting on the upper part of the hills to the north and northeast. They will almost certainly put in at Chañaral. The hills directly back of the port, and only a few minutes walk, are good. They can get a grand lot of Nicotiana solanifolia on these hills only 10 minutes walk from the boat where they cant possibly miss it. These hills back of Chañaral should be explored along the crest and back inland a bit. If there is plenty of time they might investigate the green belt on the hills along the north side of the bay. I believe they should plan to disembark at Caldera the port of Copiapo. and go south by train. Little would be gained if they disembark further north and there are a host of very good reasons against it. About Caldera there is a famous green spot on the Morro, which is the hills at the south point of the bay. There is another spot in Quebrada del Leon in the hills NE of the port, but that requires horses. I would advise the Morro. Any betw Caldera and Copiapo the coastal hills have a good vernal (loma) flora which peters out as Copiapo is reached. I suggest that these be visited by buss or auto from Caldera or Copiapo. My old friend Mr Timberlake was the biggest man in Copiapo, both in business and stature, and he can give advice if he is approached. Ask for Sr "Temberlacky". There is a lot of good c collecting ground, and such famous type-localities as Bandurrias, Carrizal, Yerba Buena, Chañarcito, just south of Copiapo which might be visited if there is buss service or cheap auto transportation. I would suggest that the train be taken from Copiapo direct to Coquimbo (or better the nearby La Serena where there are better hotels) The best collecting about Coquimbo Bay is on the dunes, on the hills facing the bay between Serena and Coquimbo, Dont collect at the Lighthouse or on the peninsula about Coquimbo -- everyone has and continues to do so. Work towards the north side of the bay. I wish an excursion could be made NE to Andazolla, the old mining district visited by Gay and Macrae, and the type locality of a lot of puzzling species. Andocolla seems to be an outlying station for the characteristic Atacama flora and to have a lot of endemics as well. Any and all plant from Andocolla would have a very high botanical interest and are very greatly needed indeed! If there is time a trip up the Coquimbo Valley to Vicuna for collecting on the hills would be desirable. Time, however, could be better spent about Ovalle and Illapel or better still in the hills along the RR between them. Any material from the prov of Coquimbo south of Coquimbo Bay is worth collecting. and has a good chance of producing new species. In fact I would slight localities between Mollendo and Ovalle so that I could have time enough to do extensive collecting in the dept. of Arequipa and the prov. of Coquimbo. Thes are your good areas. In central Chile plan to put your best efforts, not about Valpo and Santiago but in the coastal hills working towards the coast from San Fernando and Talca (to the ports of Constitucion and Pichilemu) That will produce some very valuable specimens and good garden material. Please do not plan any collecting about the overcollected localities along the transandine RR (particularly Banos del Inca and Caracoles). In Mendoza any localities below Banos del Inca are good, I wish something could be gotten about Uspallata or directly above. If collecting is done about Valpo go to the south and southeast where less has been done.

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In general I advise that the men go to Lima, collect about the area and investigate the flora south of Chorrillos and Lurin. Then plan to put in some time on the lomas of the department of Ariquipa, getting to as many points and collecting as much as the can. From Mollendo I believe they should go by boat to Coquimbo. I most strongly advise against a train trip south of the Chilean Longitudinal RR. from the northen-most ports of Chile. There are some reasons for stopping at Copiapo and then taking the train south. I suspect that the best botanical results can be obtained if they go ~~directly~~ by a boat to coquimbo and then spend ~~some~~ a good stretch of time in the prov. of Coquimbo. En route, Mollendo to Coquimbo, they can get collecting doe while the ship puts in at Arica, Iquiqui, Tocopilla, Chanaral. After a good bit of work in the prov. Coquimbo they should investigate the coast ranges between Santiago and Concepcion, and put in the minimum time botanizing about Valpo, Santiago and Concepcion. The latter localities are as well known as ~~the plants of~~ Los Angeles and San Francisco. The intervening coast ranges are very poorly known even by the Chileans and is only very sketchily covered in the books. By buss or train get into the coastal hills and sample the flora from the central valley over the hills to the coast.

You might tell the men I am particularly interested in Astragalus, Boraginaceae and Sisyrinchium. Chenopodium ambrosioides is a famous medicine in Chile, and is actually cultivated by the natives. Please advise them not to collect that foul weed. The natives always want you to do so.

In reading this letter I note many lapses in spelling and a very few grammatical slips, I hope, however, that an understanding reader will understand my mewning.

With best regards, and best wishes to you and the locky group going south

Yours sincerely

Ivan M Johnston

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Pisagua

This locality has ot been botanized--total flora abt.30 spp.

Iquiqui

Tocopilla

Antofagasta (See also West letter)

Chimba hills north of the port, good and poorly coll.good picking. The higher into hills to ca. 3000 ft. where the desert begins again the better the collecting.

Taltal

Good coll. upper part of hills no. and N.E.

Chañaral

Hills directly back of port good coll; N. solanifolia to be found. Especially explore crest of hills and back inland; also green belt on hills along north side of bay.

Caldera, port of Copiapo

Go south by train. (Nothing to be gained by disembarking farther north.) At Caldera a green spot on the Morro, hills at N. point of bay. Another in Quebrada del Leon in hills NE of port, but that requires horses. Advised: Morro half way betw. Caldera dx and Copiapo, coastal hills with good vernal flora diminishing nearer Copiapo

At Copiapo ask for Mr. (Sr.) "Temberlacky" (Timberlake) friend of IMJ -can give good advice.

So. of Copiapo: type localities Bandurrias, Cerrizal, Yerba Buena, Chañarcito

Coquimbo, by train from Copiapo. La Serena nearby has better hotels.

Best coll. abt Coquimbo Bay is on the dunes,on hills facing bay betw. Coquimbo and Serena. Don't collect at the Lighthouse - been overdone. - or on the peninsula abt. Coquimbo. Work toward N. side of bay.

Andazola, N.E. of Coquimbo --see Jtn.letter. -Many endemics. Any plt.material from this region highly desirable.

Vicuna, up the Coquimbo Valley, in hills, but should be sacrificed if necessary in favor of region about Ovalle and Illapel or, better, hill region along RR between them.

Any material from Prov. Coquimbo south of Coquimbo Bay desirable, and good chance of new spp. in fact "I wd. slight localities betw. Mollendo and Ovalle in order to do extensive coll. in Depto. Arequip and Prov. Coquimbo."

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Central Chile

Slight Santiago and Valpo regions for coastal hills, working toward coast from San Fernando and Taloa to the ports of Constitucion and Pichilemu. Do not plan coll. abt. the overcollected localities along the Transandine R.R., particularly Banos del Inca and Caracoles. If coll. at Valpo, go so. and S.E.-less worked over.

Mendoza

Any localities below Banos del Inca are good.

Desirable: Uspallata region and directly above.

General remarks: Stress Lima region, the lomas south of Chorrillos and Lurin.

Dept. Arequipa (see also West letters),
Prov. Coquimbo
Coast ranges betw. Santiago and Concepcion
Central valley of Chile and over the hills to coast.

In connection with this outline the original letter should be followed.

Notes on Utricularia - IMJ--see following pages.

"You ask about localities for Utricularia and Genlisea. The latter is Brazilian and apparently rare. Utricularia is not uncommon in Chile and Argentina and is represented there by very few species. It can be expected in any pond of still water where it grows with Potomogeton and Myriophyllum. Still water along riverbanks, reservoirs or natural ponds all support Utricularia. Any yellow-flowered plant growing in still water is Utricularia. The corollas are smaller than those in California, in the Chilean and Argentine spp. abt. 1/2" long. Any botanis in Chile or Argent. can tell you many localities for the genus."

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EXPLORACIONES BOTÁNICAS REALIZADAS EN EL PERÚ
DURANTE LOS TREINTA AÑOS ÚLTIMOS
BOTANICAL EXPLORATIONS REALIZED IN PERU
DURING THE LAST THIRTY YEARS.

By Dr. Fortunato L. Herrera.

From LA CRONICA,
Wednesday, July 28, 1937.

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BOTANICAL EXPLORATIONS REALIZED IN PERU DURING THE LAST THIRTY YEARS.

By Dr. Fortunato L. Herrera.

From THE CRONICA, Wednesday, July 28, 1937.

87 The three last decades of the present century have seen intense scientific activity concerning the study of the flora of Peru. Numerous expeditions have traversed its territory accumulating materials for the systematic investigation, and the botanical institutions of the whole world are concentrating their attention on our country in such a way that it has no precedents in the past. It all predicts that, within a short time, the vegetation of the Peruvian Andes will be one of the best known of South America. With the brevity that a newspaper article demands, I am going to review rapidly the works effected from the close of the year 1906 up to the present time and the principal publications that have reached the public.

i In 1906 Dr. Serafin Filomeno, Director of the College of "San Jose" of Moyobamba, obtains an appreciable collection of Orchideae in the reported province (B D) that contained 23 new species. It was studied by the eminent monographist, Dr. Rudolf Schlecter, who has presented the result of his studies in the notable work entitled "Die Archideenfloren der Sudamerikanischen Kordillerenstaraten --IV Peru" (Berlin, Dahlem, September 1, 1921).

In the same year Huber explores the department of Loreto, making a trip through Canchahuayo, Leche, Pampa de Sacramento and along the Huallaga River (M G, B D) and E. Kohler, inhabitant of the valley of Chanchamayo, herborizes in the valleys of La Merced and Huacapistana, devoting, preferably, attention to the Orchideae (B D).

In September of 1909, Prof. Augusto Weberbauer renews his work of herborization that he so successfully undertook between the years 1901 to 1905. In fact, with some intervals between, he undertakes new trips through the departments of North, Central and South Peru, that are prolonged up to March, 1921 when he seems

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to have terminated his mission. In this new period of his excursions, he obtains a collection of plants of more than 3,000 numbers (F M, B D). In 1922 he published in Stuttgart the first phytogeographical map that is known on the national territory.

In 1910, the prestigious German Americanist, Dr. Eduardo Seler, on going through Peru after having attended the Scientific Congress of Montevideo, makes a trip through the altiplano of Titicaca, through some provinces of the department of Cuzco and the valley of the Rimac to the town of Oroya, obtaining in his journey an appreciable lot of plants (B D).

In 1911, Prof. Harry Word Toote of the Scheffield Scientific School of Yale University explores during two months the basin of the deep Urubamba, Ollantaitambo, San Miguel, Haudquiña and Santa Ana. In the distance he traversed, he obtained an important collection of Muscineas?, consisting of 335 packages of Hepaticae (U G) and 48 Mosses (N G). The first were studied by Prof. Alexander W. Evans and the latter by Dr. R. S. Williams, In December of the same year, Prof. W. E. Castle of the astronomical observatory of Carmen Alto collected plants in the neighborhood of the city of Arequipa.

In 1912, Forbes traverses the coast of Peru, visiting, among other localities, Barranco, near Pacasmayo and Paracas Bey, near Pisco (B M) and Oquendo, he herborizes in the neighborhood of the city of Puno (K).

In 1913, Prof. Alex Hrdlicka, American physician and anthropologist, visits the village of San Damián of the province of Huarochirí where he obtains a small collection of plants (U S).

In June of 1914, Prof. Joseph Nelson Rose, monographist of the family of the Cactaceae, arrives at this Capital and immediately proceeds to the exploration of the ravine of Rimac, stopping in Santa Clara, Matucana and Chosica, from where he went to the department of Junin and then to Southern Peru where he visits the departments of Arequipa and Cuzco (N G, U S). In collaboration with Prof. N. L.

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Britton of the Botanical Gardens of New York, he publishes in four large volumes the monumental work entitled "The Cactaceae" (Washington, 1919-1922). In this same year Prof. Harlan explores the altiplano of Titicaca, visiting among other localities Juliaca Lagunillas.

In 1915, Professors A. F. Cook, botanist, and G. Bruce Gilbert, Assistant-botanist, of the Section of Industrial Plants of the Department of Agriculture of the United States, explore intensively the basin of Alto Urubamba, visiting the localities of Sicuani, Tinta, Calca, Ollantaitambo, Torontay, Machu-picchu, San Miguel, Lucumayo and Santa Ana. They obtain an abundant collection of phanerogamic plants, reaching more than 1650 numbers (U S) and several packets of muscineas? (N G). Prof. A. F. Cook is the author of interesting studies on the agriculture in the valley of Urubamba in the time of the Incas. Prof. Hiram Bingham, Chief of the Peruvian Expedition of Yale University, collected also some specimens of plants in the ravine of Totontoy and in the valley of Arona (U S).

In 1918, Prof. Carlos Rospigliosi Vigil, under the patronage of the Faculty of Sciences of the University of San Marcos, directs a scientific expedition to the department of Junin in which the prestigious botanist, Dr. Nicolas Esposto, took part that penetrates to the tropical region of the East; in 1920, Dr. Rospigliosi heads another to the same region accompanied by Prof. Otto Nordsenskjord of Sweden. The collections of plants obtained by both expeditions together with another of Mr. Luis A. Chávez, coming from the province of Huancayo, have served as a basis for the formation of the Herbarium of the Museum of Natural History of the Faculty of Sciences of the University of San Marcos (B D).

In the years of 1919 and 1920, the botanical expeditions succeed one another very rapidly: Mrs. Reid S. Schepard, evangelist, makes an extensive trip around Lake Titicaca, province of Huancané and the City of Tacna (G); A. S. Kalenborn, excursion through the ravine of Rimac and going through the village of San Damián, reaches Oroya (U S, N J, G. and K); Anton and Carl Kohler, inhabitants and

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land-owners in the valley of Chanchamayo, persue the work of their father, obtaining an appreciable herbarium (B M); Mrs. F. E. Hinckley realizes an excursion to the foot of the Volcano Chachaní, about 10 kilometers from Arequipa, where she obtains a small but very interesting collection of plants (G) and Colonel Stordy, Chief of the Agricultural Station of Chuquibambilla in Puno, visits the departments of the South collecting some Gramineae.

In this same period of time, the agronomy engineer, Christian Búes, German and naturalized citizen of the United States, carried on an extensive herborization in the province of Convención of the department of Cuzco, specializing in lichens, Mucineas?, ferns and Orchideae. His collection that reaches more than 2000 numbers, he submitted to the botanical institutions of the great Republic of the North (U S, N I and G). He is the author of numerous articles on agriculture in the valley of Santa Ana, and a valuable monography entitled "La Coca en el Peru".

The underscribed, in charge of the regency of the Chair of Botany of the University of Cuzco began his work of herborization toward the close of the month of September 1922 and persued this work in an intermittent manner and without any official assistance until September 1933, having succeeded in obtaining a collection of more than 3800 numbers (B C, U S, N I and F M and G). I gave special importance to the annotation of the common names of the plants for their publication with their respective scientific synonyms. The result of my studies is condensed in the work "Estudios sobre la Flora del Departamento del Cusco" (Studies on the Flora of the Department of Cuzco) (Vol. I, Lima, 1930 and Vol. II, Cuzco, 1933).

There followed the expedition of agronomy engineer Wilson Papenae of the Section of Industrial Plants of the Department of Agriculture of the United States who studied, during the years 1921 and later in 1924, the agricultural recourses of the country, the remarkable one realized in 1922 by Prof. I. Francis Macbride, Conservator of the Department of Botany of the Field Museum of Natural History of Chicago, in company with William Teathustone, student of the University of

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Wyoming. During the months of May and September they explored, out of preference, the departments of Lima, Junin and Huánuco, obtaining more than 7000 specimens of plants. In a second trip that he realized the following year accompanied by Prof. L.S. Beyan of the University of Wisconsin, he covered during the months of March to September the same departments exploring by choice the forest of Eastern Peru. Today he is engaged in the publication of his monumental work entitled "Flora of Peru" of which there have been published the past year four large volumes and numerous monographies on the result of his expeditions.

In 1923, Mr. Ernesto Gunther assisted by the German botanist, Dr. Otto Buchtien, makes a large herborization in the tract of arable land of Arequipa on the hillocks of Mollendo, a collection that is conserved in the University of Lubeck (Germany). Dr. A. S. Hitchcock, specialist in systematic agrostology, undertakes, in behalf of the Department of Agriculture of the United States, a very rich collection of Gramineae in the departments of Lima, Junin, Arequipa, Puno and Cuzco whose results he has presented in his work entitled "The Grasses of Ecuador, Peru and Bolivia" edited in 1927, and the German ethnologist, Guenther Tessmann, begins on a large scale the collection of plants in the departments of Loreto and San Martin, prolonging his work until April 1926. His herbarium consists of more than 6000 numbers (B D), whose state has given as a result an exceptionally large number of new species for the region of the Amazon forests.

In 1924, the botanist of the United States, F. L. Stevens, realizes a trip of exploration to the department of Junin and obtains in the neighborhood of Oroya and Huancapistana a collection of a hundred "pliegos"? (packages) (U S).

In 1925, Prof. Francis W. Pennell of the Academy of Natural History of Philadelphia, monographist of the family of the Scrophulariaceae coming from Chile, travels over the departments of Arequipa, Puno and Cuzco, penetrating, in the latter, the ravine of Pillahuata of the province of Paucartambo, where he obtains a large number of species of the genus Claceolaria and then visits the surrounding

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territory of this Capital and the province of Canta, celebrated in the annals of science on account of the excursions of Ruiz and Pavón. He accumulated an herbarium consisting en masse of 2600 numbers (F M, G N I).

In this same year other expeditions of less importance are realized, such as that of Prof. Alberto F. Blakslee, sub-director of the Department of Genetics of the Carnegie Institute, who at the close of the Third Pan-American Scientific Congress made a trip through the valley of Chanchamayo, Arequipa, Puno and Cuzco, collecting preferably seeds of DATURA STRAMONIUM L. for the determination of the number of chromosomes that its different varieties present; E Wedermann, sub-director of the Museum and Botanical Gardens of Berlin, who after having made a trip through the province of Tacna visited the city of Cuzco (B D); Ivan M. Johnston, monographist of the family of the Oenotheraceae and Dorraginaceae, visits the neighborhoods of the ports of Mollendo and Talara, obtaining a small collection of plants (G). He is the author of numerous monographies that frequently deal with Peruvian plants; and Werner Hopp who before his remarkable explorations in Ecuador, goes over the surrounding territory of the city of Arequipa.

In this same year and through several consecutive years, the Japanese Masaho Sawada begins his explorations also, who in behalf of Prof. R. Kanehira of Fukouka (Japan), explores the mountains of the department of Huánuco, especially in the localities of Pampayacu and Pan de Azucar on the Huallaga River (F M, G. etc.); and Oscar Haughth, who obtained a very important collection of plants in Talara, Negritos and valley of Pariñas of the department of Piura, in a zone botanically very little known (G U S).

In 1926, the American G. H. H. Tate collects plants in the vicinity of the city of Arequipa (N G).

In 1927, Prof. Sergio Juzepzuk, agronomy engineer and member of the Russian scientific mission to South America lead by Prof. Voronoff, makes an expedition through the departments of Junin, Arequipa, Puno and Cuzco, collecting potato

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tubercles (Solanum tuberosum L.) for their acclimatacion in Russia, and makes, in passing, an extensive herborization that is conserved in the Botanical Gardens of Leningrad; Carlos Schunke, old inhabitant of the valley of La Merced in the department of Junin, collects around 1500 species in the valley of Chanchamayo (F M); and Adolfo Diehl obtains, equally, another appreciable lot in the valley of Urubamba of the department of Cuzco.

In 1929, under the auspices of the National Museum of the United States, botanists Ellsworth P. Killip and Albert C. Smith, realize, during the months of April to October, a very important exploration through the region of East Peru. Passing through Tarma and Huancayo they penetrate the province of Huanta of the Department of Avacucho, visiting the margins of the Apurímac, they explore then the valley of Chanchamayo, stopping in San Román, La Merced and the Colony of the Perené and descending along the Pichis River and by way of Pachitea and Ucayali they reach the city of Iquitos. From here they undertake the exploration of the Huallaga to the port of Yurimaguas and finally the Itaya River Basin. In the undertaking they collect more than 8000 plants (U S, N I, F M), giving particular attention to the species used as stupefiers. Both botanists with authors of an ample bibliography on the flora of Eastern Peru were the first to introduce the technical names of the CUBE, AYAHUASCO and others whose use were already known by the natives.

Also in 1919, Prof. Llewlwyn Williams, conservator of the Department of Economical Botany of the Field Museum of Natural History of Chicago, explores for said institution the northeast region of Peru. Making the city of Iquitos the center of his excursions, he travels along the banks of the Marañón, the Amazon, the Huallaga, etc., obtaining around 8200 specimens, many of them in duplicate forms and an addition of 2154 specimens of precious woods and diverse objects (F M); Miss Inés Mexia, in behalf of the University of California, herborizes first in the department of Loreto and finally along the South American Andes.

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In 1931, Mr. Miguel Reataeguf collects some few specimens in the Mantaro Basin, province of Angaraes; Miss D. B. Stafford traverses for the same purpose the tracts of arable land of Arequipa and altiplano of Titicaca, securing around 350 specimens (K) and, finally, Prof. Thomas Harper Goodspeed, Professor of the University of California, collects specimens of the genus Nicotiana in the vicinity of this Capital and in the departments of Arequipa and Cuzco, whose results possibly we shall know very shortly.

Lima, March 22, 1937.

Conventional Signs.

B D.--Botanical Gardens and Museum. Berlin. Dahlem.

F M.--Field Museum of National History. Chicago.

U S.--U S. National Museum. Washington.

K.--British Museum of Kew.

G.--Herbarium Gray of the Massachusetts University.

N Y.--New York Botanical Garden.

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Lorentz, P. J. : Flore Argentine

in

LA REPUBLIQUE ARGENTINE
by
Ricardo Napp
Assisted by several collaborators
Work written by order of the
CENTRAL ARGENTINE COMMITTEE
for
The Exposition at Philadelphia

Cf. colored vegetation map of Argentina in Nicotiana notebook - it was taken from this article and shows where these regions are.

Covers: II Formation Patagonienne 76-78
IV " del Monte 88-100
V " sous-tropicale 100-118
VI " de la Puna 119-120
VIII " Mésopotamienne 123-124

Buenos Aires
1876

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Lorentz, P.G.: Flora Argentina in Knapp: La Republique Argentine 1876

II

Patagonian Formation

76 We are still lacking detailed and concise accounts on this formation; the (flora) of the coast are concisely described, but that (of the interior) is known to us only through scattered accounts. No botanist, no scholar, to our knowledge, has yet penetrated the interior.

The most exact description of the Patagonian flora was given to us by the Clarez and Heusser manuscript. We can only publish their accounts that relate to the coast between the Colorado and Chubut Rivers -- 39°50' to 43°25'.

"The Patagonian plateau, they say, is, generally speaking, higher than the pampas. It is intersected by numerous (low) valleys a fact that justifies the name of plateau t that we give it.

"The flora is that of a dry climate; however, the valleys of which we are going to speak are very fertile because of their depth. There we find real Gramineae and a vegetation that recalls that of the Pampa: the Glumaceae, the most remarkable of which is the species called Cortaderia (Gynerium Argentinum), the Carizo (Phalaus), the Totora (Typha) and those real Gramineae. These species, however, different from those of central Europe, have a great analogy with them and belong to the same genera and to the same families. In the valley of the Negro River we find the American willow (Salix Humboldtiana) that borders the river and forms a narrow girdle; they use it for timber. This timber, sheltered from the changing temperatures is conserved a long time, but exposed to atmospherical variations, it lasts 7 to 8 years.

"An Equisetum that we find everywhere along the river and whatever rare lichens
77 and mosses that we see usually only in winter are the only representatives of the Cryptogams; we can thus form an idea of this damp, alluvial and low but not saline ground. In the valleys, however, we find some quite numerous salt-marshes, the descriptions of which we owe to Darwin who has explored some near the Negro River. We also find several salitrades or saline efflorescences. These valleys are, then, covered by salty vegetation characterized, especially, by some bushes of a Synantherea called matorro and of some Salicornieae called Jume here, whose ashes contain a great deal of soda, are used, elsewhere, in the manufacturing of soap.

"The plateau with the Patagonian tertiary geological formation possesses a flora altogether different from that of the damp alluvial soil. Darwin has observed that this flora resembled that of Mendoza and differed essentially from that of the so-called Pampa Pailles. The principal difference lies in the fact that the Pampa is a prairie containing, at random, some bunches of isolated trees, whereas the Patagonian system, on the contrary, presents some herbs, some bushes and some shrubs, sometimes predominating, sometimes uniformly distributed. The herbs consist principally of Gramineae closely followed by the Synantherea. The ground is covered with bunches of somewhat separated "pailles" (straw?) among which there does not exist any vegetation in the summer; sometimes, in winter, the intervals are covered with the green leaves of an annual plant called Alfilerillo (species of Erodium) here, that is excellent pasutre-ground for the sheep. This plant, after each rain, produces new shoots and dominates more and more the pasture.

"The sylvestral vegetation consists of thickets not surpassing the height of a man on horseback; almost all these bushes are thorny and their tortuous trunks have only a few leaves. The Chañar and its conquer the Uña del gato (cat's claw), l'algarrabi, or algarrabilli (Prosopis), the mata de inciensi (incense bush) or

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molle (Duvana) the piquillin, the mata negra (Black bush) the mata caballo (horse bush) and the jarilla are the commonest species and form, with several Synantherae, the chief part of the sylvestral flora of these regions.

"These species are a very good fire wood; the piquillin is preferred, because the mata negra contains a resin that, in combustion, gives off disagreeable odor that is transmitted even to the food and because the incense gives off, while burning the odor of incense a fact to which it owes its name. Moreover, we shall mention a kind of bush called elcui by the Indians; the bark that contains a great deal of balsam is loosened quite easily. The Indians burn the branches over a basin full of water in order to collect the resinous balsam that trickles from them(branches) and that they chewafterwards.

"We shall conclude by mentioning the Lunas (cactus) that we find in large numbers and that sometimes have spines two inches long, and are hard as iron; and that cruelly injure the horses unaccustomed to these regions. The tunas are the characteristic plants of the Patagonian plateau. The accounts that we have just given are nearly the only ones that we have on this part of our country."

78 In the same article from which we have extracted the preceding lines the authors present some details of which we do not wish to deprive our readers; we shall add some information that we have from Dr. Heusser. The remaining space that is reserved to us in this chapter prevents us from presenting many details.

On the damp alluvious and low land that interests us and on the slopes that surround it, grain and vineyards grow perfectly and the viticulture carried on intelligently has invited a great development, because it has already produced, on a small scale, excellent results.

The author of this chapter has not visited these districts, but he is surrounded with information taken from the most respectable sources. Moreover, Musters mentions , without describing it, the comestible roots and tubercles; we do not know to what families these plants belong; at any rate, they are not abundant enough to serve as a food for the Indian population as small in number as it may be.

The sterility of the soil and the rigor of the climate are compensated, in these regions, by the products of the sea and by the wealth of the animal kingdom in which we are not interested. We point out, in passing, a large quantity of Algae (ferns) that may become later a source of wealth through the use that is made of its ashes in the preparation of sodium.

IV.

84 . . . . . Formation of the Monte(forest).

A forest is called in Spanish, monte or selva; this last word, however, is not used in the Argentine Republic or, at least, not the same meaning. The general name of monte applies thus to the forests as well as to the woods of limited extent; thus it is that we have chosen this technical word to indicate a formation of this country that is principally covered with woods.

Professor Grisebach, in his remarkable book, "The Vegetation of the Earth"(Die Vegetation der Erde) gives it the name of formation of the Chañar to the one that we shall call formation of the Monte, basing our support on the reasons that we have given above.

It resembles the Patagonian formation withits aridity and predominance of

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sylvestral plants that compose it; it even seems that many of the shrubs are common to them, future investigations may alone determine whether or not the two formations should be united.

We have not yet succeeded in explaining, in a satisfactory manner, how under the influence of a dry climate, a vegetation of trees has been produced while the much damper Pampa lacks it entirely.

It is difficult to indicate with any precision the limits of this formation; on the east, it is bounded probably by longitude 63; this, at least, is what results from the only exact observation that has been made on this point, on the west, it is limited by the formation of the Puna of the Cordilleras, without a tropical formation separating it as that in the place in la Sierra de Aconquipa; consequently, the limit follows all the sinuosities of the Cordilleras and their counterforts, passing as they do from one degree to another. The point of intersection with the Patagonian, in the south, is wholly unknown. In the north, it is bounded by the subtropical formation where already we see appear the peaks of Aconquija around which clouds gather humidity and form the reservoir of numerous springs that go to fertilise the vast plains extended at the foot of these giants.

The limits of the two formations are scarcely determined; they are found here marked by a mixture of trees and shrubs belonging to the two regions; thus, we can only set their boundary as approximately between 28° and 29°.

In the east and northeast, they are joined with the formation of the Chaco whose several representatives penetrate quite far into the interior. Considering their great resemblance the limit of the two is still more difficult to determine than the preceding
85 ones. The formation of the Monte is found here and there again as a piece of inclosed grounds in the subtropical formation, there where a large slightly elevated valley is found under conditions of humidity unfavorable to vegetation. For example, on the road from Tucuman to Salta, in the interior of the valley of the Tala River where the Sierra of Candelaria intercepts the currents of humid air, the subtropical formation reigns on the mountain slopes leaving the floor of the valley to the formation of the Monte, whereas, on the contrary, in the narrow and damp valleys of the Sierra of Ambato, the subtropical formation approaches the lowest parts of the valley. This is the reason that, in the whole of the Republic; the degree of temperature influences the formation of the plants much less than the abundance or the rarity of the permanent waters.

The formation of our plants depends very little on the geological constitution of the terrain. They are thus developed as well on the terrain of the Pampa as on a rocky soil, on the moors as on the granitic or calcareous terrains.

Now we shall designate the principal and most characteristic vegetals. And above all, without binding ourselves to the botanical order or system we shall only consider the quantity and habit of the vegetals. We are obliged to pass over in silence, a large number of secondary observations less interesting to the reader who is not a specialist; we can no more present our appreciation on the groups, the families and the resemblances of the individuals, obliged as we are to confine ourselves to a concise and dry account.

We are, above all, interested in the trees and shrubs that cover these lands, and then we shall cast a glance over the principal herbs and Graminaeae.

Nearly all the trees and shrubs of this formation are rickety and of slight height; they have prickly branches full of twigs and are, for the most part, provided with spines or with spiny leaves. The family that especially presents this character distinctly is

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that of the Mimoseae, the most remarkable and the most numerous from the standpoint of species and of individuals. We must, therefore, devote ourselves to it first of all, however, if we were to mention here all the species of Prosopis, Mimosa and Acacia that have been found up to the present time, we would go far beyond the limits assigned to this chapter; we shall be content, therefore, with describing, in passing, those that chiefly characterize the physiognomy of the landscape, or merit mention because of their industrial application.

From this twofold point of view the Algarrabas, species of Prosopis, merit first place. The very useful Algarrabo blanco (Prosopis alba) is above all sought for. The algarrabos are of various sizes; sometimes they are to be perceived as shrubs, whereas, farther away, they attain a great height; the usually inclined trunk throws up branches at a considerably less height; the crown of the tree is slightly tufted because of the scantiness of its pinnate leaves.

86 These shrubs form, sometimes , veritable forests; but, in general, we find them mixed with other species; in the country, they are used in the construction of cabins; however, their wood is especially used for fire wood. Their fruit is confined in some pods, the tender and sweet pulp of which constitutes an excellent food for the cattle; even the inhabitants eat them by making a kind of bread out of them(Patai), or a refreshing beverage that becomes frothy after fermentation; this beverage, in several departments, is the only one used in public celebrations.

About the cultivated fields, they are wont to grow several algarrobos for their shade; in this hot country, the tree placed near a building prolongs (its period of usefulness) and lends it dignity. Its slow growth obliges the inhabitant to respect the tree to which he owes his shade and that he will not be able to replace by a new grove without the concurrence of years.

Almost all the other Mimoseae are only shrubs or small trees; we shall only mention the Acacia Cavenia or Mandubay whose fruits, very rich in tannin, is used for a black dye, whereas the hard heavy wood is used in the districts where it abounds either for domestic purposes or for carpentry; the Acacia Moniliformis, that bears fruit whose branches give off a gum that we might exploit and whose fruit and bark contains a large quantity of tannin. Several species are equipped with large spines that under some thickets are impenetrable. The commonest plant, after the Algarrabo is the Tala that we, likewise, find in the subtropical formations and Mesopotanian formations in the Chaco and even in the Pampa. They are used to form spring hedges. These species belong to the genus Celtis; the commonest are Celtis Tala and Celtis Sellowiana that form thickets or trees covered with spines and usually grow among the algarrabos that are situated near the buildings. They produce a cool shade; but the fruit is not edible and the wood is of very little value.

Then comes the Quebrachos; the most important of which are three species that we are about to mention, and that do not belong to the same family although we commonly designate them by the same name.

The Quebracho Flajo or Quiriliu(Jodina rhombifolia) shrub or tree whose rhombiform leaves have some triangular spines; this very scattered plant characterizes the formation of the Monte but it is of no value except in the growing of hedges. The Quebracho Blanco (Aspidosperma Quebracho) is a shrub or tree of medium height whose ovel, oblong and spiny leaves have the appearance of leather; it forms large woods in the interior, generally dominates the other vegetation and is also mixed with the thickets in the wastelands.

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Its wood has been used for a long time for engraving, and its bitter bark constitutes one of the thousand popular remedies for the intermittent fever.

87 The third species, the Quebracho Colorado (Loxaptergyium Lorentzii), although common enough here, belongs rather to the subtropical formation. We shall mention it again further on.

The Moyes or Molles occupy a place of importance in the vegetation of this zone.

We include in this name a quantity of rather similar plants that have in some one their organs, very pronounced, a odor of turpentine and they belong for the most part, to the family of the Terebinthaceae(?), genus Terebinthus.

The principal species is the Molle a beber(Molle to drink), named thus because they prepare from its fruit a sweet, refreshing and aromatic beverage.

This magnificent tree, the most beautiful of this formation, is peculiar to the mountains and its root penetrate the crevices that exists among the rocks.

The other species of Molles of which we shall speak later on are some shrubs or atrophic trees forming an integral part of small woods and belonging to the genus Duvana; they produce berries of an agreeable taste, that are burned sometimes as an incense. One of the species called Molle a centie (Molle for tanning) merits special mention because its leaves produce a tanning substance that does not color the leather. We shall mention two more species of Molles negras that also are an integral part of the thickets of this formation; another species of this same family , the Alvarillo del campo (Ximenea americana), is, on the other hand, remarkable for its savory and refreshing fruit that has the appearance of plums and the taste of bitter almonds.

The family of the Verbenaceae occupies an important place. It is represented by a large quantity of tufted Lippias -- some elegant and others stunted -- that sometimes cover the entire regions and that contribute very much in giving a particular character to this formation. All these plants are aromatic and they have odoriferous flowers. The commonest species is the Poles that possesses an odor of turpentine. Its leaves are used as tea under the name of Argentine Tea. Another species, the Lippia lycioides or Azahar del campo is, because of its elegant form and because of the odor similar to vanilla of its white flowers, the ornament of the plains. The Lippia polystachya or Poleo de Castilla is a very valuable tonic for the people, and the Lippia salsa is to be found among the bushes and thickets that are to be found near the salt marshes.

We shall speak, further on, of the herbaceous Verbenaceae.

We find among the Lippias two pretty species of Buddleya that would make an ornament of our gardens.

The Chañar is one of the constitutive elements of this formation; it belongs to the family of the Papilionaceae and is called Gourliaea decorticans because its bark is renewed each year. The Chañar produces a sweet fruit with a pleasant taste; its wood is hard and quite valuable in spite of its slight height and its tortuous form. It only becomes a large tree in the subtropical regions, but its branches are always irregular.

88 The Brea (Caesalpinia praecox) resembles the Chañar a great deal; this plant acquires its greatest development in the western part of this formation, at the foot of the Cordilleras, where its height attains nearly that of a tree; its leaves are pinnate and its grayish bark produces a kind of resin quite much sought after.

The Caesalpinia or Poincinia Gilliesii is one of the commonest trees of the country. It is rather short and produces beautiful flowers whose long stamens have given them the

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name of Disciplina de Monja (Discipline of the Nuns.) We also term them poison for the eyes and for the dogs because of the yellowish poison pollen that covers these stamines. This surb is to be found in the subtropical formation and in that of the Chaco.

We also find some leafless Cassias, that give an individual aspect to the landscape, such as the Cassius aphylla and crassiramea, that recall the heaths of the sandy soils of Germany.

Two Jarillas of different family (Tarrea divaricata and Zuccagnia punctata) form large bushes either isolated or mixed with other vegetations; they are shrubs that attain the height of man; they have a lank form abd a bright green foliage.

The quantity of resin that they contain and that makes them viscous, ordinarily causes them to be designated by the same name although they belong to different families. Their wood, even while it is green, burns with a bright flame. The first species extends throughout this formation; the second is to be found especially in the western regions. The thickets thus formed are called Jarillares and have given their name to many estancias (estates).

Another plant peculiar to this formation is the Porliera hygrometrica known on the side of Cordoba by the name of Guayacan, and farther north(where it attains a much greater height) by that of Cucharera. This last designation is due to the fact that the hard and resistent wood is used for all kinds of domestic purposes, notably for the making of spoons (in Spanish, Cuchara).

The family of the Hypohilleae to which belong the Larrea and the Guaycan furnishes, in addition, several very common characteristic plants of which we shall cite only one, the Retama (Bulnesia Retama),plant peculiar to the desert of the western part of this formation. Its thin branches and bent branches destitute of leaves for the greatest part of the year, make it resemble the Casuarines of New Holland. Its fruit is dark, dry and divided into three compartments. This tree attains a height of from 20 to 25 ft. -- the diameter of the trunk is about one foot and its wood can be used for a great many purposes.

Another plant destitute of leaves and very characteristicof this formation is the Oxycladus aphyllus whose branches secrete wax?(cire). The Patagonians extract their wax from a similar plant, the same perhaps, and the western part of the system of the Monte is characterized by a large number of other leafless plants whose enumeration would lead us too far.

89 We shall mention, as belonging to the family of the Rhamneae, two very widely distributed shrubs of a particular habit: the first, the Piquillin (Condalia microphylla), the principal element of this formation, produces some fruit sought by the children of the gaucho who eat it off the tree or make it into a kind of candy, the second, the Colletia spinosa, leafless shrub provided with formidable spines. Its wood of very great durability receives several uses.

It is odd to note that this species is to be found especially in the formation of the Monte on the slightly elevated mountains and on the hills while, in the Mesopatamian formation, it belongs to the flora of the watersides.

The Atamisqui (Atamisquea emarginata) is quite a tall very scattered shrub, whose leaves, flowers and fruits, of a fetid odor, are useless.

The Solanaceae are very important in this formation; the commonest shrubs to this

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family belong and with their magnificent flowers they are the principal ornamental plant of these fields. Some species are to be found in the subtropical formation, but they attain a large size there and deserve the name of tree.

Together with the Compositae and Amaranthaceae they form the richest family in species and colors. Those of the genus Lycium are found in a large quantity in the bushwoods and hedges. We shall name principally: the Lycium cestroides, tufted shrub of the height of a man with tubiform and odoriferous flowers that attract a large number of humming-birds,; the Lycium ciliatum whose flexible branches seek the support of the other plants and that wefind especially in the hedges. The other species of Lycium prefer a salted soil.

The Cestrum patens and the Solanum sordidum are small thornless shrubs, very common in the glades of the bushwoods.

The Salpichroa rhomboidiea, weak shrub with branches covered with twigs, creeps on the ground when it cannot attach itself to hedges or bushes; its fruit of the size of grapes of which they remind us as to taste, are pleasant, and have given the plant the name of Uva del campo(field grapes).

A wild Capsicum, Agi (Capsicum microcarpum), has some small, red fruit that are very much sought after because of their strong aromatic odor. Moreover, we shall mention of the very numerous species of the family of Synantherea very largely represented by the quantity of individuals, but forming only very rarely thickets. We shall find, further along, several Compositae having the size of large shrubs and even of trees, but here this family only furnishes stunted shrubs, some underwoods and some herbs.

We must mention some species of Baccharis, especially the Baccharis lanceolata that resembles the willow and is found, like it, on the banks of the rivers. Frequently this species is accompanied by the Vernonia salicifolia, whose flowers are very beautiful.
90 The Proustia pungens belongs also to the flora of the rivers; it is rather a tall shrub its leaves are thick and they have some spines. The leafless species of Baccharis are common and very odd; their large stems are membraneous and do not usually reach more than a meter in height.

Some Compositae are to be found especially on the mountains and form compact bushwoods; for example, the Romerillo (Heterothamnus brunioides) is a slightly elevated shrub with leaves shaped like a needle and yellow flowers used in dyeing; the Flourensia campestris with large shiny leaves and beautiful yellow flowers.

The Jussiaea longifolia has a great resemblance to the Baccharis lanceolata;both resemble the willow and we are greatly astonished, in autumn at the time of efflorescence, to note a great difference between their flowers.

The Euphorbiaceae are represented in this formation by a small number of plants in thickets among which we shall cite the rare species of Jatropha and of Manihot whose leaves are maniform(?), large and glossy, and the fruit is of the size of an apple. These plants prefer the rocky dry slopes.

Several species of Croton and of Acalypha grow in bushes that do not attain the height of a man; the strongly purgative property of their berries (graines?) is known; it is met again, but in one degree less at le Ricin, that we find in this formation, either isolated or in groups but always near the streams.

Some Cactaceae of the greatest scientific importance are very scattered here; their form is singular, some of which are real giants; the largest are to be found in the western part and belong to the genus Cereus; they sometimes reach a height of from 30 to 40 ft; there wood serves several purposes and even furnishes the timber work in the mines;

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some species are very ramous and others,notably the smaller ones, have canaliculate trunks.

The Opuntiaceae are also quite common and of different heights; we find some from 20 to 35 ft. in height that are covered with branches; others, species, are very slightly elevated and bear formidable spines; one of them produces Tunas or figs of Barbary, also called Indian figs; still others are covered with cochineal whose intelligent exploitation might become an industry of great importance to the country. But at the present, the gathered cochineal is employed in the place of the dye of several woods serving in the manufacture of diverse special textile fabrics.

The flowers of the Cactaceae are generally white; those of the Opuntiaceae are orange-yellow; those of the Tunas are ordinarily red; the latter and the Mamillaricae are present in this formation as exceptions and are not in sufficient number to contribute a particular aspect to the region.

Some families of less importance are equally represented in these regions; for
91 example, the Mistol (Zizyphus Mistol), magnificent tree whose fruit, the size of a ball, are edible. We find it chiefly in the northern part of this formation.

The Coco (Xanthoxylon Coco) is a tree of average size; it distributew a strong aromatic odor; its bark is covered with spines of a special kind. The willow of Humboldt, already described elsewhere, borders the banks of the streams. The meridional elder-tree (Sambucus australis), very similar to that of Europe, is especially used for fences. The Berberis ruscifolia is a small shrub with yellow flowers whose brown berries are used in the making of ink while its roots produce a yellow dye. The Nesaea salicifolia, an elegant shrub with quite tall stem and spineless, produces beautiful yellow flowers. In the mountainous region we find the Ruprechtia corylifolia and two Bangainvillae; the first, a very tall shrub, the second a small tree with sharp spines.

Then we cite the Queñoa (Polylepis racemosa) that according to Professor Hieronymus, belongs to the northern mountains of this region although it is seen there rather rarely; a Rosaceae, Kageneckia angustifolia, small tree with stellate fruit.

The Myrtaceae that, in the following formation, become veritable trees, are represented here by a small tree producing tea of excellent taste, Psidium Thea. In some places we find the Justicia campestris and the Justicia xylasteoides; the first forms thickets that are decorated with pretty flowers and the second grows scattered.

The Ephedra triandra attracts the attention of travelers with its singular form, its red fruit and its leafless branches; it is the sole representative of the family of trees with acicular leaves (Gymospermes); sometimes climbing, sometimes isolated, it rarely forms a trunk one foot in diameter.

We must mention among the shrubs the Jumes that cover for the most part the salt marshes, the Gratainiae and the Chenapodeae, and, especially, two classes of Spirotachys, the Suaeda divaricata and the Atriplex Pamparum, both very tufted and sometimes they rise to two meters in height. There ashes are used in the making of soap and their abundance offer occasion for an industrial exploitation.

Finally, we must not forget the palm trees that cover a part of the province of Cordoba. We shall provisionally designate it by the name of Copernicia campestris,

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Burm., but its real place in the system has not yet been determined in a positive manner; it has been cursorily classified because its designation does not correspond to its nature; it does not belong to the fields but to the mountains where it forms large forests whereas, in the plains, it is only present as isolated trees and suffrutex. Its height is around 30 ft. The leaves serve as fans and its very sweet fruit forms a food for man and animals. They make preserves out of it and it would be easy to make an alcoholic liquor out of it. The wood of the palm-tree is used as fences and sometimes as building material in the rustic edifices.

92 The limited space at our disposal prevents us from describing, as minutely as we have done with the sylvestral plants, the herbs scattered among the trees and shrubs. We shall restrict ourselves to the citing of the commonest ones and to the giving of a general sketch of the vegetation of these regions.

The climbing plants are very numerous; they contribute mightily in the covering of the meagre thickets nearly wholly destitute of leaves.

The Enredaderas (climbers) belong to several families. The Compositae furnished us the Micanias with large leaves and with rich flowers that grow along the streams.

The Bignoniaceae offer us several species; the most widely distributed is the Anemopaegma clematoedeum whose large beautiful flowers and the fruit of a peculiar shape attract the attention. Moreover, we cite the cabello del angel (Clematis Hilarii) whose fruit serve as vesicatories, a quantity of Asclepiadeae whose stems are lactiferous; for example, the very common and characteristic Tasi (Morrenia brachystephana). Its grains are surrounded with a white silken down that is used as match-wood.

The granadillas with their leaves and their golden yellow fruit adorn the orders of the streams; many Convulvulaceae creep along the ground or climb the length of the hedges; some of them have very bright flowers; for example, the Ipomoea purpurea, the Ipomoea acuminata, the Convulvulus Montevidensis and the Brewerïa sericea. We mention, apart, the Mechoacan (Ipomoea megapotanica) whose large root is an efficacious purgative in use in the popular medicine; it is the ornament of the sandy plains and deserts. We find a species of Manettia, very similar to a Convulvulaceae.

A large part of the climbing plants of this formation belongs to the family of the Curcurbitaceae; for example, the Adobria viridiflora, the Sicyos malvifolius that encompass the thickets while the colocynth calabash creeps upon the sandy banks. The Boussingaultia baseloides covers the thickets with its glossy and carneous leaves and embellishes them with white elegant flowers. Transplanted in the gardens, it climbs along the outside of the galleries and forms there a curtain of verdure. The cuscuta serves as a transition between the climbing plants and the parasites.

We must not only understand by parasite a plant that attaches itself to another one; in botany, we distinguish two classes, the real parasites that take their food from another plant and the epiphytes that only are attached to them and that are sustained on the products of decomposition of the bark and of the precipitations of the atmosphre. These two classes are represented in this formation by two characteristic species; the real parasites are especially the Lorantaceae among which the commonest, the Loranthus cuneifolius, is distinguished for its magnificent red flowers. The epiphytes belong chiefly to the family of the Tillandsiae, some of which are to be seen in the houses
93 where they hang them on the walls, and, in this manner, they present some magnificent flowers whose perfume spreads afar.

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We must still be more brief in speaking of the Herbs and Gramineae that cover the ground.

First place is occupied here, as in the Pampa, by the Gramineae that form the basis of cattle breeding, principal source of the national wealth. The majority are hardy, more or less thick, but forming always isolated bunches around shrubs and trees or in the glades oftentimes quite vast that are to be found in the forests. The commonest species that characterize this formation are the Stipa tenuissima and the Melica papilionacea and macra. The less common tender herbs are to be found along the streams and in the shallow waters.

Other species are to be found on the mountains whose plateaus are often covered with compact and plentiful bunches, sometimes rather compressed forming a carpet of verdure.

This vegetation has not been sufficiently studied for us to give its nomenclature. A large number of species, however, have been described; we shall cite the Arundo occidentalis, plantof the mountains to which, in some descriptions of expeditions, there have been erroneously given the name Gynerium argenteum. It does not go beyond the valleys nearby the mountains where it has been carried away by the waters. If the Pampa really possesses a Gynerium, a fact that has not been proved, it certainly belongs to another species.

On the land invaded by the underwood, the Gramineae are less scattered; the other families replace them without, however, thus completely covering the ground; we find quite a bit of barren ground. The Compositae take first place; they are represented by a large number of species of slightly varied forms. We shall not make a detailed enumeration, limiting ourselves to the citing of some species that have a general use and consequently are important; for example, the Flaveria contrayerva that is used for a yellow dye; the mata pulga, (Schkuria abrotanoides) that they use as an insecticide; the Xanthium spinosum, the Zinnia pauciflora, the Parthenium Hysterophorus are popular medicines; the last, known by the name of Alta Misa, invades the lands and becomes noxious. Several species of Senecio, Eupatorium and Conoclinium are widely distributed and remarkable for the beauty of their flowers. The two Xantheae sometimes cover a large expanse of ground.

Then come the Amaranthaceae rich in species and in individuals that can be considered as characteristic plants of the Argentine flora. Many species are the embellishment of the fields; for example, the Alternanthera rosea and the Alternanthera ligulata whose vivid roseous flowers ornament the country and extend nearly to the horizon; some are recommended, in addition, because of their medicinal properties.

The Solanaceae are also extensively represented; several species are utilized,
94 as the Uva del Campo(Salpichroa rhomboidea) whose fruit, similar to the grape and having approximately the same taste is present in isolated forms and not in bunches; the Nierembergia hippomanica, pretty plant that is poisonous to animals and that bears the name of Chuchu given commonly to the intermittent fevers; some Petunias and some species of tobacco ornament the edges of the stream and the ditches.

The Agi, or Spanish pimiento, the condiment preferred by the Argentinians who cultivate several varieties of it, is represented by an indigenous species, the Capsicum microcarpum, very much sought after by the inhabitants of the Cordilleras.

Several species of Solaneae compose the verdure of this formation; for example, the spiny Solana with beautiful flowers and with spotted yellow fruit.

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Some suffruteces of the family of the Verbenaceae that we have already met in the Pampa are found here in abundance. The scarlet vervain is very common as well as other less brilliant species. The Priva laevis is commonly found around the homes.

We also find a large quantity of creeping or erect Malvaceae with white, yellow and red flowers.

TheRubiaceae, notably the Richardsonia scabra and the Mitrocarpum cuspidatum attract attention. Some Galliеae have roots used in dyes.

The Asperifoliеae present some species of Heliotropes that form the principal vegetation of the salt marshes and display their beutiful flowers by detaching themselves on almost a bare ground.

We wish to cite, moreover, some plants of different families that are very abundant in this formation; for example, the Monodora trifida and the Scoparea pinnatifida whose flowers are small and yellow, and several low plants that we could almost call shrubs, as the Nama echioides, the Mentzelia albescens that grows on the banks of the streams, and some Aenotheraeae, the Jusiaea repens, common in the lagunes, as well as the Hydrocotyle natans and the Hydrocotyle Bonariensis, two species of Martyneae whose fruit is very singular.

In addition to the mentioned species and some Eryngium, particularly the magnificent agavifolium the Umbelliferae are almost all of the imported species, as the common hemlock and the Ammi visnaga that have multiplied at an excessive rate.

Some species of Portulac merit special mention; for example, the Portulac grandiflora whose purple flowers cover the country and others that furnish an excellent salad. Other species, such as the Carne gorda (Talinum patens), are used as legumes in the puchero(dish of boiled meat and vegetables). The Oxalis comersonii extends, through preference, into the cultivated fields where it is remarkable because of its bunches. Some Lythraceae prefer the dry soils.

The Monocotyledons, if we expect the Gramineae, are represented only by a few species, whereas we can see, at the approach of spring, in other dry climates a
95 large quantity of Liliaceae, Amaryllidaceae, Iridaceae, etc., that only present here rare species whose small white or yellow flowers are ephemeral. Besides some genera of the epiphytic family of the Bromeliaceae, we find some others that form, on the dried up soils, some tall spiny thickets, whereas in the stony valleys other species cover the crevices of the large rocks with a greenish gray vegetation embellished with bright flowers. The Cyperaceae are also relatively rare in these regions destitute of water. Two important Monocotyledoneae deserve only to be mentioned because they contribute to the characterizations of agricultural establishments, these are the Agaves and a species of Arundo(probably Donax).

We might omit the family of,Cryptogams. We shall only cite the following species: the very common Selaginella rupestris that after each rain clothes the bare parts of the stony soil with a bright green turf; the Azolla Magellanica that covers the stagnant waters with its brown stems; the Equisetum giganteum sometimes forming dense thickets on the mountain slopes; then some species of Carex covering, with the Bromeliaceae, the damp lands and the shady heights.

Let us cast a glance over the whole of the plants of this formation. We find there several characteristic combinations or subformations that we can divide into two distinct parts; the western system and the eastern system with perhaps the Sierra

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de Ancaste considered the line of demarcation. The valleys between it and the Sierra de Ambato offer still several plants of western part and constitution a land of transition; beyond the end of the Sierra de Ancaste, we find the Bulnesia Retama that extends nearly to the salt marsh.

The occidental part situated between the Cordilleras and their counter-forts, to the north and to the south, reaches, if we believe the several accounts that we possess, the Patagonian formation from which we cannot distinguish it.

Its elements are common to the eastern part that, on the contrary, possesses some species that are peculiar to itself. We can not cite one plant, one shrub or one tree peculiar to the first, whereas in the second we shall mention, for example, the Bulnesia Retama, the pretty Visco(Acaomia Visco), the Tricomaria Usillo, the giant of the Cactaceae, the Cesalpinia exilifolia, an asphyllous Mimoseae (Gilliesii) the Oxycaludusaphyllum that belongs, however, we believe, to the formation of the Puna and some other species not yet determined, as the Tulisquin. The lack of knowledge does not allow to extend this comparison to the herbs. A study of this kind cannot postpone further making known the difference that distinguish these two systems. The collection of M.Schickendantz contains a quantity of species that have not yet been observed in the east.

96 The western port presents the appearance of a veritable desert. The Cordillera as stop the fogs of the Pacific Ocean and all the moisture that might reach it in crossing the vast plain of the east, is intercepted by other mountains considered ramifications of the Andes. A totally dry climate is the result, a climate in which not even fleas can exist. The rains are extremely rare there and agriculture is only possible in the plains where the high mountains give rise to a river that makes the valleys tillable by forming a silty soil where there can be built agricultural establishments, very useful to the traveler who comes across the desert space that separates them. The waters of a river suffice, however, to irrigate several fields of trefoil and several quintas (gardens) in the middle of which there are to be found sometimes magnificnet vineyards; but the water is soon absorbed, the rivers only offer a dried river bed, serving, in the rainy season, as a momentary dam.

While the salt soil without vegetation forms an argillous terrain probably clothed with thickets of Jumes - we do not know any positive observation on this point - the region is covered with forests and bushes.

The forests are made up of algarrobos in the middle of which we find here and there some Retamas, being present in the form of trees and some magnificent shrubs of Brea rise sometimes to a great height with which are to be added the already cit underwoods. The algarrobos grow preferably on a sandy soil and sometimes even in the middle of the medanos (dunes) as at Pilcino near Fuerte de Angalgala; the underwoods establish themselves on a still more movable and sterile soil; they choose the large expanses of sands.

This wooded desert is formed of the above-mentioned trees, undergoing different modifications and continually changing. The predominating species sometimes the Mimoseae, sometimes the very common Jarillas (Larrea); sometimes even, these two families are to be found equally represented.

The altitude also has its influence, that we would not know how to indicate in a satisfactory manner with the incomplete data that we possess.

The Cardones (thistles) of the genus Cereus and the Jarilla pispita seem to belong rather to the large valleys of the Cordilleras than to the plains that lie at their foot. Especially the columelliform Cactus are only to be found at a

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considerable altitude.

The same brushwoods present only a poor vegetation; we hardly see any herbs or graminaceae in the shade of the thickets; likewise, the shepherd is unfortunate in these regions. In some places, they have dug wells and established some puestos (small farms) whose produce is always small and uncertain because of the irregularity of the rains. We assert that in the places where we have not found any vegetation, the traveler, some years ago, traveled up to his knees through odoriferous Jarillas and abundant grasses.

We have only found along our way after an abundant rain some plants issuing from the ground that, for the most part, were only some Euphorbiaceae, Amaranthaceae, Oxybaphus and some other plants peculiar to every desert and not possessing
97 any nutritive source. The principal foods of these regions are the maize and the fruit of the algarrobos that serve man and domestic animals in the fruitfulyears, at least; for the harvest is uncertain there and varies from one year to another. The harvest of maize and of the algarrobo alternate, and if, unfortunately, these two products fail, the traveller only finds with difficulty, even for a night, the necessary food for his horse or his mule.

The Cordilleras, although they do not always provide pastures, are the refuge of the animals in the year of dearth; we find, compressed between the formations of the Monte and of the Puna, a magnificent Alpine vegetation rich in Graminaeae that rests the eyes of the traveler after traversing the desert.

These details concern the northern regions of this part that we know by having explored them; we haven't any exact knowledge on the regions of the south; from what we know about them we can deduct that they are also wholly forbidding, although their demarcation is less easy to determine.

Although these regions offer little of attraction, we cannot assert that they may not attain a very great development. We believe that the importation of animals more accustomed to the desert than horses and cows - camels, for example- would render these wooded deserts much more useful than what they are today; they might equally improve the oases through a more rational distribution of the water.

A great future is in store for viticulture in the localities where irrigation is systematic and rational, the raising of the vine is remunerative and they make from it some wines that can compete with the best wines produced in the world.

We find successively in the eastern part of the forests some Quebrachos and some Algarrobos, some coppices and some thickets.

The Quebracho blanco (Aspidosperma) is one of the commonest trees of this formation. We find it almost everywhere in the form of a tree or of a shrub; but it only forms veritable forests toward the eastern limit on the mountainous plains that extend to the foot of the Sierra de Ancasto. The traveler traverses these uniform forests for some days, and when he finds himself on the top of a hill, the eyes only perceive an undulating and endless plain of deep-green foliage. The Quebracho isn't the exclusive tree of these forests, but is the tallest and dominates the landscape.

These trees, with a good deal of space intervening among them, are bound together by a thick coppice composed of different shrubs and plants. We find there again a large part of the trees and sufrutecesmentioned above, as the Brea, the Chañar, the Tala, different species of Acacias and of Mimoseae, the Jarilla, some

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Bulnereae and several others intercalated with columelliform Cacti and Opuntiaceae. The ground is covered with herbs and wretched Gramineae that, however, are rather tall in the rainy season and serve as pasturage for the animals. They only cut part of these forests for the construction of cabans, for firewood, and for the formation of
98 hedges; the goats find a meager food in the bark of certain Miniosese.

In the drier places, in the glades, there are to be found some scattered homes; here the algarrobos are scattered and no brushwood fills the interices; this absence of intermediary vegetation, saving the planter all the work of clearing, certainly has contributed to the establishment of these homes on land bare as a threshing-floor and offering verdure only in the shade of the trees.

However, such is not the character, always, of the algarrobo forests; elsewhere these trees are still more scattered and the ground is covered by a turf of thick Gramineae and by some shrubs that, at a distance, form some dense thickets that the algarrobo does not dominate as does the Quebracho; likewise, an algarrobo forest appears more uniform than that of the Quebracho. This character presents itself especially in the east toward the limit of the Pampa.

We do not find a tall tree among the brushwoods, compact and impenetrable masses formed of shrubs and underwoods, the chief ones of which are the Talas and the Acacias as well as by other smaller bushes and some herbs; the ground is covered with Gramineae. This coppice offers more of a variety than the forest. A large number of shrubs and climbing plants cited further back for which air and light are indispensable, are found only in the glades or in the middle of slightly dense brushwoods. These circumstances depend on the level of the ground that in the plains produces thicker and more varied thickets, whereas on the plateaus the vegetation is less rich and lankier.

Frequently these shrubs are widely separated and then have different heights, whilst the terrain is covered with a turf or else they are closer together and do not surpass the height of a man. Sometimes these elements are intermingled, sometimes one of them predominates, sometimes even we find only a single species that gives the land a peculiar character or a name. We shall mention, for example, the Poleo, the Jarilla, the Prosopis humilis, the Baccharis lanceolata, the latter in the brushwoods along the rivers, etc.

Likewise, we find again, in this part of the formation of the Monte, some elements that, through physical or chemical influences, differ more or less(as to their nature) from the preceding ones. We must, however, consider them as forming part of this system in which they are found, and also present the tie with other similar elements; such is the system of the Sierrado Cordoba and that of the salt marshes.

The Sierras of Cordoba and of San Luis form a chain of parallel and isolated mountains, from north to south, that attain 6,000 and even 7,000 feet. We can observe on the slopes some phytogeographic regions, corresponding to the altitudes that we indicate (above sea level), to the situation, to the climate and especially to the escarpment or to the incline of their declivities. The steep slopes are covered over
99 with forests, being taller in the south than in the north; the inclined declivities and the almost horizontal plateaus are usually clothed with turf and form plains; likewise they give them the name of Pampa.

The forest is constituted of elements belonging to the formation of the Monte, the plateau presents several characteristic vegetations that are lacking in the Pampa. We shall cite among the most common, the Molle a beber and the Cona; the latter, though the forest, has disappeared, still advances far and wide on the slopes, in

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groups at first, then in isolated trees.

There usually follows the forest a mass of bushes, composed to a great extent of Synantheraeae, as the Heterothamnus brunioides. M. Hieronymus has observed, in addition, in some places on these mountains, the Polylepis racemosa, called Tabaquillo there. We then find the Alpine prairies, more or less abundant according to the altitude and the constitution of the soil; on the plateau they extend up to the forests and intermingle with them; sometimes some thickets replace the trees and form a middle region among others the Flourensia campestris and the Manzanilla (Ruprechtia).

The salt marsh presents a different character according to the amount of salt contained in the soil; the saltiest places that are only deposits of common salt wholly lack vegetation and are entirely barren. Nearby there are to be seen some scattered salt plants, the Grahameae, the Chenopodae, et. In certain places they appear in thicker bunches and taller. On the edge of the salt marshes, the number of species is increased with plants belonging to the vegetation of the Monte, as well as several Gramineae. The predominance of some species characterizes certain terrains; for example, the Chañar and some varieties of Prosopis with tortus fruit. The saline marshes are surrounded, for several months of the year, beautiful prairies very suitable for rich pasture of animals. The central part is only inhabited by the guanaco, the tiger and the ostrich.

If we are asked what future there is for this formation, we shall answer that the plain does not appear so suitable to agriculture as other districts. The soil is fertile and virginal, but the irregularity of the rains makes us believe that cattle raising will always be the basis of an agricultural exploitation and will give the inhabitant a medium of exchange with other departments or the stranger. We cannot doubt but that this exploitation may be called upon for great ameliorations and to produce some results superior to these that are being obtained at the present time.

From the botanical point of view, we shall especially call attention to the improvement of the prairies through the propagation of better species of Gramineae. Some experiments rather quickly would show what the species are that especially merit being recommended for this purpose.

Wherever irrigation is possible and wherever the mountains feed the rivers or the springs, the soil produces extraordinary harvests. By means of a better distribution of water with the construction of canals like the ones that the Jesuits and some landowners had built in times past, they might change a large number of square leagues, at present sterile and desert, into lucern or wheat fields; there is only lacking for this purpose good workers and the indispensable capitals. The valleys present all the desirable conditions for the growing of fruit trees, tobacco, medicinal plants, and some woods for dyes, whereas the Alpine prairies offer to cattle raising a sufficient remuneration for the present and a fortune in the future.

100 . . . . . Subtropical Formation

This formation that we may call the garden of the Argentine Republic offers us landscapes of an extreme fertility and magnificence. The traveler is so much the more transported by its appearance who can only reach it by traversing desert regions and at the cost of much fatigue and many privations.

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This region is bounded by the high mountains of the Cordilleras and their counterparts on which depends the chain of Aconquija. These mountains arrest the damp winds coming from the Atlantic Ocean and rob them of their waters. Thus it is that the slopes of the mountains furnish with water and with fog the plains lying at their foot and give cause for this luxuriant vegetation that we are going to try to describe.

This formation can only exist in the regions where the mountains are rather high enough to condense the atmospheric humidity in arresting the winds; consequently if the mountains are not high enough that we estimate at 10 or 12,000 ft., or if other higher ones intercept the passage of great atmospheric currents, passage of great atmospheric currents, the subtropical formation cannot be developed or it is found limited as is easy to be seen in the valley irrigated by Talas River, where the Aconquija chain rises that we ought to call Sierra de Candelaria. On the floor of this valley, we find the formation of the Monte that extends nearly to the Passje River, whereas the eastern slope of the Sierra de Candelaria is embellished with a magnificent tropical forest. So, the large valley where the San Francisco River flows, among the principal peaks of the Cordilleras and the high isolated mountains designated on the map by the name of Sierra de Lumbrera and Sierra del Maiz gordo, is covered with a formation similar to that of the Chaco with its thickets of Bougainvilleae, of Pereskeae, etc. These two examples will suffice to prove what we assert.

There is no need of long sentences toexplain why the subtropical formation is
101 only found on the eastern slopes of the mountains, while the western declivities are arid and without vegetation. The moist winds never reach them, for the mists of the east are absorbed by the eastern slopes and these of the Pacific Ocean are arrested by the high wall of the Cordilleras. Consequently, the low terrains that are found between the principal chains and their counterforts present us with a formation that we know already, as being the western zone of the desert of the formation of the Monte; but, on the contrary, wherever we find a plateau on the mountains, we find there the Puna that we shall describe further along.

In the north, the subtropical formation stops with the Bolivian tropical forests that cover the eastern slope of the Cordilleras and extend nearly to the tropical ones themselves (we have followed it to 21°30' lat.). These forests, however, have not here the characters that we attribute to the tropical ones; they are composed of the same elements that we have observed on the mountains and the slopes of the province of Tucuman, but with the addition of some new species. In what manner is effected the veritable transformation in tropical forests thatbegin at about 19° lat., this is what we do not know yet.

We have believed it necessary to divide the formation that occupies us into sub-formations: this method has seemed preferable to us over that that consists in beginning with an enumeration of its principal elements; we shall place this de-description at the end. As this formation shows on the mountain slopes, its divisions are much better marked and its elements more distinct. The same as in the case of the description of the formation of the Monte, the limits that are assigned to us, have obliged us (to give) a superficial summary, the same and with greater reason, the great wealth of the subtropical formation forces us to an extreme conciseness.

The region can be divided as follows:

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The central part formed by the subtropical forest called on our second map Montes subtropicco occupied the lower part of the slopes and reaches, with some exceptions that we shall mention later, nearly the altitude from 3,000 to 3,500 feet.

Then follows the region designated on our second map by the name of Parque. This is a continuation of the plains with their thick and not very tall grass. Here are found the magnificent prairies and brushwoods offering in part the same elements as the forests of the slopes and also some trees of the same species. Sometimes, the different elements are mixed and the Compositae and Mimoseae alternately dominate.

The zone that forms the following part is more arid; it extends in the directio of the plain; the tree that predominates is the Cebil, from which comes the name of zone of the Cebil. It displays other Gramineae and more tufted herbs that we find hardly or not at all in the Parque. The forest that we find there most frequently is the Cebil, sometimes replaced with a small palm grove. We also find large expanses without a single tree.

102 A third zone that, in our opinion, appears also in the subtropical formation has been called after the tree that characterizes it, "zoneof the Quebracho Colorado." It constitutes a ventable zone of transition into which penetrates quite far the elements of the formation of the Monte, especially the Quebracho blanco, that does not exist in the subtropical formation, properly speaking, and that is found often near the Quebracho colorado. The only reason that makes us classify this zone in the formation that occupies us is that the tree that characterizes it is even found in the tropical forests whereas the formation of the Monte is destitute of it (abstraction made from the exception of which we are about to speak). Besides, this magnificent tree, without spines and having a very great height, does not present the general character of the formation of the Monte.

We pass on from the subtropical forests to the summits of the mountains and study twoother wooded zones that extend beyond the forests and that, according to the pr dominance of the one of their two elements, may be designated by the names of regions of the Aliso or of the Queños.

Above these zones or besides them (as we shall see further on) extends the region of the Alpine prairies, pastos alpinos, rich in Gramineae and studded with flowers whose magnificent verdure rests the eyes.

In the low part we find often some brushwoods, more tufted at the foot of the mountains and covering the declivities to a high altitude. The beauty and fertility of the Alpine prairies naturally diminishes directly as the altitude renders the climate less favorable to vegetation; it is the same on the steep and rocky slopes; other species make room for elements of the lower regions which fact,we believe, does not authorize us to make a new division of this formation. We shall assign to it, as its last limits, the summits of the highest mountains in the south, and, in the north, the region of the Puna.

Now we shall examine the elements that constitute this formation. The subtropical forests are only found, as we have already said, on the eastern slopes of the mountains and, sometimes, at their foot. It is rather difficult to indicate their limit on the declivities; it depends not only on their altitude above sea level but also on quite numerous other circumstances, the chief ones of which are the situation and the degree of inclination of the slopes. The general direction of the mountains of the Argentine Republic being that of north to south, the winds are forced to follow this same direction; they are then generally from north to south. The winds that, coming from other directions, find themselves

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stopped by the mountains, skirt, for long distances, the obstacle that they have met. There are only rare local exceptions to this rule.

It is agreed that in these regions the winds from the north bring the moisture and the heat, whereas those of the south are cold and, consequently, condense the
103 mists brought down by the north winds. According to our observations, this is a rule without exception that the rain only falls with the south wind.

We shall then easily understand why the southern slopes of the ramifications of the principal mountains are damper than the slopes of the north and, consequently, why the timbering mounts to a higher altitude on the former than on the latter. It is difficult to express this difference numerically, especially if we consider the accessory circumstances; thus we shall merely express the general opinion that adopts the altitude of 800 ft.

The second circumstance that influences the altitude of the forests is the escarpment of the slopes. Wherever the inclinations is less steep, the forest is replaced with brushwoods and the plateaus are not concealed by a single tree: this is a general law for all these mountains. It is true, however, that the situation of the slopes makes this law vary sometimes: we often find, in fact, some plateaus facing south destitute of trees, while a large number of steep slopes running north are covered with forests. The Alpine prairies oftentimes offer woods beyond the limit of the forests. Consequently, we only present a general indication in saying that the limit of the forests is found around 3,500 ft., this altitude being subject to variations.

The subtropical forests contain a large quantity of majestic and magnificent trees, giving cool shade, not dense enough, however, to prevent a less tall vegetation from forming at their foot.

The soil is completely covered with brushwoods. In the more shady places are seen the ferns, while among the thickets the spaces are filled with herbs and Gramineae. The trunk of the trees is generally covered with epiphytes (the real parasites are rare) belonging to several families, with Orchideae, with Bromeliaceae, with Cactaceae, with Piperaceae, with mosses and with lichens; we often find, in the decayed parts of the trees or in the soil and the dust that accumulate little by little at the base of the branches, certain plants that ordinarily are only found on the ground. There are then two superimposed vegetations.

Some gigantic lianas that encompass the trees like twisted cables make their stems come down almost to the earth and, in spring, they tapestry the forest with flowers of an extreme magnificence.

A traveller who, after having traversed the tropical forests of Brazil, visited those of Tucuman, has declared that the latter can rival in beauty the former; however, he only partially, knew the forests of Tucuman that, from the point of view of vegetal wealth, of height of trees and of the large quantity of species, are very inferior to the northern forests, notably to those of Oran.

However, we are taking as a basis the flora of Tucuman because the rich collections gathered in the north are not yet studied.

We shall mention among the commonest and most bautiful trees of the subtropical forests, the Tipa(Machaerium fertile), a very tall tree of beautiful form and whose foliage gives a great deal of shade. This tree is embellished, in spring, with numerous papilionaceous flowers that later become penniform fruits. In the narrow crevices of the monteros, it reaches 150 ft.; the trunk is thin and straight, and the branches only appear at a height of 60 to 70 ft. In the less dense forests near

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the streams, it presents some rather large branches much closer to the ground and its pretty pinnate leaves cover with shade these cool banks.

The Laurel (Nectandra porphyria) is almost as common. It belongs to the family of the Laurineae and thus bears the name of the laurel that it resembles in leaves and flowers. It is a magnificent tree but its rather thin foliage does not give as thick a shade. We usually find it isolated, sometimes, however, it forms forest, as near Lules for example, or in the forest of the Alto de las Salinas. We distinguish several species; one of which, still not completely studied, has some leaves that contain a kind of camphor.

A third element of the subtropical forests is the Nogal (Juglans nigra, L.) var. (Juglans boliviana, D.C.). It resembles the European walnut-tree and bears some fruit like it that we eat, but whose shells are harder.

The two Ramos, Ramo blanco and Ramo colorado, trees of the family of the Sapindaceae, present pretty nearly the same form and the same character; their scientific names are Cupiania Uruguensis and Cupania vernalis; their flowers and fruits, however, do not resemble those of the walnut-tree.

The cedar (Cedrela brailiensis var. australis) offers the same characters; they are already exporting its wood easy to work and used a great deal in these districts; unfortunately, it is littel developed for want of care; it is in vain that we seek it along the highways and the old tall cedars are very rare.

It is desirable that the government, if it is solicitous of the future of the country, enact a law and create a school of forestry, for the wealth of our forests, however great that it may be, is not inexhaustible.

We also find numerous species of the family of the Acaciaq such as the Cebil blanco, the Cebil colorado, and the Horco cebil and several other genera.

These species are different from the Cebil colorado that we already know as characterizing another zone that we find in the subtropical forests, but they are still not very well known. The husks that contain their fruits sometimes cover the ground, and their thick whitish trunk makes them quite easily recognizable.

Also we find two magnificent species of Myrtaceae, the Mato and the Arragan (Eugenia mato and Eugenia umiflora). They are large and beautiful trees with myrtiform leaves; their fruit that are the sizeof a cherry are eaten. The Mato grows out of preference in the crevices and on the steep slopes; its form is thin and its green and glossy bark allows it to be distinguished easily. We shall also mention two species of Myrsines: the Myrsine floribunda and the Myrsine marginata--the latter probably is, according to M. Hieronymus, another new species. The first is called Palo de San Antonio and the second, Lanza blanca. The latter whose thin trunk rises well beyond the other trees will serve already as a transition to the tropical forests.

Among the other trees of forests of full grown trees, we shall cite the Palo borracho (Chorisia insignis); it is a Bombaceae whose trunk is inflated and provided with quadrangular mossy spines; the leaves are digitate; the flowers, large and white; the fruit fraught with a kind of white cotton with somewhat coherent threads used only in the making of wicks. The form of this tree is one of the most singular that we may find in the country. One species of Pentapanax, also called Palo de San Antonio, rises majestically in the primitive forests, but attains a shorter height in the opener places. Two species of the family Bignoniaceae (Lapacho), belonging to the genus Tecoma, are also one of the most beautiful ornaments of the northern forests. This tree is, we believe, the most majestic of the vegetal kingdom, when its branches, black and destitute of leaves in winter, are covered, in spring, with millions of large roseus or yellow flowers which the

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leaves follow. Another probably different species is found near Tucuman; it does not reach the same height and prefers the zone of the Parque to the veritable forests.

The northern forests offer, in addition, a considerable number of large trees still but partially studied. We shall only mention the Urunday, the Quina Quina producing an odorous resin and presenting itself almost only exclusively in the outer zone of the subtropical forests; the Cascaron, tall Leguminosae; the Roble that, from its leaves, appears to be also an Leguminosae and whose bark is reddish and glossy; the Mora whose fruit they eat and that have the form of mulberries; the Tatané originating in Paraguay, resembles the cedar; its bark contains a sour milk and its wood is as hard as iron; the Espinillo of the north (different from the Espinillo of the south), magnificent tree of the family of the Leguminosae and easy to distinguish from its congenitors in that it lacks spines; the Palo Mortero, very similar to the Tina and whose wood is very valuable; the Pacay (Inga Uruguensis) whose wood is precious and whose fruit is the choice food of the parrots; the Suiquillo; the Mayana Itara; a second species of Sombre del Toro, etc., that will be classified as soon as their flowers and their fruits will have been studied.

All these trees, as well as the following, that are smaller in size, offer to industry a precious wood easy to work, and up to now only used on the premises. In the other parts of the country, the furniture is usually imported from Europe and from North America. These woods will become a source of wealth when the industry is developed with the increase of population, provided, that in place of destroying the
106 forests, they properly preserve them. Most of these forest offer another interest; they greatly influence the climate and their destruction would transform into a desert a part of the country that may be called the garden of the Republic. Space placed at our disposal in this book obliges us not to enter into a greater development. We refer our readers then for fuller details to the Boletin de la Academia de Ciencias exactas, 4me Livraison.

Among the smaller trees that, with the above-mentioned ones, compose the subtropical forests or replace them in certain places--as on the eastern slopes of the chain designated on our map by the name of Sierra de Candelaria-we shall only mention the already cited Lanza blanca; the Lanza amarilla; a Combretaceae of the genus Terminalia; the Zapallo caspi; a Pisonia with porous wood rich in ashes; the Durazmillo blanco, very common in the northern forests but not yet determined, no more than the the Coronillo with unknown flowers and fruit, but whose bark is protected with formidable spines and leaves similar to those of the Viraru (Ruprechtia excelsa); the Quillay of the north with spiny bark; the Chal-Chal(Schmidelia edulis) whose fruit in the form of berries are edible; the Runa caspi (Achatocarpus nigricans) that is often present in the form of a shrub; the Erythroxylon ovatum known in the north by the name of Coca del Monte; the Randia pubescens, often a shrub and the Rosaceae Kageneckia amygdalifolia (?). Moreover, we find some arborescent Solaneae belonging to the tropical forests as the Jochrona arboreum; the Solanum-pulchrum, the Solanum verbascifolium, etc. Then come the arborescent Urticaceae peculiar to these forests whose leaves are gigantic, the flowers, bright red and the berries, white. It only reaches the height of man as a rule and makes a trip into these forests very difficult; in some places, however, they rise to a height of 25 or 30 ft.

In the south, the species of the genus Croton, only are present in the form of shrubs; in the north, on the contrary, there exists a Croton that reaches the size of an ordinary tree; we find, in addition, in these forests, several species unknown in the south, among others, a Melastomaceae, a Chinchona, with large white flowers and several other magnificent but only partially described trees.

The wild-orange trees constitute the principal element of some forests. They come surely from pips dropped in these places. The molle of Cordoba, Lithraea

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Gilliesii, is only found scattered, as near Cuesta de Juntas. Another tree that--as we have said above--characterizes the mountains of the province of Cordoba and is found here, if the Coco, called in the country Cochuchu, that grows on the edges of the subtropical forests; the broder that limits these forests, almost exclusively composed of this species that some shrubs may join, may be considered as a separate zone.

107 Moreover, we shall mention columelliform Cactaceae 20 ft. high, having only six to eight flutings; it attaches itself especially to rocks mixed with some Bromeliaceae as in the valley of Juntas. Among the low vegetations of the subtropical forests we may distinguish some arborescent species with hard wood and with small and usually resistant leaves, as well as other smaller less tufted species with large broad leaves that are an ornament of these forests.

We shall not say so much about three species of the first group, two species Tala and the Garabato, that because of their formidable spines prohibit one from penetrating into the forest or, at least, render access difficult. The Talas belong, as those of the south, to the genus Celtis of the Ulmaceae and are called Celtis tala and Celtis acumiamata. There come to join these, on the edges of the forests, in some places, the Tala blanca that, because of its general habit and its leaves, resembles the realTalas, but that, in reality, does not belong to the genus Celtis and is the Duranta Lorentzii. The Garabato is a Mimoseae(Acacia Tucumanensis) whose curved spines can only be withdrawn with a great deal of pain when they penetrate the garments. A variety of this species, the Acacia subscandens, offers the same habit as the lianas and entwines the trees. We still find in the north other species of Tala. Among the shrubs of a certain grandeur, we shall cite: the magnificent Piperaceae called Enkea Sieberi, the Piisonia hirtella, whose fruit resemble scratch-wood(graterons), and the Abutilon niveum, reaching 4 m. inheight and ornamented with beautiful white flowers.

The northern forests contain an immense quantity of shrubs that have not yet been studied. We must, however, mention one species that grows principally in the dense shade of these primitive forests and especially in the deep ravines. It is a Gramineae, Chusquea Lorentziana, about 12 to 18 ft. high and that in certain favorable places attains nearly 30 ft. Its massive stem is of great use to the natives who use it for several purposes.

Among the shrubs that form the second groups, we shall mention, as the most common, the Phytolacea Bogotensis, the Celosia major, the Chamissoa celosioides, the Acalifa cordifolia, the Phenax urticifolius, the Boehmeria caudata and some Solaneae. In this respect, the study of the collections of the north will acquaint us a great deal more with the new species.

The creeping plants that are lacking in the forests of Tucuman, offer, in the northern regions, some magnificent forms. The largest species belong to the family of the Bignoniaceae; their trunks often have extraordinary diameter as compared with other species of this family. The common name of all the large creeping plants is Vejuco, whereas the small ones are called by the name of Enredaderas. In the province of Tucuman, we distinguish several species of Sacha huascas. Sacha is an Indian word th at means"wild" hardly an exact designation, and that indicates that a plant has not been imported, but belongs to the indigenous flora. These Huascas are supple like the osier and replace, in the construction of the roofs, the thongs and the pack-threads.

We have said that the most beautiful lianas belong to the Bignoniaceae, a fact that does not signify that they are limited to this family; the lianas, here else-

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108 where, are recruited from a large number of families. The pretty Canavalia gladiata, that we name maliciously, as well as other lianas, Tripa de fraile, belong to the Leguminosae; the Desmodium adscendens, the Colaronia australis, the Rynchosia melanostica, the Tragia volubilis and the Tragia dodecandra, to the Euphorbiaceae; the Heteropteris glabra and the Janusia guaranitica, to the Malpighiaceae; the Serjania fulta and the Serjania foveolata, to the Sapindaceae; the Cyctanthera tamnifolia and the Prasopepon cucumifolius, to the Cucurbitaceae, etc. This last family presents a special liana that deserves to be mentioned because of its importance in the subtropical forests; it is the Sycyos montanus. This very common species is found outside of the subtropical forests; it extends up to the zone of the Queñoa and often covers the highest trees, up to their top, with green festoons of a fantastic shape and of an infinite variety.

It also covers the slopes whose weaker vegetation it chokes. At the beginning of autumn, it loses its leaves; then its brown stems and its spiny fruit have an aspect as sad as its flowers and its leaves were cheerful during the summer.

We shall mention yet some climbing plants that prefer, however, the zone that we have called the zone of the Parque and that only borders the subtropical formation. They are: two species of the genus Clematis, the Boussingaultia baselloides, the Cissus Tweediana, the Cardiospermum halicacabum, the Paullinia brachystachya, the Rubus imperialis (called Mora here whose fruit they eat) and some Passifloraceae.

The Micaneae that predominate in the formation of the Monte are rather rare in this formation under discussion and do not exist in the forests. One common species of the formation of the Monte, the Salpichros rhomboida, is also a creeping plant, and we must mention the genus Blumenbachia that is a veritable ornament of the brush-woods. The Azucena (Echites funiformis) is also very common and pertains rather to the formation of the Parque; its flowers are large, white and very odorous.

We also find quite commonly several species of the family of the Convulvulaceae that especially embellish the hedges with their pretty flowers, mixed often with the bright red flowers of the Manettia leianthiflora and with some remarkable species of the genus Cuscuta.

Among the most beautiful species of the Monocotyledons we notice the Bomarea fimbriata whose flowers attract attention, whereas the Bredemeyeriana belongs to the forests of the Aliso. The species called Santa Lucia resembles, sometimes, in the hedges, a creeping plant; the Smilax campestris is not rare in the forests and its resistant spiny branches are one of the principal obstacles that the traveler meets in his journey. The Dioscorea glandulosa, although rarer, yet is found quite frequently.

109 We cast a glance over the epiphytic vegetation that grows on the trunk of trees. We have already indicated above the families to which these epiphytes belong and of which the Orchideae form the majority; we shall add here some species of the genus Oncidium and Batemanianum, of the Bromeliaceae and several species of the genus Tillandsia as the Tillandsia usneoides with large beautiful flowers hanging from the highest trees in filiform clusters, especially in the zone of the Queñoa.

We shall also especially mention, among the creeping Cactaceae, three species of Rhypsalis whose fruits they eat; one, spherical, the second, flattened and third, trilateral. One species that attaches itself to the trunks of trees belongs rather to the zone of the Quebracho colorado.

Among the ferns whose forms are elegant and the species numerous, we shall cite

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the Polypodium areolatum, the P. incanum, the P. macrocarpum, the P. lycopodioides, the P. ensifolium and some species of Peperomia.

The mosses and the lichens that cover the trunk of the trees are very common, but the species, less numerous; their large quantity characterizes certain localities as the upper part of the ravine of Monteros where the forest, almost exclusively composed of Matos, is covered with a countless number of Meteorium and of hanging Pilotrichella.

The real parasites of the family of the Loranthaceae, in very small numbers, can not be mentioned here.

We also find many lichens with remarkable forms, especially the Stictes and the Cetraries, that predominate in the north, whereas the Usnese characterize the zone of the Quebracho colorado. The herbs are less numerous, hindered by the trees and the brushwoods whose shade, without being dense enough to suppress all vegetation, is, however, the cause of this relative sterility.

We shall cite some characteristic species of them; above all, two ferns of the height of man that attract attention and cover over a large expanse the shady ground of the subtropical forests. Their scientific names are Pteris deflexa and Davallia inaequalis.

We still find, at the bottom of the dark ravines, hidden in the shade of the forests, a large quantity of magnificent ferns that we may mention in passing. It is quite interesting to ascertain that about the third of the plants observed by us were new to science, and, yet, among these, we did not find a fern that had not been described previously.

Among the plants that grow in the shade of the forest, we must especially mention some species of Gramineae with large soft leaves, rather different from the species with hard, narrow and pointed leaves of the Pampa. The form of these species indicats the difference in climate. We shall cite the Mühlenbergia diffusa, the Digitaria marginata, the Orthopogon loliaceus, the Panicum oblongatum and the Panicum eneaneuron. In this dense shade we find few pretty flowers: one magnificent species of Begonia
110 (B. micranthera) and one Gloxinia (G. gymnostoma) are the only ones that merit mention. A characteristic plant of this formation is the Petiveria alliacea, producing a disagreeable taste in the milk of the cows that eat it.

We shall name as characteristic and common plants: the Gomphrena elegans, the Pavonia spinifex, the Elephantopus scaber, the Acanthospermum bispidum, the Heterospermum rhombifolium, the Chaetothylax umbrosus, the Plagiacanthus racemosus, the Diclipteta Pohliana, the Cyperus Luzulae, the Scirpus crinalis, the Herbertia euryandra, etc. Among the small herbs, we shall cite the pretty Selaginella jungermannioides that habitually covers the damp stones sheltered from the sun that is often mixed with a beautiful species of the genus Hypopterygium. The mosses are more numerous in individuals than in species, and the botanist seeks in vain some representatives of several genera that he believes he should find at first glance there.

Now we study the subtropical Parque that extends as well into the plain as to the foot of mountains, in the valleys as on the slopes too steep for the forests, near Siambon, for example. The Parque is distinguished from the forests in that the prairies and the brushwoods alternate in some places, and that the trees are found more scattered. The conformation of the soil produces this difference of vegetation that would be blamed still more if man had not modified the work of nature.

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The Parque is susceptible to very rich cultures; later, certainly, the soil will be covered with fields and gardens, and some towns and villages will be built on the sites where today the herds graze. Up to now this fertile land is only very imperfectly exploited; however, the cultivation of rice, maize and sugar is productive enough, and the woods of the orange-trees of Tucuman are known beyond the seas. The species that form the thickets are generally the same as those that we have found in the forests probably choked out and that grow better in the small woods or separately. We shall only mention the following species; the Lecheron (Sapium aucuparium var. salicifolium); the Porliera hygrometrica that we have found in the formation of the Monte, but that, here, has the proportions of a tree and takes the name of Cucharera; the Guayacan of these regions that is the Caesalpinia malanocarpa that we especially find on the limits of this formation, either in the region of the Cebil, or in that on the side of the Monte; the Pacará (Euterolobium Timbawa) whose fruit and bark serve as soap; the Carica quercifolia that they call Higuerita because of the resemblance of its leaves to those of the fig-tree; the Tairco (Jacaranda Chelonia), popular remedy employed against venereal diseases; the Ceibo, an Erythrina, (probably Crista-Galli) whose large red flowers animate the landscape; the Sombra del toro, species of Myoschylus, with savoury fruit and the Lapacho of Tucuman that, as we already know, belongs rather to the Parque than to the forests.

111 A large number of shrubs cover the glades or, forming some brushwoods on the edge of the woods, might be considered as belonging chiefly or exclusively to this zone.

On the floor of the valleys and on the hillsides we ordinarily find some species of Croton, as the Croton Tucumanensis var. oblongatum; the Collaea Argentina that we find on the heights; the Caesalpinia Gilliesii ornament the hedges and the thickets, in the same places, several Cassies, the C. bicapsularis var. eriocarpa and the C. hirsuta; the Mimosa sensitiva that we may mention among the shrubs because of its branches although they do not attain the height of a man. The beautiful Jussiaea Peruviana is the ornament of the streams and of the rivers; we also find the Sambucus Peruvianus, peculiar to the zone of the Aliso; the magnificent Cnicothamnus Lorentzii as well as other somewhat tall shrubs replace the forests on the western slopes; in other places, we see a similar shrub with yellow flowers that probably belongs to the same genus. The Nicotiana glauca is very scattered in all this region, especially near the streams, and the Lycium cestroides forms the high thickets that attract a large number of humming-birds. The Cestrum pubens and the Cestrum Lorentzianum decorate the floor of the valleys, and we also find the Acnistus parviflorus and the Acnistus arborescens that sometimes attains the height of a tree. The Solanum Crispum var. Tomatillo is peculiar to the arid regions, whereas the Palo blanco (Solanum verbascifolium), of the height of a tree, is the ornament of the glades.

We find in the hedges two magnificent species of Tecoma, the yellow (Tecoma stans) and another one, little studied, with red flowers and quite tall, mixed often with a species of Senecio, remarkable for the size of its leaves and of its flowers and that rises to the height of man; the latter is a characteristic plant of the vegetation of the province of Tucuman. The Tournefortia elegans likes the thin thickets, whereas the Phacele acuminata, that is a shrub, and some Labiateae--the Hyptis verticilata, Hyptis canescens, the Minthostachys mollis, the Salvia rhinosina var. arborescens, etc.--grow, out of preference, near the rivers or on the edge of the forests. Several Lippeae decorate the prairies and the brushwoods with their odorous flowers.

The species that we just mentioned are all the shrubs belonging more or less to the subtropical forests; but we must still cite two species--we already know one by the name of Tala--that we find scattered, and that characterize the sterile localities.

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They are often mixed with other shrubs; they (the sterile localities) present a large quantity of Compositae, chiefly of the genus Baccharis; we find them everywhere in the undulating terrains, slightly mountainous or on the slightly steep slopes, as in the extreme south of the Sierras of Candelaria and of Tucuman, as well as in some elevated valleys.

The vegetation that covers the edges of the rivers generally consists, also, of
112 shrubs in which different species of Baccharis, the B. serrulata, the B. amygdalina, the B. dracunculifolia, the B. effusa, etc., predominate. The dry regions and the summits of the hills are covered over with shrubs belonging to the family of the Mimoseae, that sometimes form thickets more or less tufted, or sometimes grow separately.

The commonest species are called Tusca; for example, the Espinillo (Acacia Cavenia) and the Acacia monoliformis, whose comestible pods serve as food to man and domestic animals.

If we return our attention to the prairies of this zone, we shall find this magnificent verdure that rests the traveler from the desert parts of the formation of the Monte. The grass is composed principally of the single Gramineae, the Paspalum notatum, that presents some dense and not very tall bunches and constitutes an excellent pasture for the animals, especially on the salt terrains; wherever the soil is less salty, as near Jujuy, for example, its nutritive property is less. This plant especially covers the plains, the bottoms and the plateaus of the large valleys. Wherever the Paspalum predominates, we only find a very small number of other species, and when the latter appear in abundance and replace the first, we can assert that the soil is less fecund. We do not find, in these prairies, many herbs of other families. We shall only mention the most characteristic ones: the Kyllingia triceps and the Cuphea hyssopifolia are very common there; some spiny species with pretty flowers of the genus Solana (S. claviceps and S. sisymbriifolium), attract attention, whilst another species with large yellow fruit decorates these places in autumn. Several species of Senecio are quite common and the presence of some Malvaceae, as the Malva rhombifolia, sufficiently displays the sterility of the soil. We also find the Mimosa sensitiva, that we have already mentioned,as well as the Nierembergia hippomanica and the Nic-Nic (Baccharis coridifolia), plant poisonous and injurious to animals.

The plants that are mixed with Paspalum are much more numerous in the valleys than in the plains. The space assigned in this book to us does not permit us to cite all of them; we shall limit ourselves to those that we just named.

On the hills whose terrain is ripped up by the burrows of the viscachos (kind of rodent the size of a rabbit that lives in the mountains of Peru and the pampas of Argentina) and where that aridity of the soil is indicated by the presence of the Acacias, the grass makes place for a poorer and lower herbaceous vegetation composed of Gomphreneae, Euphorbiaceae, of Oxybapheae, etc., among which we distinguish especially a large species of Caladium producing enormous roots. The town of Tucuman is surrounded with this vegetation that deceives the expectation of the botanist.

Before terminating the study of this formation, we must occupy ourselves with the characteristic flora of the waters that irrigate the cultivated plains or form the lagunes in the desert parts. We find, for example, some large species of Cyperus,
113 for the most part hardly studied; the magnificent Gymnogramma trifoliata, and, in the lagunes visited during the winter by a large number of aquatic birds, the Pistia stratioides, the Azolla magellanica, some orpines and some rushes.

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This sketch, as brief as it may be, is already too long and we must abandon the Parque to busy ourselves yet with the zone of the Cebil.

The tree that characterizes this zone, the Acacia Cebil, is one of the most useful of this region; its bark so rich in tannin renders it one of the most valuable of the Argentine Republic. Furthermore, it is almost the only tree of this zone, for, in the forests, the Cebil is only mixed with the Guayacan and with some shrubs.

The herbaceous vegetation differs especially from that of the Parque in that the Paspalum is replaced by another species of Gramineae that resembles that of the Pampa and is present in the form of scattered bunches with thin long leaves. This species has not even received a scientific name up to the present time. It is found mixed with some other herbs that we find hardly or not at all in the Parque and that are not yet studied; we shall only mention the Plumbago scandens; a Solidago with yellow flowers, probably the Solidago linearifolia; a species of Pterocaulon; finally the Hysterionica subvillosa, the Lippia turnerifolia var. camporum, etc.

The presence of these characteristic plants authorizes us, in this description and on the map, to give the name of zone of the Cebil to a region where we encounter none; moreover, we have had another reason for doing thus: it is a fact generally known at Tucuman that the forests of Cebils extended, in times gone by, very close to the town; the excessive waste in their exploitation has made them recede a greater distance. The gaucho, who unloosens the bark as high as he can reach, occasions the death of this tree, whose upper bark is lost as well as the wood. It is impossible to destroy the resources of a country with less improvidence and it becomes necessary that the authority devote itself to repressing this waste. We believe, then, that all the desert terrain that extends, at the present time to the east of Tucuman, has been covered, in times gone by, with woods of Cebils. We have already noted that, in the terrains that present a similar herbaceous vegetation, the Cebil is sometimes replaced by a small palm-tree, different from the palm-tree with tow (étoupe), but that, because of the absence of flowers and of fruits, has not yet been studied.

We have only a few words to say on the region of the Quebracho colorado whose scientific name is Loxopterygium Lorentzii. It is a large magnificent tree with slightly dense bower. Its penniform leaves have a penetrating odor and a little too long contact with them forms, they say, some blisters on the skin. Its flowers are hardly apparent, but its red fruit recalls the sorbs of Europe, and its wood, very much sought after, already gives occasion to an important commerce.

The other elements of these forests are similar to that of the Monte or common to the subtropical formation and that of the Monte, as the Talas, for example. We must mention the widely distributed Mistol (Zizyphus Mistol), whose fruit they eat
114 and whose bark is used as soap. We have found it also in the formation of the Monte, where it penetrates farther than the Quebracho colorado, and it also grows sometimes in the zone of the Parque.

Now we shall consider the mountains and study the zones that are found beyond the subtropical forests. We find first of all the zone of the Pino (Podocarpus angustifolia) that grows principally on the northern slopes of the Cordilleras and on the chain of the Aconquija. This region is very characteristic in the valley of Tarija and on the northern slopes of the Cordilleras, west of Oran near San Andres. On the chain of the Aconquija we find in several places some isolated species whereas other expanses are so greatly covered with plants that we might consider them as a veritable zone.

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In the Alto de las Salinas, on the Sierra de Candelaria, the steep sides that dominate the subtropical forests are exclusively covered with the Pino, while those that are less arid are covered with Alpine prairies.

The Pino, a tree of average height, very ramose and crowned with a dense foliage, does not resemble any species of the European pines. The inhabitants of these districts use its wood that otherwise does not have a great importance in the country. We could not mention any characteristic vegetation that accompanies it.

The zone of the Aliso is a little more varied; this tree forms, on the steep slopes and in the deep ravines, some dense and shady forests; it greatly resembles the European alder-tree (Alnus ferruginea, var. Aliso). The only tree of a species that we find is the Sauco (Sambucus Peruviana), that is found in the middle of the alder-trees. The shrubs that are very rare there are represented by some pretty, rather tall species of the genus Eupatoria; we also see in some places the beautiful Escallonia, that attains a very great height and some other shrubs belonging to the Compositae. A herbaceous vegetation grows there in the shade, especially in the damp parts where the ground is covered with a heavy layer of clay that, during the rains, renders all the roads inaccessible, for the mules, slipping on the bare ground, can not ascend the steep slopes. This peculiarity influences the herbaceous vegetation. We shall only mention some characteristic and very common species: the Colignonia glomerata, whose variegated leaves attract attention; the pretty Melastomaceae called Plerome paratropicum that grows here on its real terrain and that also covers the Alpine prairies; the Begonia octopetala; the magnificent Lobeliaceae Siphonocamphylos nemoralis; a climbing plant, the Bomaria Bredemeyeriana; the Polymnia sonchifolia and the Jungia floribunda that surround the springs of the Alpine prairies; the beautiful Gentiana cosmantha with red flowers; a species of Thalictrum; some species of Rumex and a species of Valeriane.

The Gramineae are tall and somewhat dense, as the Mühlenbergia phragmitoides, for example. The vascular Cryptogams are represented by the ferns, some Soliganelles, Lycopodium Saururus, that cover the trees and the ground as well as by other species. We note on the trees a large number of epiphytes, of Orchideae, of Tillandsiae, of ferns, and especially mosses, but of slightly varied species; for example, the pretty Cryphaea, several beautiful lichens, some Stictes, some Cetraires, some Parmeliaceae and a large number of smaller species.

The preceding lines suffice, we believe, to give an idea of the region of the Aliso whose limits are extremely difficult to indicate; in the damp and shady districts the Aliso descends to the tropical forests, while in other places, it rises on the slopes to an altitude of 8,000 ft. all seeking the cavities. It is not rare to find at the same altitude the Aliso and the Alpine prairie skirting one another or encroaching one upon the other according as the situation of the terrain is more favorable to one of the two. The veritable limit of the Aliso is found perhaps between 4,000 and 7,000 ft.; this is, however, only a general indication.

The zone of the Queñoa rises beyond that of the Aliso from which it is distinctly separated. The tree that characterizes it is the Queñoa, a Rosaceae (Polylepis racemosa), very ramose, of a height of 16 to 20 ft., not deserving, consequently, the epithet of dwarf whose new trunk often has a diameter of a foot and whose wood is very hard; its brownish-red exfoliate bark forms large scales resembling dry tobacco leaves, a fact that gives it the name of Tabaquillo in the Sierra de Cordoba. Its wood is very useful to the inhabitants of these mountains, for it is the only tree of this zone; we find it rather scattered on the slopes, whilst in the ravines it forms a denser wood.

No characteristic vegetation accompanies it; we only find at its foot the vegetation of the Alpine prairies and that of the zone of the Aliso in the damp shady

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ravines. No part elsewhere, the Tillandsia usneoides with long white filaments swinging on the branches, acquires so great a development.

We shall terminate this description of the subtropical formation with a rapid glance over the vegetation of the Alpine prairies that, because of their wealth, their magnificence, and their picturesqueness can emulate the vegetation of the subtropical foreste and that of the zone of the Parque. Henceforth, the animals of these provinces may furnish an article of exploitation; but the Alpine agriculture promises to increase considerably these riches directly that the people seriously devote themselves to exploiting them.

The limit of this zone is not any easier to trace than that of the Aliso; near the wooded sides of the north, it passes beyond the limits adopted for the subtropical formation and reunites immediately, in the valleys near Siambon, for example, the prairies of the Parque from which it differs with the presence of some other species of Gramineae. On the less elevated counterforts of the Cordilleras, or in the large wooded valleys as well as on the plateaus, the conditions necessary to the formation of the zone of the Puna are lacking; the prairie becomes poorer and poorer in pro-
116 portion as it rises, and only ends at the eternal snows; in the center of the Cordilleras, it unites with the zone of the Puna that stops at an altitude of 10 to 11,000 ft. in the unsheltered places, whereas in the valleys it descends much lower.

The Alpine prairies are found on the west sides and their elements seem to resemble those in the subtropical formation and that of the Monte; thus, we have designated them on the map with the same color seeing that it would be difficult to delimit the different parts. These prairies are very fertile; for example, on the slopes of the Cordilleras near Belen in the valley of Granadillas where they extend along and between the formations of the Monte and of the Puna; we might include them in a zone that we might call Alpine zone of the Monte.

Sometimes this vegetation is similar enough to that of the mountains of Tucuman to be considered as a representative of the subtropical formation whose other elements are not found here.

The Gramineae characterize the vegetation of the Alpine prairies; this is not the thick grass of the Paspalum, but, as in the Pampa, some scattered bunches with tall narrow leaves that come close enough together to cover the ground. It is useless to say that these accounts vary according to the climateric conditions and the physical and chemical properties of the soil. The principal Gramineae are : the Bromus unioloides, the Bromus Haenkeanus, the Poa annua; the Airopsis millegrana, the Mühlenbergia Cleomena, the Epicampis caerulea, the Sporobulus Indicus (that extends to Cordoba), the Cinnagrostris polygama, the Nasella caepitosa, the Stipa Ichu, the Bouteloua tenuis, the Paspalum platense, the Paspalum elongatum, the Setaria galuca var. penicillata, the Gymnothrix latifolia, the Cenchrus myosuroides, the Andropogon condensatus, the Sorghum nutans, etc. These Gramineae--whose number will greatly increae with the study of the new collections--enjoy, in the formation of the grass, a role that varies, as we have just said, according to the climate and the soil.

This grass is studded with very beautiful flowers and we can, however, only devote a few lines here. It is certain that it is the Alpine prairies that, because of the number of their species, have contributed more than any other region to the subtropical formation.

This flora varies a great deal according to the seasons.

The country folk report that from the month of September--that corresponds here

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to spring--the prairies are covered with flowers. They are, in general, some plants of the family of roots and bulbs, plantas con papas, and also probably some Monocotyledons of the families of the Liliaceae, Amaryllideae, Irideae, etc. The more uniform flora of the summer presents a large variety of colors; the Compositae predominate and offer some superb individuals; for example, the Cosmos peucedanifolius and some species of Bidentes with large flowers. The autumn presents a flora in which the Gentians and the Calceolarias predominate. Among the principal families
117 that compose these flowers, we shall mention the following: some Renonculaceae, some Berberideae (that present some characteristic shrubs), some Cruciferae, some Polygalae (Monnina and Poligala), some Coryophylleae, some Amarantaceae (some pretty Gomphrenes), some Malvaceae, some Chenopodae, some Nyctagineae, some Geraniaceae (Geranium, Oxalis bipartita), some Urticeae, some Papilionaceae (of numerous species, from the small trefoils up to the thickets), some Swartzieae (of the gigantic Cassies), some Acacias (Acacia cavenia in the lower zone), some Rosaceae (Alchemilla, Acaena), some Mealstomaceae (Pleroma), some Lythrarieae, some Onagrarieae (with pretty Epilobeae and Aenotheres), some Loasaceae with vine-shoots covered with flowers, some Umbelliferae (much less important since they only offer a large species of Eryngium). The Passifloraceae are represented by an often characteristic species, the Tasconia umbilicata; and the Rubiceae only present some species, for example two Galiaceae whose roots are used for dyes. We also find two species of Valerianas. We have already mentioned the predominance of the Compositae whose size varies from the smallest herb to that of a shrub (especially the species of Baccharis and of Proustia). Place is lacking, unfortunately, for us to speak further. The Campanulaceae are only represented by a remarkable species and the Lobeliaceae by the Lobelia Cymbalaria, pretty and very characteristic plant.

We also find some Plantagineae and some climbing Asclepiadeae that twine around the columelliform Cactaceae and the shrubs and sometimes attach themselves to the rocks. Some give off a fetid odor.

We have just mentioned in the flora of the autumn the importance of the Gentians. The abundance of these plants makes us believe in a large number of new families. The Personateae play an important role here; they are represented by several species of Calceolaria that can be considered as typical of this zone. Some are commonly found in the Alpine prairies; for example, the C. teucrioides and others that ornament the autumnal flora along the streams, the Mimulus, the Gerardia, commonly known. A Bartsia very similar to the Alpina of Europe also belongs to the Alpine flora, whereas the pretty Bruddleyes are present in the form of some shrubs in low lands.

The large family of the Solanaceae, so rich in species in all the zones of the country, is equally very abundant here. It forms the essential part of the brushwoods of the zone, especially in the narrow gaps that divide the slopes. Some species are arborescent; others produce some pretty flowers and edible fruit; for example the genera Salpichroa and Jochroma. The Acanthaceae are represented by a Dicliptera; the Gesneriaceae by a Ligeria; the Convulvulaceae by some species of Ipomea and Cuscuta; the Hydrophytes by some characteristic Phacelies; the Boragineae are rare, but the Labiatese are very widely distributed; we shall only cite the Matico (Salvia M.) very much sought after medicinal plant in the form of shrub that ornaments this zone up to a considerable altitude, then some species of Xenopoma; some species of vervains mount from the plain to a high altitude; the scarlet vervain as well as
118 the vervains Juniperina and bonearensis that we have already found in the Pampa and the Monte; the Lippiae embellish the Alpine prairies in the low places; the Cactaceae present a large species, the Cactus with melons whose fruit is a large calabash; some families of Ephedra are found, according to M. Hieronymus, up to a high altitude.

Except for the Gramineae, the Monocotyledons that we have found during our

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expedition were not very numerous; we shall cite some pretty Commelyna, a small number of terrestrial Orchideae with beautiful flowers. These species are not yet studied. Some Sisyrinchese are present in great abundance besides some characteristic Cyperaceae; and some Cienegas that cover the marshes and sometimes grow in the dry places.

The ferns and the Selaginelles are not numerous in these prairies and less remarkable. In the crevices of the rocks, the species are a little more numerous. The mosses are very rare, whereas the lichens are very abundant on the rocks.

We must close this account here; we only yet mention two peculiarities; the thickets of the family of the Xenopams are found, as we have said, in the Alpine prairies up to a considerable altitude, principally in the gaps and consist of Solanaceae, Compositae and Barberideae. Sometimes, they form, in the large valleys, the principal vegetation; for example, near Tafi, the Casnia Rockeriana and the Eupatorium virgatum; the Baccharis sculpta predominates in the valley of the Granadillas or on the heights of Cuesta de Juntas; in the same gaps we find, up to an altitude of 13,060 ft., a tender species of Piperaceae visited by a class of humming-birds.

A single word on the Alpine vegetation that we shall call the dwarf vegetation of the mountains. In places where the slopes flatten out and form some large valleys, we often see, at a variable altitude from 6 to 7,500 ft., a soil that resembles the clay of the Pampa. There, there is found a dwarf vegetation whose first element is a creeping Alchemilla, A. pinnata var. Minima, called Algarrobilla here, very valuable as a food for the animals, the same as the Alchemilla alpina of Europe is sought for the same purpose. Some elements of the Alpine prairies are enjoyed there, but all assume some stunted forms; for example, the Poa annua, the Geranium leucanthum, the Tagetes filifolia and several others. On the plateaus, we find a medley of this dwarf vegetation with the real Alpine flora, and each disturbance of the terrain, being able to determine a variation of moisture, makes sometimes the one, sometimes the other, predominate.

This is all that we can say here on the Alpine prairies of the Argentine Republic.

119

VI.
Formation of the Puna.

The formation of the Puna is composed of spacious valleys surrounded with mountains of the second order, with undulating plains with or without lagunes, with narrow dales, with deep ravines, all situated at quite a high altitude. It is the vegetation of the high Cordilleras to which we have given this name and in which we include that of the tropics that M. Grisebach has separated from it; however, we admit that, though our information will be less superficial and less imperfect, there will be cause to make this distinction and even to admit several other classifications.

We have already indicated the limit of the Puna with the Alpine prairies; this limit is not definite. It terminates, we believe, on the side of the Monte at the place where the thickets that characterize this last formation, as the Jarillas, the Mimoseae, the Caesalpinia Gilliesii and several others, disappear to make room for the predominant plants of the Puna, the Compositae, the Solanaceae, the Gymnocladus, the Adesmeae, etc.

We must, however, call attention first to the fact that a large number of plants that especially grow in the zone of the Puna extend and penetrate into that of the

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Monte so that it is sometimes difficult to know to what zone they belong, as with Campo del Arenal, for example.

The limit with the Alpine prairies is yet more difficult to point out; we believe to admit it in the presence of the Llareta or Yareata (Azorella Madreporica) and of the Adesmia horrida that ordinarily indicates a change, sometimes however but slightly marked, in the size of the vegetals. These plants as well as other spiny species of Adesmias, extend also into the Alpine prairies, or those of the latter encroach on the Puna, a fact that makes the line of demarcation disappear.

The upper part of the subtropical formation beyond which rise that of the Puna is not always well determined. Near San Andres, for example, the latter is found immediately beyond the zone of the Pino, and near Tarija, beyond that that of the Queñoa.

The formation of the Puna is especially characterized, in our opinion, by some thickets, among which we shall mention: the Adesmia horrida, the A. pugionata, the A. inflexa; some species of Baccharis, as the B. polifolia, the B. calliprinos, and several other species not studied; the Heterothamnus spartioides, the Tessaria absinthioides, the Chuquiraga spinosa, the Ch. erinacea, the Gochnatia glutinosa, the Proustia pungens var. ilicifolia (that extends separately to Cordoba, but that grows here in abundance), the Fabiana densa and the F. denudata, the Oxycladus aphyllus, the Salvia Gilliesii, the Acantholippia salsoloides, the Neosparton ephedrioides, etc.

120 The herbaceous vegetation greatly resembles that of the Alpine prairies, especially in the narrow valleys and on the steep slopes. The tough herbs that grow in large numbers among the thickets stop the development of some tender herbs that are found there; the brushwoods of Gynerium cover large expanses, whilst the stony slopes are clothed in gigantic columelliform Cactaceae or with a very large Bromeliaceae whose floral and fruit stems have a length of 6 to 8 ft. and a diameter of half a foot. Moreover, we find in places where sand and salt predominate, a low thick turf of Cyperaceae representing nearly the only verdure of this desert region. We shall mention, moreover, as characteristic plants: the Pycnophyllum sulcatum, the Lupinus tomentous, the Astragalus unifultus, the Hoffmannseggia andina, the Margaricarpus alatus, the Acaena canescens, the Aenothera nana, the Loasa coronata, the Azorella madreporica, the Mulinum axilliflorum, the Calycera calcitrapa, some species of Senecio, the Werneria cortusifolia, the Doniophytum andicolum, the Pachylaena atriplicifolia, the Pratia olygophylla, the Gentiana podocarpa, the Argylia Uspallatensis, the Pharcelia pinnatifida, the Arundo Sellowiana (Gynerium Argenteum), and some other Graminese. These plants are found in the Sierra of Catamarca and their list will increase directly that the collections of the plants of the Puna, gathered between Humahuaca and the valley of Tarija, are studied.

The climate of the Puna is disagreeable, the ground steep and the water very scarce; thus, the immigrant will only settle there where are found commerce and metallic treasures. The diligent Indian doubtlessly for a long time will be the only inhabitant of these deserts; he knows how to utilize the smallest stream that descends from the mountains, how to conduct it across the rocks in order to wrest from the soil a quite meager harvest that still comes to the relief of the indolent inhabitant of the more fertile subtropical valleys.

We can only devote a few lines to the last two formations, that of the Grand Chaco or Paraguayan and Mesopotamian, because they are still but partially known to us, and the author of this chapter has not been in a position to assemble the scientific reports written on these regions.

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123

VIII.

Mesopotamian Formation.

Although this formation may be much more accessible than the preceding one, its vegetation is almost as little known to us also. Its fertility and its wealth will render, in a short time, the provinces that compose it the most important of the Argentine Republic, the day when peace reigns in these regions, especially in the province of Entre-Rios.

They are very suitable to agriculture and the establishment of colonies; whilst the formations of the Pampa and of the Monte furnish us, principally in early times, with beasts, whilst the subtropical forests and those of the Chaco will be our great provider of timber, whilst the zone of the Parque will be the garden of the Republic, the Mesopotamian formation, with a part of the provinces of Cordoba, Santa Fe and Buenos Aires, will be the granary. However, we only approximately know what products the Argentine Mesopotamia will be able to produce, and its indigenous vegetation, as we have already said, is almost unknown to us. We have only explored, up to the present time, the environs of Concepcion of Uruguay and the results of this exploration are not yet classified.

In general, we may say that this formation differs from that of the Pampa because of the large quantity of trees that we find there. We find everywhere in the prairies with gentle slopes some brushwoods and some small thickets that also border the rivers and cover the isles. The forests abound; we shall cite that of "Montiel" celebrated for the events of which it has been witness. Likewise we find on several islands some extensive woods. The vegetation that we find along the rivers consists in palm-trees; we count five species of them, the chief one of which is designated by the name of Yati.

The grass is different from that of the formation of the Pampa (at least in the case of that that concerns the zone that we have studied); it is shorter and denser, resembles that of the Parque of the subtropical formation and presents the same element the Paspalum notatum and some other herbs peculiar to these prairies.

This formation resembles very little that of the Monte if we except sometimes some plants widely distributed and common everywhere. The brushwoods and--they assure us--the forests are generally composed of elements that we have seen in the subtropical region, and likewise some species entirely new to science that we have not found elsewhere in the Argentine Republic and that correspond more or less to the Paraguayan or Brazilian flora.

We shall close this study with the wish that it may contribute to the making
124 known of the vegetation of the beautiful Argentine country and that it may aid immigration. The immigrant will come to this land who, thanks to its lovely climate, can produce all the fruits of the temperate zone. He who arrives in the Argentine Republic without exaggerated hopes, but with the firm intention of working here, is assured of prospering and of giving his family comforts that work does not refuse here.

***

Explanation of the Maps.

On the phytogeographical Map of a country, whose regions are only imperfectly known, the limits of each formation or each zone can not be indicated with exactness. Sometimes the observations are based on some superficial reports or on some analogies; sometimes even only on conjectures.

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In order that our Maps have a scientific value, we should inform the reader of the reasons that we have decided on to fix the limits such as we have indicated them.

Such an explanation is not possible here and it can only find place in a scientific journal. We shall have attained our object if, in casting a glance over these Maps, the reader of this chapter can form an idea of the configuration of the vegetation of this country and of the actual estimate of our knowledge in this regard.

NOTE.--The author of this chapter, not having been able to reread this translation, made from the original written in German, is not responsible for the errors that might be found there.

Finis.

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LA VEGETATION DES HAUTES CORDILLERES DE MENDOZA
THE VEGETATION OF THE HIGH CORDILLERAS OF MENDOZA
(Republic of Argentina)

By Lucien Hauman.

From the "Anales" of Sociedad Cientifica Argentina.
Buenos Aires, 1918.

Introduction.

121 The High Cordillera of Mendoza which extends a little over three degrees of latitude, comprises the eastern declivity of the highest group of the entire Andean chain--a group that yields in altitude only to the Himalaya. In it one finds, spread over some seventy kilometers, the mountains Aconcagua, Tupungato, Juncal, Navarro, Polleras, whose height is between six and seven thousand meters; besides, there are ten others, at least, higher than Mount Blanc.

Although not very well known even from a topographical point of view, these mountains have been visited by many naturalists--Darwin, for example. They have been, in fact, accessible with relative ease for a long time: several routes cross them, the historic one of which today is followed by the railroad, uniting the large cities of central Chile with the rich Argentine province of Mendoza,--routes whose importance was very great, perhaps, when no railroad traversed the thousand kilometers of plains which extend from the foot of the Cordilleras to the banks of Rio de la Plata. Also many kinds of observations have been made in the course of the last century, and some important collections were reported. For that pertaining to botany, we must cite Miers and the English doctor, Gillies,
122 who, around 1820, resided in Mendoza where they made real explorations in the mountain and whose collections were studied like those, also, of Cumming and Cruckshanks by Hooker and Arnott and by Don; R. A. Philippi, much later, is occupied with those collected by the naturalists Reed and Leybold and several other travelers; then F. Kurtz gave a brief account of his voyages to the neck of the summit and to the upper part of Salado River. Some pages of his works are devoted to the High Cordillera; Otto Kuntze crossed the Andes by way of the neck of la Cruz de Piedra (Paso Cruz), a little to the south of the region that I have visited, and published fifty names in the third volume of his Revisio. Lastly, Chodat and Wilezek began, without having completed unfortunately, the publication of the plants collected by one of them, in the region of Rio Diamante, not far from that which Kurtz had visited; the Fitz-Gerald expedition brought back from the foot of Aconcagua a small herbarium which was studied by R. Burkill.

But most of these works are purely systematic, all are partial and none gives a somewhat detailed phytogeographic study of the Alpine level, as such, insufficiently separated more often from the Precordillera. The western declivity of this same range is, in this latitude, not well known; Reiche, in his great work on the botanical geography of Chile, gives only very little information on this region.

It would, therefore, be very interesting to study at the same time the vegetation of these mountains, but leaving for subsequent work the flora of the Precordillera which is only a subAndean section of the Argentine Mount, I shall occupy myself especially with this of the Alpine level; that is, to the narrow central band of the groups where the characteristic elements of the plain do not reach. I shall analyze further along the botanical reasons for this separation.

I have divided this study in the following manner:

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Descriptive part	(The central part; (The principal associations.
Analytical part	(Systematic analysis; (Ethologic analysis; (Phytogeographic analysis.
Systematic part	(Catalogue of the vascular plants (Bibliography.

As for the description and ethologic remarks, I held strictly to my own observations. I, therefore, hasten to remark that the region that I have visited,
123 from Aconcagua to Tupungato, region that is precisely the highest, does not represent nearly the fifty of the most northerly "mendocine" Andes; however, as I shall explain later the results acquired by the other authors and the collections coming from some valleys farther south have allowed me to extend my conclusions to a much vaster region: whence the title of this memoir (1).

(1) The region visited extends from the transAndean railroad sixty km. toward the south. Five valleys (valleys of the Rio Mendoza, Las Cuevas, Rio Tupungato, Rio Blanco, Rio Plomo and Rio Tosca) have been followed to their source; the limit of the snows has been reached and passed in a number of points; the entire excursion represented a trip of close to 500 km. (see chart p. 125). I spent around 60 days there, in January--February 1908, January 1910, November 1913 and March 1918, having stayed or camped in ten of the places beyond Puente del Inca, point of departure of the excursions necessitated by each of the trips; see further on the table which precedes the catalogue.

Before going into the matter, I must again call attention to the uncertainty of our systematic knowledge of the flora of the region, uncertainty that obliged me, by reason of the multiple notes that necessarily made it dull, to give an undoubtedly exaggerated development to the catalog that terminates this work. This is due, in part, perhaps, to the great variability of the floraof these mountains, flora relatively modern and subject also to very variable conditions of the soil and climate, but more than that surely to the insufficiency of the descriptions, not only in the old works, but too often even in the most recent ones. It is thus that the species of the old English authors cited further back, species which often have not been described nor even mentioned for more than twenty-five years, are often impossible to recognize with certainty, to the point that the redescription of the types from collections of Gillies is imposed as a necessity for the Argentine botany. It is very often the same for the innumerable species of Philippi; the same when they have been taken up by Reiche in his modern Flora of Chile.

The existence in nature of a considerable greater number of types than we formerly supposed, renders absolutely indispensable not only descriptions in detail (2),

(2) Especially without which one could never over-state the information on the dimensions of the organs.

124 since it is not always possible to give drawings, but especially the indication by the authors of the differences of their species with the more closely related ones; it would be a trite expression rather than what one says, if, very often, one has not ascertained in the modern works the absence of this kind of indication,-- only admissable excuse today,for the creation of new species, if I thus dare to express myself! However, it appears that this part of the systematic (botany)

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124 that is only an inventory, should be most exact for the biological sciences -- since, (if it is only) approximative, it is more harmful then useful -- and before the uncertainty encountered everywhere, we understand but very little of the prestige that it conserves of our days!

I should have completed this work with more profound comparative study then I could accomplish, of the Andean flora and Patagonian flora, of which flora we shall see, further on, close relationship. It was one of my objectives, in accepting without any sort of contract, for leaving in January, 1914, with a botanical expedition to Lake Argentina, under the direction of Mr. C. M. Hicken, expedition generously subsidized by the Minister of Agriculture of the nation. Unfortunately for me, the rich collections that I have collected in the course of often laborious and also dangerous herborizations have all been taken from me; without informing me, they have been, consequently, mixed with other material, and their study confided to another naturalist. If I must resign myself to thus lose the fruits of three months of hard labor, it is, on the other hand, impossible for me to continue to appear guilty of not having brought back any scientific observation from this official expedition, the only one in which I may have had the honor to belong, and to share, a great while, the responsibility of silence which has hovered, for almost four years, over its results. Hence the simple declaration.

The beautiful drawings which adorned this work are due to Mr. C. Villalobos, sketcher for the National Museum of Natural History of Buenos Aires.

Descriptive part.

1. Study of the central part.
Geographical outline.

The Cordilleras of Mendoza are therefore formed by the western range of the Andean declivity, between 32°40 and 36° south latitude, and it is to the most
126 northerly part of this section that this work more particularly relates.

For some botanical reasons that I shall consider further on, the zone that I shall study commences there where the altitude of the floor of the valleys exceeds 2300 m. (that is to say, in those of the Rio Mendoza to Punta de Vacas), altitude that does not go beyond the characteristic elements of the Precordillera. This Alpine level extends in Argentine, over a wide band of about 25 to 30 km. and constitutes, therefore, the median zone, the highest of the enormous mountainous mass whose total width is here around 170 km., 120 of which enter the line of divortium aquarum that forms the political frontier with Chile, and the plain of Mendoza. The valleys are narrow there, confined between some mountains with always steep slopes and dominated by summits many of which, as we have seen, have an elevation of more than 6000 m. Outside of these peaks dominating by far the whole chain, many are the peaks which exceed the limit of the eternal snows, that fluctuates here between 4200 and 4500 m., but that are disengaged from others still more numerous, for a more or less long time, according to their altitude and according to the years, with the thick layer of snow that covers them for at least six months (pl. VII to X).

In the middle of summer, however, (Jan.-Feb.), it is frequent to see that some peaks not exceeding 3500 m., far above, consequently, the limit of vegetation, remain for some hours or even some days covered with a thin white mantle (pl. IX, fig. 2).

On the other hand, we must call attention to the great development that the

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126 glaciers of this part of the Cordillera have made. (see Reichert, XLVI) (1):

(1) The Roman figures in parenthesis refer to the bibliographical list that one will find at the end of this work.

all the frontier chain, a little south of Aconcagua up to Juncal, over a distance of almost 30 km., is occupied by an immense sea of ice, from whence descend, sometimes even below 3500 m., the numerous glaciers, sources of rivers and torrents, that we find at the beginning of the most of the valleys (Nos. 1 to 22, fig. 1); from others they have disappeared or have changed place, leaving behind them very often extensive moraines. (pl. X, fig. I, and pl. XI).

Another important characteristic of these mountains, which Darwin already pointed out, is the considerable activity of the phenomena of erosion; all along the
127 valleys, as well as on the sides of highest masses, the eyes meet everywhere the lines and oblique planes of stones that often descend even as far as the bank of the rivers and it is in these debris, as well as in the old moraines, that we find, around 4200 m., the last vestiges of the phanerogamic vegetation.

Eternal glaciers and snows naturally determine the formation of a great number of water courses, and from all sides, at various levels, on the slopes, flow some springs often producing a small marsh or giving rise to a stream very quickly transformed into a torrent, excavating deeply the side of the mountain, and spreading, fan-shaped, before rejoining the river flowing along the bottom of the valley; these marshy spots, these ravines sheltered from wind and the alluvions of the cones of dejection are naturally some stations characterized by some vegetable associations of sufficiently different types. The course of the rivers are generally torrential and very variable, not only according to the season, but also according to the hour of the day, the melting of the ice and the snow is completely interrupted above the altitude at which the sun sets, they sometimes flow in a narrow bed with the banks overhanging (pl. VII, fig. 1), and sometimes, are dividing as by chance into multiple branches, they occupy the floor of the valley, in this case large, horizontal and covered with gravel (pl. VII, fig. 2). In this part of the Cordillera, lakes are totally lacking; we can point out only some ponds or pools of very little importance.

The vegetal mantle being very poor, the aspect of the landscape with its narrow valleys, its bare rocks with dark colors, often red or brown, crossed on all sides by oblique lines of its stones, is always somber, even sad, and become imposing when viewed from a very high (point) or when one or the other of the great snowy summits dominate it.

The Soil.

One cannot enter the frameworks of this study by giving even a brief outline of the complicated, very incompletely known, however, and much discussed geology of these mountains. I will only recall what the geologists admit in general that the Andean chain is of relatively recent formation, produced by the rising, in the tertiary period, of old terrains constituting all the Precordillera and even a part of the central region studied here (some fossils have been found on the summit
128 of Mount Polleras, at 6200 m. altitude). Only the central cordon of the highest summits probably is formed of contemporaneous eruptive rocks from the rising.

According to the recent work of W. Schiller (XLVIII) here is some information on the age and the petrographical nature of the terrains; as we are going to see, the dorsal point of the system is composed of eruptive rocks dating from the upper cretaceous or even from the lower tertiary: these are for example banks sometimes extremely rich in porphyrite-andesite, often cut by some layers of trachyte (upper

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128 tertiary), like those which constitute Aconagua, Tobosa and Rio Blanco mountains, fragments of which rock we find, in abundance, in the gravel-pits and beds of rivers. There follows from West to East, some terrains, always much older, that have undergone violent overthrows and in some we have recognized sandstone, slate, cretaceous conglomerates, thick banks of calcareous fossiliferous Neocomian oxfordian gypsum in abundance; lastly, toward the lower border of the zone that interests us, porphyry quartz, Mesozoic granitic (laceoliths) rocks and devonian corneous rocks.

We must still mention the terrains of recent formation which are precisely those that supported the most abundant vegetation, the quaternary river deposits(ordinarily argillaceous sand, sometimes wholly sandy) of the bottom of the valleys, the cones of dejection formed by each lateral torrent (pl. VII, fig. 1), the debris, and the stone drains, and lastly the moraines.

These terrains, and many others that I have passed over, frequently in a great number (the horizons often are repeated many times), crop out one above the other, on the slopes limiting the valleys: it is thus that Schiller (loc. cit., pl. 15 and 16) recognizes more than fifteen superimposed layers on the side of the mountains that tower for 1,000 m. over the bathing station of Puente del Inca.

129 Has this diversity in the composition of the soil a direct influence on the vegetation? We dare not absolutely deny (it), but the phenomenon is, at all events, of the least apparent ones perhaps this diversity is one of the causes of these curious localizations of the "rare plants" that we find sometimes in abundance in a valley or on a summit, and none in the suburbs; but the composition of the ecological associations, that I shall distinguish further on, is extremely constant, and I only saw some differences in the nature of rocks, at some points near the slopes of the same valley, involving some perceptive modifications in the vegetation.

We may remark, however, that in the view of the factors of elimination which constitute, on the one hand, some climateric conditions, as extreme as those which we encounter at these altitudes, and on the other hand, of the importance of the physical and mechanical conditions of the terrain (soil, rock, debris more or less exposed to the sun or wind), it is natural that with slight differences in the composition of the soil they remain uninfluenced.

Apart from some outcroppings of gypsum, no particular mineral is pointed out. I only recall the presence of bicarbonated and ferrugineous thermal springs, among which those of Puente del Inca, celebrated, I am assured, from before the Spanish conquest, for their therapeutic properties.

Here at last is the analysis, that I owe to M. F. Bade, of the soil collected by me at the bottom of the valley of the Rio Tupungato, about 2400 m. altitude, at a place where the vegetation offered the most normal habit.

Physical analysis of the fine soil.

Particles of less than 0.004 millimeters in diameter		7.27
Particles of a variable diameter from	0.004 to 0.05	5.8
- - - - - - - - - -	0.05 to 0.2	19.3
- - - - - - - - - -	0.2 to 0.55	
Retention of H_2O per 100cc.	34.8	

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Chemical Analysis

	Per 1000 of fine soil
129 Humus	7.120
Total nitrogen	0.360
Total P_2O_5	0.94
P_2O_5 by citric extraction	0.23
Hydrochloric extraction:	
Silica (SiO_2)	0.45
Oxide of Iron (Fe_2O_3)	31.2
Alumina (Al_2O_3)	19.6
Lime (CaO)	4.0
Magnesia (MgO)	6.2
Potash (K_2O)	0.28
Soda (Ha_2O)	0.49

It evidently does not deal as we can see, with fertile soil, but nevertheless it seems to me, with a sterility of soil to which can be attributed the poor vegetation.

The climate.

We can hardly reply upon the fact that there exists complete, exact and numerous observations on the climate of a desert region, actually having almost no economic importance and also removed from centers of agriculture and industrial production, as is themost central zone of the Andes mountains. However, twelve years ago the Argentine Meteorological Bureau had installed in Puente del Inca (at 2700m. altitude), a station of secondary importance; the operation of which suffered some interruptions, it is true, but whose observations, as a whole, even if they were not always strictly exact, give a very complete idea of the rainfall and temperature in these mountains.

Upon my request, Mr. Wiggins, whom I thank very much, has sent me complete tables of observations effected: we find below a summary, all the more interesting as this is, to my knowledge, the first time that there has been published as satisfactory information as on the climate of the High southern Andes. (1).

(1) The publication of this work has been held back for many years: it is thus that these statistics were stopped in 1914. The figures that I give have been copied from manuscript tables which have been sent me from the Officina Meteorologica Argentina, or calculated according to them, and scarcely different from them, much less detailed, however, than those published later (XLIX, p. 275).

130 Temperature. Among the monthly averages for the year 1905 to 1914, the figures of which I have before me, I have chosen three that give a very complete idea of the variations of the climate. I have united the average monthly figures by indicating on the last line, as I shall do for all the tables which follow, the numbers of observations on which they have been calculated.

I. Average temperatures.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct	Nov	Dec.	Year
1907	14.1	12.9	12.0	6.9	1.7	-31.0	-4.6	-0.3	1.5	6.8	8.1	11.5	5.6
1911	14.2	13.9	11.1	5.3	4.5	- 1.9	0.6	0.9	2.5	5.5	8.4	10.7	6.2
1913	13.0	13.9	10.3	9.0	4.3	2.5	1.3	3.1	3.9	7.8	11.2	11.9	7.7
Averages	13.8	13.2	11.4	7.0	3.6	- 0.3	-1.0	0.5	2.9	6.8	8.6	11.3	6.5
Years of observation	9	10	10	10	10	8	9	9	9	9	10	10	8

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131 For greater clarity I shall not publish the maxima or minima for all the months of the ten years of observations of that I am preparing, but, in order to give a more exact idea, however, then that which will result from absolute maxima and minima, published generally alone, I will write the maximum low and the minimum high observed for each month. Thus, in the following table, the maxima figures for January, for example, signify then the highest temperature observed during this month in the space of 9 years, was 28; but, in the lowest of these years, the thermometer showed about 23°2.

Another important element in so extreme a climate is the diurnal variation of the temperature, but I have only gathered some information on this subject in the course of our expeditions. Even at 2500 meters the nocturnal freezings are not rare in the middle of summer (January - February), but they are nearly diurnal and quite severe (up to 4°) towards 3500 m., as the thermogram shows here taken at the foot of the glacier of Juncal at an altitude of about 3400 m., in a rather sheltered place, as it has been chosen for the encampment and where the vegetation was that we normally observed at these altitudes. The temperature of the sun on the other hand is high enough in the middle of the day, and I have observed in the place maxi-
133 ma of 32 and 34° at the end of January, 1910., (Table omitted, p. 132), (thermometer on small board of wood). I will add that the rising and falling of temperature is extremely sudden according as the sun appears or disappears in a determined place.

One sees, therefore, as is natural at this altitude, that we treat with a temperate cold climate, with moderately warm summers and very severe winters: the annual isotherm is 6°5, isotherm that is that of the western part of the Straights of Magellan and of the nortern Tierra del Fuego (XLIX, pl. X). The climate of Puente del Inca corresponds, however, with remarkable exactness, except for a slight retardation of spring, with that of Puerto Gallegos, on the Atlantic coast at 19° latitude farther south, and differs only in its seriously colder winters than that of La Quiaca, 10° farther north (Bolivian frontier), in the northern Andean region of the country; this is shown in the following table, to which I will add the thermic characteristics of the cities of Mendoza and Santiago (Chile), both situated at the foot of the Cordillera, obviously in the same latitude as Puente del Inca. (Table omitted, p. 133).

134 By its isotherms of January and July, corresponding inversely to those of July and January of the northern hemisphere, the thermic climate of Puente del Inca is, on the other hand, comparable to that of central Norway, latitude 65° north.

Atmospheric humidity. -- I have assembled in the following table the average figures for the period 1905, 1914, as well as the extremes observed for each month of the year. (Table omitted, p. 134).

The dryness of the air is, therefore, very accentuated in the high Cordillera of Mendoza, especially during the summer months, and this is positively one of the factors that contributes largely in reducing the vegetal forms. A similar dryness of the air is to be found in Argentina only in the desert region of the extreme north, at La Quiaca, where the average for the year is also 53%, but with an inverse annual curve, the summer months being the most humid; it is the same although in a less marked degree at Andalgala (province of Catamarca, lat. 27°10'5, altitude 1118 m); it is perfectly comparable to that of the authentic deserts, and K. Wolffhuegel (LIX, p. 366) has ascertained the absolute absence of the flea in Puente del Inca, absence

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due according to him to the dryness of air, as is the case in the Sahara (1).

134 (1) Here are, in addition, some facts which will give an idea of this dryness: in order to dessicate the meat which is desired to be preserved, it need only be spread out in the air for several days, on some stones; in several microbiological tests that I have made in camps, the dessiccation of the nutritive mediums in Petri dishes was one of the principal difficulties; the preparation of the herbarium is naturally facilitated, but it happens that the drying may be excessive and that some samples insufficiently wrapped fall in powder.

Rain and snow -- In consideration of the great importance of the rain factor, I carefully copied the very curious results of the observations realized from 1905 to 1914, at Puente del Inca (tables V and VI).

135 In table V, an asterisk signifies snow, until 1911, this had not been measured; in the last years, when an asterisk agrees,however, with a zero, this is, I suppose, when the quantity of snow-fall had been so slight that one could not measure the water from melting in the pluriometer.

These tables, even if they are not precisely exact, eloquently show how rain is an exceptional phenomenon in these mountains: thus, from 1907 to 1910, it seems not to have rained a single time, the precipitations being all produced in the form of snow. (1).

(1) This agrees, moreover, with my observations: during the whole summer, one can camp in the desert valleys of the Cordillera without fear of more than a few days of rain, in general without force or duration, and even without seeing fall a single drop.

From 1906 to 1914, not once did it rain in January, and during the five years-- March, 1905, to February, 1910-- during which the water from the melting snow was not collected, the pluviometer only received five times the measurable quantities. The number of precipitations is, it is true, considerable enough (33 on the average) from May to November, but it concerns, in nine-tenths of the cases, snow and not rain.

I will add that the climate of the Argentine plain, to the East, is extremely dry, and it is only 200 kilometers from the foot of the Andes that the average pluviometer surpasses 400 millimeters. In Chile, likewise, we have 543^{mm}6 on the Pacific coast = near Valparaiso, and 374^{mm}. 8 in Santiago; at about 75 km. from the divortium aquarum.

Our knowledge about the snow region is unfortunately very limited, nevertheless, its biological importance is very great in the high mountains. In fact, on one hand, as it is generally in Alpine climate, the melting of the snow in Spring and its appearance in Autumn normally determine the awakening and the hibernal buying of the vegetation; burying which is protection against the cold; on the other hand, it acts during the Summer as a water reservoir upon which the innumerable springs and rivers that play a considerable role here exclusively depend for it is to the subterranean waters, on account of the almost total absence of Summer rains, that we must attribute the relative abundance of vegetation (see table, p. 136.
137 Table omitted) but it is quite certain, although the exact data may be lacking that considerable variations exist not only in the quantities falling during winter, but also in the distribution of precipitations in autumn and in spring, sometimes very early and sometimes very late.

Lighting and wind. -- With the rather rare rains, so dry air and, in addition,

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137 at the altitudes varying between 2300 and 4000 m. above sea level, one conceives that, in Summer especially, light must be extremely intense.

Finally, the winds are nearly constant; they are more violent on the crests and summits, where they intervene forcefully in reducing the vegetal forms: on the other hand, in the valleys which I have visited, although sometimes very regular according to what direction and the hour in which they blow, their intensity is nothing extraordinary during the summer months, and we must attribute to them but a secondary role from the biological point of view.

Effects on the life of the plants. -- It results from what we have seen, that the climate of the High Cordilleras of Mendoza are extremely unfavorable to vegetation on account of the great dryness of the air, extraordinary scarcity of rains, frequent nocturnal freezes during the summer, slight freezings but more important than the extreme cold of the winter, and by the constant and violent winds discharged from the bottom of the valleys. Dryness being corrected in part, as we have seen, by the abundance of subterranean waters, the xerophilous character will not be , from afar, as marked as in the Precordillera; it is the resistence to cold and the necessity for the defense against the wind, that probably influence it more greatly either by elimination, or by transformation of the types, according to the composition and habit of the flora.

But a more direct effect of various climatic data is the annual duration of the vegetation. Since I was only once in Spring (Nov. 1913) and once in Autumn (end of March, 1918) in the high Cordillera I can not make use of personal observations that permit me to fix the average duration of vegetative activity, extraordinarily variable duration as we know, in mountainous countries, not only according to the years, but also according to the exposition of the wind or to the sun of the places under consideration. Analysis of the preceding tables gives us, however, some
138 precious information for Puento del Inca, situated at the bottom of a narrow valley, at 2700 m, we see, for example (table II), that the minimum average for September and October are respectively -- 2.5° and 0, and the average temperature (table I) which varied from 1°5 to 3°9 in September, rises to 6°8 in October, with some fluctuations of 5°5 to 7°8. It is, on the other hand, the end of September that generally produces the melting of the snows, according to information gathered on the place. We see in the same way that from April the cold spells vary between -3 and -13° (table II) and that the average temperature of 7° falls in May (table III) to 3°, at the same time as the sudden increase of the quantity collected in the pluviometer (water of fusion), indicates to us that winter has commenced. Towards November 20, 1913 -- year, however, rather warm (table I) -- I found in Puente del Inca the vegetation very slightly advanced (rosette of leaves just developed, budding just commenced) and showing considerable delay in the blossoms that we found in full bloom at 25 km. downstream in the valley of the Rio Mendoza, about 2000 m. altitude; but M. Miles Stuart Pennington assured me of having observed at Las Cuevas (3100 m), in the month of September, of a year very poor in snow, the budding of several species around some springs. In March 20, 1918, the impression that the vegetation has given me was altogether autumnal: most of the species had completely shed blossoms, and many were entirely dried up; it is true that most of the springs and rivers were dried up along the slopes; the snow having fallen during the preceding winter was negligible.

We can, therefore, admit that in the valleys and at 2700 m., the period of vegetative activity, extends in the average from the middle of October to the middle of April, or at the maximum a little over six months.

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The fauna

138 The large Mammiferae are represented by the Guanaco (Lama huanacus) still abundant, it seems, in the high Cordilleras, in certain places and in certain seasons, andby foxes, -- and we found some traces of small rodents around some springs, in what I call the oasis, upwards to 3500 m. Besides numerous small birds, and outside of the Condors, rare however, aquatic birds (various ducks: Anas cristata Gm., among mothers, and especially a kind of bustard, the "piuquen," Chloephaga melanoptera Eyton) are common enough on the marshy banks of the rivers, (1).

139 (1) The ducks (patos in Spanish) and the "piuquenes" frequently intervene in the geographical nomenclature of the region: Cordillera de los Patos, Cordillera de los Pinquenes, etc.
and it likewise happens some grallies venture up to these altitudes.

As for insects, three kinds particularly interesting (exist) as medium of fecundation, the Lepidoterae are very rare, above all diurnal insects, in species and individual (I have observed only one species): the Dipteral, particularly the flies, and the Hymenopteral are, on the other hand, abundant and no doubt reach the upper limit of vegetation: it is thus that up to 3700 m., at least, we can observe Hymenopteral plundering the pollen from the Adesmia. Some specimens that I had reported have been lost, but we will find in a work of M. J. Biethes (LI) a list of 26 Dipterae (of which 9 Muscidae and 3 Syphidae) and 14 Hymenoptera collected precisely in the valleys of which I described the vegetation: in all 40 species of which two-fifth come from altitudes above 3000 m.

Civilization

In 1908, during my first and longest sojourn, it was some years before the transAndean railroad passed Punta de Vacas (2300 m.). The bathing resort of Puente del Inca (2700 m.) still very modest, was hardly frequented; we found no roads, no paths, nor flocks, in short no sign of civilized life when we came out from the valley of Rio Mendoza, where the road from Chile and the transAndean railroad pass. Also, it is in the proximity of the latter Spas that I collected the introduced species, evidently foreign to the region. Only one, Convolvulus arvensis, was propagated, already then to a degree of modifying the aspect of the landscape.

Since then the transAndean tunnel has been inaugurated (May, 1910), and although the thermal station of Puente del Inca may be greatly developed, although they may have placed some flocks in the neighboring valleys, and although the old lucern fields of Punta de Vacas extend as far as Puente del Inca, still I did not find, ten years later, any perceptible modifications of the vegetation. I shall return further on, moreover, to this question of the "injurious herbs" (weeds).

II. Various Associations

140 It suffices to have traversed one of the innumerable valleys of the High Cordillera as far as its source and to have climbed some points of the slope that confines them, to have examined the vegetable associations there whose distinction is obtrusive. In fact, we shall have very quickly given account of the following facts: on the bank of the river that flows on the floor of the valley, at least for a ways, exists a thin strip of hydrophilous vegetation, as it does around the springs, frequently on the slopes, and along the streams that descend, streams that often form before reaching the river -- a small marsh or a pond; the bottom

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140 of the valley, when it is not entirely covered with the pebbly layer of the stream, is characterized by the presence of shrubs not over two meters high, form of vegetation that extends to the foot of the slopes bounding the valley; these are in turn occupied by a herbaceous and subarborescent vegetation that at a certain height becomes scattered, disappears, because in the region neighboring the summits, we do not find more than the very small plants of the high altitude scattered among the rocks.

But, as in the latitude that occupies us, there is in the Cordillera neither plain nor plateau, and as in each valley the same distribution of the vegetation is repeated, it is evidently proper to distinguish the four following associations:

Hydrophilous vegetation;
Vegetation of the bottom of the valleys and of the foot of the slopes;
Vegetation of the slopes;
Vegetation of the summits.

The diagram on the next page will also give an accurate idea of the terrains which they occupied.

Hydrophilous vegetation

Although their composition may be far from being entirely different, I will distinguish, for further activity, the four following groupings: the flora of the river banks, that of the marshy terrains; the so called aquatic vegetation; lastly, that of the place that I shall call the Oasis of the High Andes.

142 1. River banks. -- The water courses, we have seen, have the aspect here of torrents with very variable flow, some of which divide into more or less numerous branches displacing a very large and stony bed; under these conditions, a border of hydrophilous plants -- generally a very narrow border -- may appear there only where the current is retarded, in the curves, in the places where the river is considerably spread out or along the shallowest branches.

The most characteristic and constant species are, above all, the Gramineae that reach 50 cm. in height. (1) Hordeum secalinum var. pubiflorum, with violet

(1) In order to assist the reader, I will not include in the text, the Latin names of the cited species with the name of their authors: we will find them easily in the systematic catalogue that terminates this work.

spikes, Agrostis glabra with long red panicles, Polypogon interruptus var. cunitus; then Cardamine nivalis and two other closely related species, all three of which because of habit and taste, recall the cress (Nasturtium officinale). Mimulus luteus, various very closely related Gentiana, with mediocre and very pale blue flowers (Gilliesi G. Pearcei, G. Ottonis), Erigon Gayanus with large bunches of d'Epilobium with small roseous flowers (E. valdiviense, E. Glaucum). Triglochen maritima, and on the side of the slope, the beautiful Senecio chamaecephalus, with large nearly acauline capitula (pl. XIX, fig. 1), or the large clusters of the superb Ranunculus peduncularis var. erodiifolia. From the plain there ascend up to about 2500 m. Baccharis juncea and Baccharis sagittalis. In the sandy places Juncus Lesueuri with rigid and prickly leaves is plentiful, sometimes associated with Hypochaeris glauca var. viridis, while on the bank, growing between the stones, rise tall floral stems of Oenothera (O. odorata var. brachycarpa) and the slender culm of Elymus agrophyroides var. brevimucronatus, similar to beardless wheat, Acaena laevigata with innumerable spherical capitula and, not descending below 2800 m., the odd Rumex crispissimus var. unigibbus, with decumbent stems and strangely sinuous leaves.

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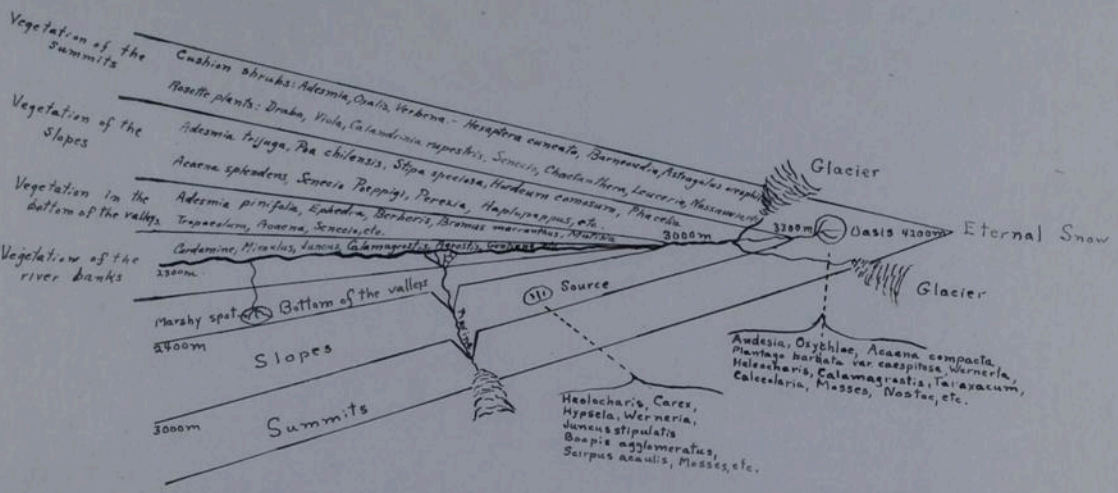

Fig 3 Scheme of the distribution of the various vegetation associations in a valley of the High Cordillera

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142 In the places where the river is divided or greatly diminished and sometimes forms small marshes, besides the species cited above, we find in abundance three, superb Gramineae: Calamagrostis eminens, Roa acutifolia and Deschampsia cordillerarum growing in round clusters 2 or 3 feet in height, clusters composed of an infinity of stems arranged like the radii of the sphere (fig. 4; pl. XVIII, fig. 2).

143 Along the streams descending from the summits and excavating, very often, deep ravines in the side of the slopes, we find the majority of these species, Hordeum, Agrostis, Phleum, Mimulus, Cardamine, Gentiana, Calceolaria biflora, that we shall find further on, then, Juncus scheuchzerioides, distinctly aquatic, the superb Erigeron pulcher with large violet flowers, and finally, especially in the ravines more sheltered from winds by high rocky walls, some herbaceous species with greatly ramified tall stems (1 m. and more) and abundant foliages: Sisymbrium leptocarpum, S. andinum forma dolichocarpa, Valeriana glauca with yellow flowers and Leuceria sonchifolia with bluish or roseous capitula.

2. Humid and marshy places. -- On the sides of the slopes, at all levels, sometimes near the summits, sometimes even on the banks of the torrent that flows to the bottom of the valley, issue forth some extremely numerous springs from whence often rises a river, but still more often, the slightly abundant waters are lost after having formed a marshy spot, overrun, of course, with a series of species having strong affinity for water (pl. IX, fig. 1.) In the same way, before joining the river, the stream that descends from the nearby summits often expands in a small delta at the surface of the cone of dejection that it has formed, and these are other places favorable to the hygrophilous associations. It forms green spots, generally of small extent, covered with a short but extremely dense turf, where the following species intimately entangled and all of very small height dominate less than 5 cm.) Hypsela oligophylla (Lobelioid.), Werneria pygmaea (Composit.), Colobanthus quitensis (Caryoph.), Juncus stipulatus, Ranunculus cymbalaria, Crantzia lineata, then much rarer, Gentiana prostrata (with small flowers), Gnaphalium perpusillum; lastly many Cyperaceae: Scirpus acaulis, Sc. macrolepis, Carex incurva, Carex atropicta form monodynama (in the spring), Helercharis albibractecta; mixed with all this, some mosses among which innumerable small spherical colonies of Nostoc. of the Pruniformia section. A little taller are the following species: Plantago barbata var. elongata, with pauciflorous inflorescences, the very pretty Calceolaria biflora whose rosette leaves sometimes form dense carpets - the Gentiana, Cardamine, Agaena and Mimulus already cited, some Gramineae: Calamagrostis velutina (fig. 5), C. eminens (in smaller form than the preceding) two Koelina (rare), lastly, one of the strangest species of this region and which we only commence to find at about 2800 m., the Calyveraceae Boopis (Hastanthus)
144 agglomerata, the capitula of which, agglomerated and more or less concrescent, form large white deaks 5 to 20 cm. in diameter, surrounded by a crown of leaves and which make one think of a kind of flat cauliflower (pl. XIV, fig. 1, and pl. XX, fig. 1).

3. Aquatic flora. -- The aquatic flora is very poor in Phanerogamae, on the other hand, rich enough in Algae and especially in Cyanophyceae. There does not exist any lake in this part of the Cordillera; even the pools or ponds are rare. In that of Horcones (2900 m), into which the very transparent, but very cold waters (1) descend from nearbyglaciers, I found only Potamogeton pectinatus and Myriophyllum elatinoides in small quantity and sterile, although the bottom disappeared under enormous masses of Chara (Ch. contraria, according to Burkill) and filamentous Algae (Spirogyra, Zygnema, Mougeottia, Cladophora, Oedogonium, Vaucheria) among which numerous Diatoms and Desmidiaceae (Closterium, Cosmarium); M. Speggazzine has found Zannichellia palustris which I have observed, but in great abundance, only in the trans-Andean water reservoirs, between Puente del Inca and Punta de Vacas; in another pool, warmer still (in the valley of the Rio Tripungato, at 2400m.), Myriophyllum elatinoides, in bloom, covered the surface of the water (pl. XV, fig. 2). In the

(1) 9° in Summer: January 19, 1908.

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144 streams through which flow the waters from one of the hot springs of Puente del Inca, Oscillatoria formed enormous masses, and around a spring, likewise hot, in the valley of Rio Plomo, spring whose waters were likewise covered with Oscillatoria, the soil was covered, over a great expanse, with a thick crust formed by the calcareous layer of Chara sp. Conjugaceae and Chlorophyceae of the genera cited, further back are naturally to be found and sometimes in great abundance in the streams and among the plants on the water's edge, as well as numerous Cyanophyceae (Nostoc from the sections Verrucosa and Paludosa, Lingbya, Nodularia, Tolypothrix, etc.

4. The Oasis of the high Andes. -- Here I shall study the hydrophilous vegetation of the high altitudes, from 3200 to 3600 m.

It often happens that at the base of fallen ground or in the middle of an immense moraine, dersert of stones where we only find isolated, one distant from the other, the small plants that constitute the vegetation of the summits, we encounter in a depression of the ground, where the springs spout from between the stones and
147 where, thanks to a slightly favorable inclination, a little sedimentation could be produced small islets of dense and varied vegetation, making such contrast with the absolute sterility of the environs that the name of oasis is to be really imposed. Their form and dimensions are naturally very variable and their largest diameter seldom reachs 100 m. (pl. X, fig. 1 and 2).

The most important element, one of the characteristic plants, however, of this region of the Cordillera, is the odd Joncacea Andesia bisexualis, the systematic place of which I have discussed in another place (V, p. 290): its rigid and prickly foliage constitutes thick carpets or hemispherical pads from 15 to 30 cm. in height, scarcely surpassed by terminal, solitary, brown and relatively large flowers (pl. XX, fig. 1); Oxychloe clandestina, that I encountered only once, forms denser and even larger mats (pl. XVII, fig. 1); besides Andesia, two other species also anemophilous, and that in the same way form more or less extensive dense pads, Acaena compacta and Plantago barbata var. caespitosa, quite different from the variety that we have seen around the springs in lower altitudes (pl. VIII, fig. 2, and pl. XXII, 2). As Phanerogamae I shall cite, moreoever, more or less, developed and blooming with more or less abundance according to the exposition, the Calamagrostis, Heleocharis, Calceolaria, Cardamine and Werneria, all cited further back, and a dwarf form of Taraxacum laevigatum (3600 m.), that so to speak is never lacking. At lower altitudes (3200 m.) we again find Boopis and also Hypsela; where the ground is drier on the edge of the oasis, Calamagrostis velutina var. breviculmis, and a few species on the slopes (Jaborosa, Perezia) that, at these high altitudes, are only encountered there, in the same way as the dwarf shrub Discaria prostrata that we shall find further on.

The cryptogamic flora is also very interesting: on the soil are spread large carpets of Funaria (with which Juncus stipulatus scarcely higher than it, often mixed, while aquatic mosses accumulated in large quantities in the more marshy parts -- Mosses on which we can sometimes find red fructifications of the Pezigaceae Sphaerospora patagonica. In the water, there grow in great abundance some Algae of the genus Vaucheria v. sessilis vel aff.), Eriastrum, a superb Pediastrum reddening in spots the submerged herbs (3400m.) a Diatoma of the genus Fragillaria forming long filaments, and, above all, some Cyanophyceae among which I could recognize in two oases, at 3400 and 3600 m., some species of the following genera: Aphanocapsa,
148 Aphanotheca, Chroococcus, Nostoc div. sp., Anabaena, Hypheothrix and Nodularia. We must lastly cite separately, a Nostoc (section Communia) sometimes covering the soil

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148 for several square meters with a thick carpet of its colonies and, in the rivulets, enormously gelatinous masses of brownish rose that one is astonished to recognize, with the microscope, as being formed exclusively of Diatomeae.

The Bottom of the Valleys and the Foot of the Slopes.

This association is characterized by the presence of shrubs, the highest of which never reach to 2 m., and among which the principal element is Adesmia pinifolia. This Papilionoideae that grows as isolated individuals, is divided from the base in numerous branches, erect, tortuous, slightly ramified and entirely covered with filiform leaves (pl. XXIII, 5); closely limited to the floor of the valleys, it only ascends a little up the slopes on the cones of dejection and on the edge of the torrents, and as its foliage is of a more intense green than that of the other species covering the soil, it often delineates, thus -- at the foot of the mountains, large dark triangles, very characteristic of this region of the Andes (pl. VII, fig. 2; pl. VIII, fig. 1, and pl. XIII, fig. 1). Along the Rio Mendoza and its confluences we find it only between 2200 and 2900, seldom at 3000 m., but it seems that it descends a little more along some rivers south of the province (Upper Rio Salado, according to Kurtz, XIV). I will add that it frequently carries over its branches the small Raffesiaceae Pilostyles Berteroi, that also attacks A. trijuga, and that I observed on this same inhabitant in the vicinity of Santa Cruz, in Patagonia, about 51° s.l. A. pinifolia plays quite a preponderant phytogeographic role and can serve to characterize this section of the Andean flora.

Some other shrubs, the majority of which, however, do not go beyond 2600 m. accompany A. pinifolia on the floor of the valleys: Ephedia americana var. andina, one of the forms of which sometimes reaches two m., Tetraglochia alata anemophilus (Rosaceae), Berberis empetrifolia (1) the most common, Chuquiragua oppositifolia and (1) I found only once, which I think exceptional (dissemination by the birds), a stunted but blossoming specimen, in the oasis of Rio Blanco at 3500 m.

149 Senecio uspallatensis that forms some dense clusters around 50 cm. in height (pl. XIII, fig. 1 and 2).

Although seldom, I will again call attention, because of the strangeness of their presence, to three plants in the form of mats that I never have seen growing in the slopes: these are Opuntia andicola, the unique Cactaceae of the region, which forms large dense hemispherical clusters, sometimes one meter in diameter(pl. XVI, fig. 1), then, a type entirely different, Asorella Gilliesii,representing some regular Polsterpflanzen of the Cordillera, forming dense and hard mats, more or less convex but not lignified, and sometimes surrounding some damp spots; lastly, Laretia acaulis (Umbelliferae) still more rare.

As an herbaceous plant, we must cite, above all, the superb Tropaeolum polyphyllum that rests its short and thick stem on the soil, with erect and very conglomerate leaves (intermediate nodes do not grow longer) and terminating in a cluster of orange corollas with light yellow calyx (pl. XII, fig. 1(, Bromus macranthus extremely abundant (fig. 5), as well as several Acaena (anemophilous Rosaceae); A. laevigata (pl. XV, fig. 1), A. splendens (pl. XXI, 4), A. pinnatifida; then Astragalus Cruckshanksii with fairly large bluish flowers(pl. XXI, 5), Phacelia magellanica (Hydrophyllaceae with light blue flowers), Descurainea canescens var. andina, in places Mutisia taraxacifolia with large roseous capitula one of the most beautiful species of this region (pl. XXI, i), several Senecio: S. rutaceus var. brachycephalus with its beautiful corymbs of ligulate flowers, S. linearis-

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folius, etc., the latter discoid and semi-shrub in form, Doniophyton andicolum (Mutisieae) Pozoa coriacea, small Umbelliferae with entire leaves and dense capitula frequently among the stones, the small odd Polygonaceae, Oxytheca dendroidea so abundant on the ground that its fine dichotomous and nearly aphyllous leaves give the impression of transparent tulle extended over the soil, Gayophytum humile, Oenotheraceae quite similar to the preceding species, Elymus erianthus, Calycera sinuata (pl. XIV, fig. 2) with capitula bristling with points like a mass of arms; lastly, so abundant sometimes that the valley is all white, Convolvules arvensis which is mixed, more rarely, C. demissus (valley of Rio Mendoza, from 2400 to 2800 m.).

It is also on the floor of the valleys, in the blocks of rocks, that I observed, in a very small quantity, the only foliaceous lichen that I may have found, associated with two crustaceous species -- much more abundant-- the one green, the other orange.

If the characteristic elements of this group only go up a very little way on the slopes, the species that cover them descend, on the other hand, almost into the valley: thus Adesmia trijunga is constantly associated with A. pinifolia, as well as Poa chilensis, Hordeum comosum, Stipa speciosa, Jaborosa caulescens, etc. It results, as we must expect, moreover, that this association is by far the richest in species.

The vegetation from the slopes.

Three elements are here wholly dominant: Adesmia trijuga, semi-shrub with whitish foliage that forms some flat clusters 20 to 30 cm. in height (1) more and more dense and perfectly round according as the altitude increases (pl. XXIII, 3), Poa chilensis reaches 50 cm., with prickly foliage but of rather mesophyllous type, and Stipa speciosa, distinctly xerophytic in many forms or varieties (fig. 5), Hordeum comosum, also abundant, with the spike sometimes green, sometimes violet whose flat forms(var. humilis), are the most abundant(fig. 5), Perezia carthamoides var. cuspa (pl. XVI, 2), Mutisieae with cream colored capitula
150 and vanilla fragrance Jaborosa caulescens that hides its small white flowers under its clusters keep green leaves, Calandrinia sericea, small Portulacaceae with white flowers, then roseous Phacelia magellanica, the already mentioned Acaena and lastly the remarkable but previous coronata (pl. XII, fig. 2), whose dark and dense clusters of finely cut leaves, bristle with rigid and sharp hairs, and are surrounded close to the ground with a wreath of large white flowers. Not one of these species is exclusive to the vegetation of the slopes;many, as I have already stated, often descend into the valley, others rise to the higher zone, but this association, although presenting very little of the characteristic element, is no less wholly different from that of the valleys and the summits.

(1) In austral Patagonia at a very low altitude, but about 50° south latitude, it may attain double dimensions.

Some species, however, are characteristic: Senecio Poeppigii, S. depressus (pl. XXI, 3) both ligneous, close to the ground and covered with white hairs; the others are found, it seems to me, only in the crevices of the vertical cliffs. I will cite Calceolaria pinifolia, Haplopappus densifolia, Melica andina, Galium
151 eriocarpum, Eritrichium capituliflorum. It is also, sheltered in a crevice of rocks, that I found at 3600 m., a unique specimen, some centimeters in height, of the only fern found in the region, Cystopleus fragilis.

Many of these plants and especially the more common ones forming some round, flat, rather dense bunches, regularly, separated one from the other, make the

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151 ground appear as if punctuated with dark spots, and this "punctuated vegetation" which we observe not only on the slopes but also on the floor of the valleys, is from the botanical point of view, the dominant characteristic of the landscape.

The summits.

Naturally, it is not the question here, of the high summits that exceed by far the limit of vegetation, but innumerable secondary summits between 3000 and 4200 m., as well as the immediate level below the eternal snows in the highest mountains, level and summits that we reach by either scaling the slopes limiting the valleys or by following these (valleys) to their origin (pl. VIII, fig. 1; pl. IX, fig. 2, and pl. XI). Up there, the normal soils constituted of more or less fine soil are naturally very rare and never occupy but very small extent; these are, near bare rocks, stones, drains and moraines that cover the greatest expanses. It is to this vegetation from the summits that also belong the small oases of the humid places studied further back.

I shall briefly recall the essentially unfavorable conditions that have to support the plants: period of vegetation very short, by November 15 snow has not yet wholly melted at 3000 m., and from April it often starts to fall in abundance- nocturnal temperature several degrees below zero, with or without more or less fleeting snow; during the summer, on the other hand, diurnal temperature relatively high, violent winds, extremely intense light, without considering the direct effects of the altitude too poorly known yet to make a statement on. Likewise, not merely could only some profoundly modified forms grow here, but still we only found here a vegetation, not especially poor in species, but, except in some privileged nooks, extremely poor in individuals, vegetation more scattered, less continuous then could be imagined.

152 I shall study separately the vegetation of the stones, drains and fallen ground and that which,on the contrary, we might call the vegetation of terra firma.

There, then, where a little normal soil is fixed on the summit of a crest, on a flat space at the bottom of a dale, we find an association characterised by the presence of dwarf shrubs with subterranean stems. These curious shrubs are compared ordinarily of a very deep unique root, spreading an abundant system of ligneous branches, thick and sometimes solid, the latter ramifications come to form, very often at the level of the soil, a covering of very small leaves pressed one against the other and that, in certain cases, scarcely exceed the thorns, and that is flat or convex, smooth, dense and solid from which emerges nearly sessile flowers. The more constant in this part of the Andes is Adesmia subterranea, whose pale green discs, covered in summer with quite bright yellow corollas of bright yellow, often reaches 1 m., in diameter and whose old very hard wood makes excellent firewood (fig. 6 and 7, pl. VXII, fig. 2). I also found of the same type, Verbena uniflora with very small squamaceous leaves and Oxalis bryoides (pl. XXII, 1,6). Other less reduced shrubs form some more or less flattened or spherical mats. Discaria prostrata, preferring the humid places and entirely covered in January with small white flowers with a sweet odor, Adesmia horrida (pl. IX, fig. 2; pl. XVIII, fig. 1) and Adesmia hemisphaerica, this last with thick stems covered with wax and whose very round hemispherical clusters sometimes one m. in diameter covered with thorns, seem posed on the soil (pl. XIX, fig. 2; pl. XX, fig.1).
153 These last forms constituted evidently a transition towards those still more specialized than the first ones I mentioned.

Near the shrubs cited further back grow a whole series of small plants the largest of which do not exceed 10 to 15 cm., these are (pl. XXIII to XXV): Hexaptera cuneata (Crucif.), which is the Phanerogam here reaching the highest altitude (4200 m.) but which we already find in the valleys at 2500 m., Astragulus oreo-

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philus and A. Landbecker, with blue flowers and whose pods inflated with air are red veined, some Calandrinia with leaves ordinarily fleshy (C. picta, C. Gayana, C. sericea div. var. C. rupestris, this last more rare but remarkable for its corollas some red and some intense yellow, already described by Reiche as the most brilliant flowers of the region), Aster andicola with small light violet capitula, Adesmia subsericea; then some plants in rosettes, Leuceria scoobiculata var. glabra with white flowers, Draba pusilla, Dr. Gilliesii, very similar to the species of the Alps, Chaetanthera (Carmelita) spathulata, Mutisieae with large sessile capitula; lastly, two species of the genus Barneoudia, B. chilensis and B. major: these remarkable Ranunculaceae whose bearingclosely enough resembles Cerianthus hiemalis, are very abundant in places and we sometimes find in the Spring (15 November 1913, at 3000 m.) their peducles piercing the edges of the heaps of snow left in places sheltered from the sun; the rare somewhat fleshy leaves appear only after the efflorescence; the flowers, that scarcely project beyond the soil, surrounded with an involucrum whose chlorophyl is hidden under a brown pigment, reminds us before and after the anthesis of the fructification of a Geaster. Lastly, some characteristic elements of the slopes, especially Adesmia trijuna, Stipa speciosa f. andina and Hordeum comosum var. humilis, in very small specimens, accompany up to a great altitude (3800 m.) the species cited above. If the conditions are favorable, we can also find Perezia carthamoides, Jaborosa caulescens, Phacelia circinata and even some Acaena (3400 m.). Some rare crustaceous lichens are to be found on the stones up to 3800 m.

The flora of the stones, drains, from the so-called fallen grounds, is much poorer. Here also are , in general, some plants with rosettes, but no acaulous plants. The rosettes are terminals on the end of the subterranean more or less elongated stems. The dominating elements are Hexaptera cuneata, Nassauvia Lagascae, Calandriana picta and C. macrocalyx; then some curious violets of the Rosulatae section (Viola Montegnei, V. Philippii, V. canobarbata); Adesmia debilis, and some very small Mutisieae: Chaetanthera acerosa, Ch. pentacaenoides; morerare, Nassauvia oligocephala, Nassauvia macrantha and sometimes also the already cited Barneoudea. Senecio Hickens, with multiple stems forming flat bunches and where we note the tendency toward the formation of terminal rosettes, is also very abundant in most of the stone drains (pl. XXIV and XXV.).

. . . . . C. Phytogeographic Analysis

Our actual knowledge obviously only allows us to undertake this study, and moreover very imperfectly, of the Phanerogamae that we may, from the geographical point of view, divide as follows:

Autochthonous species:

Tropical and subtropical Andean elements
Patagonian and south Andean elements
Elements of the Precordillera and of the plain.
Cosmopolitan elements.
Characteristic (middle Andean) elements

Species introduced by man.

In this classification I do not prejudge in any way the origin of the species, the center of formation of these groups, or the direction of migrations, questions, in my opinion, too obscure in the majority of the cases. I simply have in mind their actually known geographical area, and I shall arrange, for example, among the tropical and subtropical elements, all those that I have seen conspicuous in the tropical or subtropical Andes.

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176 I believe it useful to eliminate, first of all, this group, slightly important, however. In fact, I believe, we can consider only as adventitious and artificially introduced, the following 17 species. All have been found on the floor of the valley followed by the railroad or in that of the Rio Tupungato, not far from Punta de Vacas:

Bromus unioloides
Poa annua
Polypogon aviculare (1918)
Rumex crispus
Chenopodium album (1918)
Chenopodium hircinum
Chenopodium ambrosioides (at P. de Vacas)
Capsella bursa-pastoris (1918)
Lepidium sp. (L. calycinum ?) at P. de Vacas
Medicago sativa
Trifolium repens (rare, 1908)
Erodium cicutarium
Convolvulus arvensis
Veronica arvensis
Plantago major
Sonchus asper
Medicago lupulina (rare, 1908).

177 Perhaps I should add Lepidium spicatum collected by Güssfeldt at the foot of Aconcagua. The species whose names are not followed by any information have been found several times and in many places: they can, therefore, be considered as common and more or less constant.

Now if we remember that the valley of the Rio Mendoza and Rio Cuevas, followed today by the Transandean was a route already very much frequented at the time of the Spanish domination, a long time before the construction of the railroad was cultivated -- without irrigation, the lucern at Punta de Vacas, cultivation which is today extended up to Puente del Inca, ancient thermal bathing place which has acquired after ten years considerable importance, and on the other hand, if we consider the enormous development that the adventitious vegetation has made after at least half a century, in all the Argentine plain wherever civilization has penetrated., (1) we find that the number of species introduced is very small, without any doubt, on account of the extreme power of the factors of elimination. I will add that I had found almost all these species starting from 1908, that I observed only three new ones in 1918 and that, on the other hand,
178 at Las Cuevas (3200 m. alt.) at the entrance of the great tunnel where was to be formed in a few years a village of workers and engineers, I found only the lone Chenopodium album attributable to the passage of man.

(1) Recently M. R. Sanzin (XXVII bis) published a list of 146 species invading some cultivated places, roads, etc., in the environs of Mendoza, about sixty of which are foreign to the region and nearly all European.

A species might be conspicuous for its extraordinary abundance; this is Convolvulus arvensis that exists everywhere in Argentine, but that I have seen nowhere as abundant as between Puente del Inca and Punta de Vacas. The lucern-grass, in fine, short, reputedly demanding humidity, heat and fertility, frequently escapes from irrigated and cultivated fields where it receives splendid development, and sometimes reappears rather far up on the slopes.

In the adjacent valleys I observed only Rumex crispus, Trifolium repens and Poa annua in the lower course of the Rio Tupungato. This last species has been described by Kurtz (XIV, p. 196) as apparently spontaneous in a much less frequented part of the Cordillera (upper Atuel), and the same author (XXVII, p. 521) gives the species as certe spontanea for the high Andes of Mendoza, San Juan, etc.; we must not forget, however, that it only requires the passage of a mule or a guanaco to propagate this small Graminea, spread everywhere in the plain, where it is a winter or spring plant and that, in summer, is to be found the best in damp places of these high mountains. Taraxacum laevigatum that we find around some springs in the most remote places, at the beginning of all the valleys, appears to me, on the other hand, to be considered as autochthonous.

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178 We shall remark, lastly, that among these "injurious herbs," only four are American (Bromus, Lepidium and two Chenopodium); the others are originally from the Old World.

Cosmopolitan Elements

I have arranged here 28 species whose area of dispersion largely exceeds those of the three following categories, in each of which, moreover, the majority should be represented. We shall find, first of all, nearly all the aquatic plants and several of those inhabiting damp places (Potamogeton, Zannichellia, two Triglochin, three Clarex, Helocharis, Myriophyllum, Crantzia, Veronica Anagallis), and we may, no doubt, add most of the Algae and Cyanophyceae, when they shall have been specifically studied. There also merits pointing out Phleum alpinum, Gentiana prostrata, Cerastium arvense (in several varieties), Taraxacum laevigatum, as well as the species common to the two Americas: Juncus Lesueuri, Nothoscordum bivalve, Ranunculus Cymbalaria, Gilia gracilis.

Tropical and Subtropical Andean Elements

179 The contribution of the northern elements is very slight. I count here only 37 species most of which are only subtropical.

(a) Tropical species. - - The number is very small (16): I shall cite the most important ones: Werneria pygmaea described from Venezuela, but which seem to reach its southern limit here; Juncus stipulatus and Colobanthus crassifolius that extend respectively from Ecuador and from Peru as far as Tierra del Fuego, Cajophora coronata, Hypsela oligophylla and Calamagrostis eminens of Peru, Chuquiragua oppositifolia and Epilobium nivale that extend as far as Bolivia, besides some extremely doubtful species through the Andes of Mendoza (Calandrinia acaulis, for example, synonymous according to Reiche, with C. affinis);

(b) Subtropical species. -- The contingent of the species reaching the Cordillera of Atacama or of the northwest of Argentine is slightly higher (21): Atropis tenuifolia, Scirpus acaulis. Scirpus macrolepis, Oxychloe clandestina, Barneoudia chilensis, Hexaptera cuneata, Pachlaena atriplicifolia exist in the mountains of Tucuman, several Calandriniana and Acaena, Azorella trifoliolata, Phacelia Cumminggi, etc., are known in northern Chile. With respect to the mountains of La Rioja (Sierra Famatina), they are still too slightly explored for us to be able to judge of their floristical relations, no doubt important -- with the central Cordillera; I shall only point out two Koeleria of the High Cordillera, closely related to the species of Famatina (even though the genus, to my knowledge, has not been pointed out for Chile), Senecio eriophyton, and two Chaetanthera.

Patagonia and South-Andean Elements

The relations of the Cordillera of Mendoza with the southern part of the continent are much more marked and they will appear more familiar to us no doubt, in proportion as we become better acquainted with the two domains: it is thus that the last work of Skottsberg (XXX^{bis}) on the Patagonian flora has augmented rather considerably the number of species that are common to them.

I count here some 38 species several of which are very important.

180 Among the Magellanic elements, I shall cite Poa scaberula represented by a new variety (another exists, it is true, in the mountains of Cordoba); Hordeum secalinum var. pubiflorum also Patagonian), several Carex, Heleocharis albibracteata

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180 two Juncus, of which J. stipulatus already cited with Colobanthus crassifolius, Ranunculus pedunculariS, Phacelia magellanica, Plantago barbata. The Valdivian species are much less numerous and slightly distributed: Agrostis araucana, Epilobium valdiviense, for example.

With respect to the Patagonian elements, on account of the very similar climates and absence of a barrier, we can only wonder at not finding them still more numerous, especially(since we have been)given the general resemblance of the forms, resemblance already pointed out by Darwin. Some play a fundamental role in the composition of the vegetal mantle: Bromus macranthus, Hordeum comosum, Stipa speciosa, Scirpus acaulis, Calandrinia rupestris, Barneoudia chilensis, Berberis empetrifolia, Hexaptera cuneata, Draba Gilliesii, Adesmia pinnatifida, Tropaeolum polyphyllum, Calceolaria biflora, Nassauvia Lagasoae, and especially Adesmia trijuga that we find at sea level at 51°, in southern Patagonia.

Although the point in question was the characteristic species of the region, we must still point out the presence of some subAntartic genera, especially in the southern sector of the Cordillera of Mendoza: Elymus, Deschampsia, Caltha, Quinchamalium, Escallonia, Xerodraba, Cruckshanksia; the Ericaceae, on the other hand, do not go beyond, in the north, the Andes of the Neuquen.

Elements of the Precordillera and of the Plain

I only count here 56 species a third of which is at least doubtful, because of the uncertainty that exists as to the exact origin of the samples studied and mentioned by the authors (those ofGillies, Philippi, Kurtz and O. Kuntze); this is why I shall devote myself, first of all, to those that I observed myself.

Although the difference be more marked than we might believe, a certain number of species of the plain and of the Precordillera blend with the first elements of the Alpine zone and form a very distinct level of transition, although narrow. This is so then until about 2400 m. in the valley of Rio Mendoza and of Rio Tupungato; above Punta de Vacas we find, mixed with Adesmia pinifolia on the floor of
181 the valley and at the foot of the slopes, Stipa Neaei, Sporobolus asperifolius, Tetraglochin stricta, Mulinum spinosum, Baccharis juncea, B. sagittalis, Senecio albicaulis and Soldiago microglossa, that are some species of the plain all of which we find at the same latitude, or several degrees farther south, very close to the Atlantic. Others, on the other hand, are more or less characteristic of the upper level of the Precordillera: Ephedra americana var. andina(abundant here and highly developed, much rarer and nearly dwarf between 2500 and 2700 m.), Stipa chrysophylla, Hoffmannseggia, Asteriscium Dipterygia, Lycium chilense, Fabiana denudata, Baccharis rosmarinifolius. Lastly, some species. go considerably beyond 2500 m. descending greatly below the lower limit of the Alpin level.: Epilobium glaucum, Mimulus luteus, Calceolaria pinifolia, Doniophyton anomalum.

Like I have said, the bibliography obliges me to take account here of a number of species; for example, six or eight Verbena of which I doubt very much ever pass 2000 or 2200 m., but as for the region that I have visited, out of 240 species actually known, 27 only, outside of the "injurious herbs," belong to the flora of the lower levels to the well-known plain of the same latitude.

We must also point out some species of the Chilean Precordillera that we still recognize in Argentine only as the High Andes: Valeriana glauca, Cryptanthe floribunda and especially Sanicula graveolens that probably extend from the Chilean coast to the summit of the Cordillera beyond which it scarcely passes to reappear, it is true, in Patagonia, 10 to 12° more to the south. It is, on the other hand, of greater interest that the more important species of the Precordillera stops on the other hand, precisely in the valleys at the level lower than

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181 that which I call the Alpine level; it is thus that, along the Rio Mendoza, the last Larrea nitida, one of the Zygophyllaceae characteristic of the mountain us found at several hundred meters below Punta de Vacas, accompanied by the latter shrubs Verbena and Baccharis and that Schinus dependens with a parasite Phrygilanthus and Cortaderia dioica stop some Kilometers farther down, about 2000 m. altitude, where we find no more than one species typical of the upper level.

Elements peculiar to the Middle Andes

I call the middle Andes the intermediary part between the damp and wooded
182 subAntartic Andes, and the tropical and subtropical Andes. I shall come back later to the geographical limits that we might be able to assign to them. I will add that we must naturally add to the central mass, constituting the Andean chain, some crests and summits of the Precordillera exceeding 2000 m., places where one has found, like we expected, the same types of vegetation, and save for some exceptions, the same species.

As species peculiar to the region, I count 210 Phanerogams, a little more than half of the total figure. We can divide them into two groups: the species known to the two slopes, and those, in so far as we know, peculiar to the Argentine slopes.

Argentine-Chilean species. -- These are naturally most numerous and if some material circumstances did not come too often to swerve our activities and limit our efforts, there is no reason for describing one of the slopes of the High Andes without concerning ourselves with the other, because, although not being identical as we shall see, they assuredly form but one and the same phytogeographic district.

Limiting myself to the species peculiar to this sector of the Andes, I shall cite: Poa chilensis (in a strict sense) (1), Agrostis glabra, Aijona andina, Oxytheca dendroidea, 8 Calandrinia, 3 Cardamine, 5 Hexaptera, 4 Acaena, Adesmia subterranea and 7 other species of the same genus, Astragalus oreophilus and 7 other species, 5 Oxalis as Oxalis bryoides, 8 Viola, Azorella Gilliesii, Laretia acaulis, Gayophytum humile, Verbena uniflora, Jaborosa cauliscens, Trechonaetes laciniata, Boopis agglomerata, 6 Chaetanthera, Leuceria scrobiculata, 8 Nassauvia, Perezia carthamoides, 10 Senecio, that is, outside of the Patagonian elements whose importance has been described further back, nearly all the commonest or the most characteristic species for the most part, also pass on to the Chilean side.

(1) See discussion on the subject of this species in the sustematic part

Endemic species. -- I find 60 by counting some well characterized varieties: it concerns some new species described by Hooker and Arnott, Philippi, O. Kuntze, Chodat and Wilczek, myself and several others. This important number is trebly provisional: in the first place, more than a floristic discovery remains to be made in this vast domain; in the second, with rare exceptions, these new species are only known to us by their original descriptions and more than one is certainly destined to fall in synonymy: thirdly, our knowledge of the neighboring regions
183 is much too incomplete so that our ignorance of the other habitats even is a real presumption of endemision!

We must cite first of all Adesmia pinifolia. Although we do not know the exact limits of its area of disposition. I believe that this species peculiar to the region that occupies us -- region that can be used better than all others, to characterize (pl. XIII). In fact, in the Cordilleras of Mendoza, at the same latitude, we do not find it at an altitude lowe r than 2000 m., even in the

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183 southern part of the province, and when Chodat and Wilczek mention it only for the plain of Atuel between 1900 and 2100 m., I am not certain(refer to the note in No. 167 of the catalogue which follows) that it concerns the same plant. Farther south it does not exist in the Patagonian plain, only region of Argentina where the flora may be relatively well known, and nobody points it out for the Andes of Neuquen, much less explored, it is true. Our knowledge is unfortunately more incomplete still for the Andes of San Juan and La Rioja, but various indications make us believe that the species does not exist there: it does not figure in the rather important collections gathered in those regions by M. Bodenbender; neither Echegaray nor Hieronymus mention it in their catalogues. Further on, in the Andes of Atacama, on the other hand well studied, it does not reappear. On the other hand did it exist in Chile? It seems not: Gillies has gathered it in Argentine territory, and Hooker and Arnott who make it known indicate as its place of origin "valley of Las Leñas amarillas, Andes of Mendoza;" Gay only cites it according to these last authors, but replaces Andes of Mendoza with "the cordilleras between Santiago and Mendoza," that Reiche reproduces word for word, and the specimen of which he speaks in his description (Flora of Chile II) is no doubt that mentioned by Philippi, by number 50 of his Sertum Mendocinum alterum, for the eastern slope of the Cordillera, there remains only one indication of Chodat and Wilczek who recall with A. pinifolia var. dentata, an Adesmia paucifolia var. dentata, an Adesmia pauciflora Vog. (1) from the herbarium of De Candolle, coming from the Cordilleras of Santiago. There is, no doubt, confusion, because it appears very difficult that this shrub, the largest one, one of the commonest, peculiar to the floor of the valleys and furnishing the indispensible wood to the caravans may have not been pointed out on the Chilean slope if it existed there, although all the authors have cited it for the opposite slope. I shall add that for the other side of Paso de la Cumbre, I have not seen it in Chile, in the valley of Rio Juncal.

(1) However, it does not figure in the list published by Burkill, but we find (p. 372), an Adesmia sp. near A. pauciflora Vog., for Puente del Inca. Would there really be a possibility of confusion between these two species?

Among the more interesting species, I shall cite:

Deschampsia cordillerarum
Koeleria, 2 var. nov.
Phippsia Wilczeki
Xerodraba ? mendocinensis
Adesmia hemisphaerica
Adesmia, 6 species
Lathyrus cryophilus
Elatine nivalis
Coldenia decumbens
Boopis, 2 species
Chiliophyllum densifolium
Senecio, 12 species
Mahuenia brachydelphis

184 Not any genus is peculiar to the region.

Conclusions

Nobody, better than I, gives an account of how much the groupings, that I am about to study are, in detail, subject to correction or discussion, and the reasons that I am about to give for considering only as provisional the figures concerning the endemic species, reasons to which we must add the errors of determination, apply to the whole of this classification. Nevertheless, in its general lines, this analysis appears to me very interesting and fertile in consequences that it only can bring to light.

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184 We have then approximately:

Characteristic elements:	argentino-Chilean	150
	endemic	60
	Total	210
Northern elements:	tropical	16
	subtropical	21
	Total	37
Elements from the lower levels:	Precordillera	41
	Plain	15
	Total	56
Southern elements:	austro-andean	10(±)
	Patagonia	73
	Total	83

185 Cosmopolitan elements 28

Adventitious elements 17

From these figures it results evidently that the region studied in this work, although of acknowledged Patagonian character, has direct floristic affinity only with the high Cordilleras of the contiguous Chilean slope and that it must be separated from the phytogeographic point of view, as much from the eastern Precordillera, as from some sectors adjoining the so called Andean zone.

Northern boundary.-- The Andes of Peru of Bolivia, of Chilian Atacama and of Northern Argentina are rather well known, particularly by the works of Weddell, Weberbauer, Philippi; Reiche, Fries, and I have been able to form of the vegetation of the mountains of Tucuman by the collections of M. M. Castillon, Lillo and Jorgensen: these flora have only slight relation with those of the "mendocine" Andes. On the other hand, the information, furnished by the bibliography or that I have been able to find in the herbariums on the centralCordillera of San Juan and Catamarca, is absolutely insufficient and it is, I believe, actually impossible to fix a northern limit to the district studied in this work. we are not aware of, for example, how far it extends toward the Adesmia pinifolia and A. trijuga (1)

(1) I did not find these species in the herbarium gathered in the Cordillera of Espinacito (south of S. Juan) by M. G. Bodenbender.

and even if they exist in the Cordilleras of San Juan. I have the impression, however, by what we know of the Chilean cordilleras and by the rare collections that I have seen, that the character of the flora changes very rapidly beyond 32° latitude and that this region is, in Argentina, the only one too little known to be able to furnish, even today, ample collections of novelties to the botanists who will explore it.

Southern boundary. -- Toward the south, the boundary is more pronounced: the Valdivian forest on the Argentine slope commences from latitude 37°.

It isproper to remark that the Valdivian elements,already numerous in Chile, from 34° appeared only more to the south of this side of the Andes, continuing across the Cordilleras the northwest southeast oblique line general for the dessemination of the species in southern and middle Argentine: it is thus that Libocedrus chilensis is encountered in Chile in the Precordillera of Santiago (34°), while it only appears in Argentina in Neuquen, 3 or 4 degrees farther south. It

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186 is the same for the Myrtaceae, Ericaceae, Ribes, and other genera or subAntartic species like Quinchamalium, Caltha, Escallonia, Cruckshanksia glacialis, that already may appear toward the south of the province of Mendoza.

On the other hand, as a certain number of Andean elements extend less toward the south, not mentioning those that invaded the Patagonian plains, there certainly exists from probably the 36° parallel, a zone of transition, very interesting no doubt but the study of which remains to be made. We may, however, form an idea from the plants collected by M. F. Pastore in the Cordillera del Viento, lateral chain of the Andes of Neuquen (XXIX).

Eastern boundary (or lower).-- In the damp climates, in the Alps, for example, or in other sectors of the Andes, the Alpine level is distinctly characterized by the disappearance of the arborescent vegetation. We miss this characteristic entirely here, for, since it is so far in the plain, the entire country is covered with a uniform bush, the Argentine Monte (mountain) in its shrub form, and this is scarce if we note, in reascending the valleys, that on leaving, a certain altitude, the xerophytic character of vegetation slightly weakens; the landscape becomes a verdant; this is because we find it in the proximity of great water reserves formed by the glaciers and the eternal snows, and because numerous springs spring forth everywhere at the base or on the slopes of the mountains: thatn an increase of humidity naturally accompanies and that a considerable diminsihing of temperature accentuates. This modification of the landscape is due to a profound change, for the present complete, of vegetation. We have seen before that at an altitude of about 2300 m. at 33°, and doubtlessly a little lower toward 35° and 36°, the last elements characteristic of the vegetation of the mountain (Larrea, Schinus) disappeared in the valley, that other less important ones scarcely go beyond this limit and that they are both replaced by an entirely different flora where either peculiar elements or southern species, absent in this latitude in the lower level, dominate.

On the summits of the Precordillera, still but very poorly known, even from the topagraphic point of view there is to be found a large number of species characteristic of the places analagous to the middle zone, but they seem to introduce Valeriana Gilliesii, for example, and many species of the large genera,
187 Acaena, Adesmia, Oxalis, Viola, etc. Unfortunately I do not possess any information on the transitions that may exist between these Alpine islets and the subAndenicflora that surround them, but it is evidently necessary, from a phytogeographic standpoint, to ally them with the High Cordillera.

Argentine slope and Chilean slope.-- I shall not discuss here the limit of the Andean and subAndean level in Chile, where it is infinitely more disputed than in Argentina, because, no doubt, of the damper climate of the western Predordillera, but it is worthwhile to compare the upper level of the two slopes: the resemblance is evidently quite great as the floral lists given further back show us, but, in addition to the difference of the extent reached of the two sides of the Andes, it is necessary to recall, because of the many more northern species in Chile thanin Argentina, the absence of Adesmia pinifolia here on the western slope. On the other hand, some elements that reach in Chile even to the foot of the crest separating the two countries does not pass beyond it(the crest): this is the case of the Alstroemeria and Schizanthus (1) that we find in abundance

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187 (1) Philippi, himself, cites Alstroemeria magnifica Herb. for the Chilean side of the neck "Portezuelo del Portillo" (XV, no. 104).
around the station of Caracoles whose neighborhood theyornament with their large bright flowers and that are entirely lacking in Las Cuevas; other species, Laretia acualis for example, very common in the western side appear very rare on on the eastern side of the divortium aquarum (watershed).

Because of the poverty of the flora of the eastern slope as compared with that of the western declivity -- a poverty but recently proclaimed by F. Kurtz (XIV, p. 203), I believe that it is more apparent than real and due especially to the fact that the Chilean Cordillera easily accessible in every latitude is much better known than the Argentine Cordillera. The large genera, such as Calandrinia, Adesmia, Oxalis, Viola, Aster, Senecio, Chaetanthera, Nassauvia, etc. , contain, in fact, a much larger number of Chilean species, but I shall remind(the readers) that only a very small number of valleys have been explored on this side of the Andes, and that I have observed in my trips that, if the flora in general is extremely constant, I have never ascended or visited a valley where I had not been before without finding there a species that I have not found elsewhere. As I have already stated, I am absolutely certain that a whole new exploration will enrich, for a long time to come, without doubt, our catalogues of the Andean flora.

188 The result then is from this long analysis that, from the Phytogeographic standpoint, the High Cordillera of Mendoza, Alpine level of this part of the Andes, is characterized by a flora almost entirely different from that of the plain and of the Precordillera in the same latitude and that, although marked with a vigorous Patagonian character, likewise, appears very different from the subAntarctic or tropical flora. It is reduced to a narrow strip, the lower altitude of which, in the valleys, varies, according to the latitude, between 2300 and 2000 m.; a strip to which we must add the crests and summits of the lateral chains surpassing, at least, 2000 m. It seems to constitute nearly the whole of a sector of the Andes that we may, because of the Argentine geobotany, call the middle Andean sector, sector bounded on the south, about 37°, by the Andean level of the Valdivian forest, and to the north, by the subtropical sector in a latitude(30-31°) that we can not yet determine, the central cordilleras, very inaccessible, of San Juan, La Rioja and Catamarca being but a trifle of the unknown territories as far as their vegetation is concerned.

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Desiderata

Seed of: Clematis

Stipa

Labiates, esp. Stachys

Corn, Peruvian native

Oxalis rosea -coll. earlier in Prov. Valparaiso, S.W. slope of Campana de Quillota; trail from Quepué.

Poissonia

Berberis

Bromeliads

Verbena

Viola

Cultivated annonas

Rubus

Godetia

Lycopersicum and other Solanaceae, including seed of potato, but no tubers

Carica

Alstroemeria

Palms, esp. the Wax Palm

Calceolaria

Apium

Antirrhinum

Living specimens:

Utricularia

Fragaria, cuttings to be sent by air express.

Stylocereus, as per directions of Blandy Farm.

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Disregard Genlisea - entirely Brazilian.

Memorandum re collecting of Utricularia
and Genlisea (Lentib.)

Floating species of Utricularia less important than terrestrial. That is to say, float-

sp. are more easily seen because expected.

To find terrestrial spp. best hint is: Look for yellow, blue or purplish, more rarely white flowers, one to several, raised on slender peduncles in wet places. Flowers of the snapdragon type, usually small. Then look for leaves which will be small in rosettes or not, often very scattered. To get a good specimen of the parts in the substrate dig up the substrate about base of peduncles and if soil is loose wash away water. If entangled with roots, pickle a good mass with peduncles attached.

Flowers of Genlisea and Utricularia are very similar. Genlisea has traps buried in the muddy bottom of shallow water or just mud, and look like roots superficially, but at always once forked and have a bulb somewhere midway their length. It is a compact growth, while Utricularia is loose and spreading, the traps small and colorless(or blue to purple if exposed to light.) Traps of Utricularia terrestrial sp. may be as small as 0.5mm. but usually one to twomm., those of floating spp. larger, 2 to 3mm.

Of floating spp. which are sometimes bulky, take say two or three leaves attached to the stem from mature but not too old parts. Entire plant as herbarium specimen.

Genlisea has a compact rosette of leaves, rather conspicuous if small.

Underground parts of both Genlisea and Utricularia must be dug. If the peduncles are pulled up by hand, nothing sticks to them, or rarely if in loose mud, and the specimens are well nigh useless.

One good plant in formalin is better than a hundred badly collected.

In jungle country or at least where there are trees and moisture, Utricularia may be epiphytic, some spp. with large (1 - 1.5 inch) flowers. The stolons grow in the wet moss like orchids, Bromeliads. One or two spp. of Utric. grow in the water held by Bromeliads.

"I know only one station on west slope: Utricularia Gayana DC. Prov. Coquimbo, Dept. Ovalle, El Paqui, La Paloma, alt. ca. 400 M. Coll. Dr. E. Werdeman, no. 932, 1926. (This is a floating sp. allied to our U. gibba.)

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S.A.
Letters of Introduction
See "I" Section of file.

Argentina

Mr. Carlos A. Newbry, Buenos Aires -Sibley

Bolivia

Mr. Fred P. Gerbracht, La Paz -Sibley

Chile

Mr. Roland W. Barr, Rancagua -Sibley
Dr. Atilio Macchiavello, Santiago -Moe

Peru

Archibald Balfour, Lima -Logan
Mr. Leon J. Rosenshine, Lima -Sibley

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Memorandum re collecting of Utricularia and Genlisea (Lentib.) -- continued

A sure guide to them is water. Ponds slow running stream and even more swiftly running streams (there harbor one known sp. attached to the rocks and sending up its flower shoots above the surface. Sandy soil which is wet for some months during the year and any kinds of swampy country may yield spp. either freely floating (in ponds, lakes) or anchored in the substrate. In the warm tropical (and perhaps even temperate if wet) one should keep the eye peeled for epiphytic forms which look like orchids, flowers large and conspicuous. Some grow in mossy banks and the like, some in Bromeliads; in desert country, if they are present, they may be looked for in sandy wet soil, usually temporarily wet if the rainy season is marked and the terrain suitable for catching and holding the water. Wherever water is there may Utricularia and Genlisea be also.

Collecting. It is most important to collect the parts in the substrate in case of terrestrial species. Floating species are no trouble but call for a lot of formalin because of their size. Except that there are some very minute species growing in shallow quite water or wet mud - flowers only 2-4 mm. long. These have been collected only twice. The material should be preserved in alcohol or formalin its only the flowers that really need the alcohol, since they get badly crushed in formalin. Formalin is easier to manage on expeditions. Vials 2x10 or 2x15 cm. will do the trick. Pickle bottles for the larger floating forms. The hardest is washing out the soil, etc. from the substrate parts. If it doesn't come away easily, better preserve the whole thing. Its a con amore proposition.

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To increase our knowledge of the Alpine Flora in the northern part of Argentina

by

Rob. E. Fries

Introduction.

The present work is the result of my participating as a botanist in the Swedish Chaco-Cordillera-Expedition 1901 - 02 to the plateau, which is situated in the northern part of the Argentine Andes and is locally called " Puna ". This is a part of the large plateau, which extends from the Titicaca-basin in the north, running through Bolivia towards the south into the northern part of Argentina and northern Chile, and which is divided into several secluded basins by high or low mountain-ridges, which are conspicuous by the absence of water. I had the opportunity to travel in one of these areas, which is a long, narrow, coherent plateau, extending from the north to the south. However, the northwestern corner of it is defined (limited) by a mountain-ridge,-- the Sierra de Cochinoca -- and in this way forms really a small shut-off water system. Although I did not travel in this part myself, I have included it in the following description, since I had a large, valuable collection of plants from that part at my disposal, which up to now has not been studied.

The largest part of this territory lies in the province of Jujuy; only the most southern part of it belongs to the province of Salta, and the western edge forms a part of the Atacama territory (Gobernacion de los Andes). This is approximately 280 km long, it reaches about from the 24° 25 to the 22° of southern latitude; its width is narrow and changes between 60 and 100 km. Separated from the territory which is lying south of it by the 4800 m high mountain pass Abra de Acay extends the plateau in almost northern direction up to the Bolivian frontier; however, not far from the frontier, this plateau is limited in the north by low mountain ridges, which form a parting-line of the waters towards the Bolivian high-plateau. The frontier in the east is formed by irregular, partly very high mountain-ridges, the position of which is plain, if we connect the Abra de Cortaderas, Abra de la Cruz, Abra de Tres Cruces, Sierra del Aguilar, Abra de Lipan, Abra del Angosto, Nevado de Chañi, Abra del Palomar, also Nevado del Acay with each other on the map. The western parting-line of the waters is formed by an irregular line of Queñoal, Sierra de San José Cerro Cabalonga, Cerro Tocal, Cerro Hornillos, Cerro Morado down to Abra Colorada.

Chapter III. Plant Formation

The meteorological conditions, which we have described here are the cause of an alpine flora, and in case no edaphic factors are added, a strong xerophilous flora develops. Naturally, the increased rarification of the air, the stronger light and the severer climate exert such an influence, that we encounter above a certain altitude (which is approximately 4500 m) a different formation as to their characteristics and their composition of species, than in the relatively lower situated regions (namely the Azorella formation), which, in higher regions --- 5500 to 5700 m above sea level --- has to make place again for the sterile Lichen-desert (Flechtenwueste). Disregarding these meteorogical factors, only the edaphic ones of the distribution of the species

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on different plant formations are considered here. Uniform edaphic conditions generally seem to produce quite uniform formations in the whole area; however, the conditions seem to be somewhat different in the north, since we find some species there, which seem not to exist in the other parts of the area. However, I had little opportunity to investigate the northern part, since I only got acquainted with the flora there, when I passed through this territory from Moreno to Bolivia. The general statements which I have made here, however, also hold good for that part.

The edaphic factors, which condition the distribution of the formation in the area, are based upon the moisture of the soil and its chemical composition and physical formation.

The variable degree of moisture in the soil is conditioned --- not taking the eternal snow on the highest mountains, which produces only a poor microscopical flora into consideration --- by brooks, which flow down in several places. We find in these brooks a pronounced hydrophilous flora (of the Potamogeton filiformis formation). These brooks, however, irrigate more or less the adjoining soil, according to local conditions, thus forming a kind of damp meadows (the Hypsela formation). If these brooks contain sufficient salt, we find instead of the mentioned meadows in some places a halophilous marshy country, where a xerophilous flora grows on account of the salt. (the Salicornia formation).

However, there are only a few brooks in the Puna territory and the largest part of it is barren land. The vegetation consists of several formations, according to the physical formation and the chemical composition of the soil. The sandy, stoneless soil of the high plateau is covered with shrubs (the Hoffmanseggia formation), and it is distinctly separated from the Cactus formation, which covers the stony high plateau of the mountains. On the above mentioned quicksand downs we find a few quicksand formations (the Patagonium arenicolum and the Lampaya formations). As regards the chemical composition of the soil, only the absence or the presence of salt seems to have anything to do with the difference in the formations. In contrast with the four mentioned formations, the Sporobolus arundinaceus and the Lepidophyllum formations are conditioned by salty soil; we find the first one on the sandy salty banks of the Salinas grandes, the latter one we find in less salty and more muddy soil.

These are the plant formations which I think have to be considered in this territory. For a better understanding I am making a list of them, before I start to describe each one separately. In order to have a complete list of the flora of the Puna, I am going to describe the cultivated plants and weeds, which have been brought in by men, last.

A. The Hydrophytes formation
   1. The flora of eternal snow
   2. The Potamogeton filifornis formation
   3. The Hypsela formation

B. The Xerophytes formation
   Non-halophytes
   4. The Hoffmannseggia formation
   5. The Cactus formation
   6. The Azorella formation
   7. The Lichen desert

   Quicksand formations
   8. The Patagonium arenicola formation
   9. The Pampaya formation

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Haplophytes
10. The Salicornia formation
11. The Lepidophyllum formation
12. The Sporobolus arundinaceus formation
C. Cultivated plants and weeds.

The flora of the eternal snow.

I had only once an opportunity to get acquainted with the flora of the eternal snow region. This happened (on Nov. 29th 1901) on the Nevada de Chañi, where I collected samples of snow from an altitude of 6000 m. When I examined them, I found that they contained only a very limited flora of two species of Diatomaceae.

The Potamogeton filiformis formation

Open waters are very rare in our territory. There are only a very few small fresh water ponds or ditches. They have been formed by rain water, which has collected in holes, and which dry up during the dry season, leaving a barren spot without any vegetation. There is no macroscopical flora in these pools. The Laguna Colorada, which has been charted on the map is such a pond of larger dimensions; When I was there, it contained water hardly a foot deep after it had rained for several days, and there was absolutely no vegetation. Undoubtedly it dries up entirely, sometimes leaving a barren plane without any vegetation. Similar conditions are found in the large Lagoons de Guayatayoc and de Pozuelos (Brackebusch I p. 156). As regards the flora of the open waters, only that of rivers and brooks comes into consideration. The Puna territory has many brooks, but a part of them dry up during the dry season, some of them gradually disappear in the sand and only a few of them reach the Salinas grandes. In fresh water brooks, or in those with but a slight contents of salt, a characteristic limnaea formation appears in suitable places where the water is flowing slowly. The composition of it can be seen in the following two habitats of different places.

I. A brook near San Antonio de los Cobres, 3650 m above sea level (Nov. 6th). The brook is a few meters broad and 1 - 2 dm deep. The bottom is stony and sandy. The water is clear and tastes sweet, but on the banks it deposits a little salt. The vegetation in the water is poor in species, there are only Potamogeton filiformis and here and there in places, where the water is standing still, we find a small carpet of Myriophyllum elatinoides. Near the brook we find occasionally water holes or puddles which, when the water is high, connect with the brook. In these holes we find a richer flora; there are Potamogeton filiformis, Myriophyllum elatinoides and Zannichellia palustris, also one or the other species which usually belong to the species of the sea shore, which accidentally have become " submers ", as for instance Crantzia lineata (sterile) and Ranunculus Cymbalaria var. exilis; a green algae flora is found intermingled with this vegetation.

II. In another little brook near Moreno (3480 m above sea level) which was about 3 dm wide and about 1½ dm deep, running through a damp meadow, the following species were found:

Potamogeton filiformis: forming a copious carpet on the bottom.
Zannichellia palustris: copious in some places, forming carpets.

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Chara foetida (?) rare, but forming thick carpets on the bottom in those places where they were found.

Myriophyllum elatinoides: sporadic, especially in quiet places, nooks, holes a.s.o.

Crantzia lineata (sterile, elongated leaves, a couple of times as long as usual) Ranunculus Cymbalaria (with floating leaves) and Cardamine flaccida subsp. minima (growing on the bank of the brook and forming a transition to the Hypsela formation). In some places the edges (of the leaves) and sometimes the entire surface of the leaves were covered with green algae or the algae had grown through the leaves now and again, especially on Enteromorpha sp; between these algae we often find thick carpets of Azolla filiculoides and Lemna minima, which are held by these algae. The latter species is less apparent on account of its small growth.

The formation which we have described here reminds us very much of conditions which we knew from other places. For example, B. Dusén (II) has described similar conditions in the prairies of the Tierra del Fuego, where the same or closely related plants grow in similar places. A few of the mentioned species are indigeous to Europe (Potamogeton filiformis, Zannichellia palustris), and the others are represented by closely related, corresponding species (Myriophyllum, Lemna, Azolla 1)).

1) Azolla filiculoides has been brought even to Europe, and in some places has become acclimatized (in Holland, according to Bernard I, in France, according to Ducamp I a.s.o.).

There are a few places in our territory where we find hot springs, as for example east of Casabindo and also near Incachuli at the border of the Atacama region. I only investigated the latter one. It is situated about 5000 m above sea level and the water is about 50° warm when it sprouts from the earth. However, we could not determin the temperature exactly, since our therometer registered only up to 40°. Round the source a small round pool of about 20 m diamter, 3 - 6 dm deep had formed on an offset of the steep mountain slope, which was bordered (towards the slope) by a 1 dm wide wall. The temperature in this small pond was 35 - 37.5°; the latter temperature was found to be near the source. The water had a slight salt contents. The Phanerogamae were represented only by Ruppia maritima; this plant still grew at a temperature of 37.5° and formed a dense carpet upon the bottom of the pond. However, it could not stand a higher temperature. The habitat of this species, which is usually found at the sea shore is quite interesting in a place of warm water at such an altitude.

The Hypsela formation

On the banks of the brooks in our territory which in certain places spread out in larger or samller meadows of low, dense, green growth, another hydrophile formation is found, which by one of its characteristical plants can be determined as Hypsela formation Moisture, caused by fresh water or water with a slight contents of salt, on or close to the surface of the soil is necessary for its existance. This damp soil may be a few meters wide, according to the nature of the banks, and it will reach as far as the water of the brook can soak through; consequently, there is not much of the Hypsela formation in places where the banks are steep, but in places where the banks are flat, we find small meadows. In fact they represent in miniature those conditions, what forests are in prairy formations which are bordered by rivers; the vegetation is

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conspicuous by its fresh, green color and differs from the more or less gray and poor vegetation, just as we find the conditions in the gallery-forests of the prairy.

We encountered this formation on high plateaux as well as in higher altitudes even as high as 5000 m above sea level. The composition of the species is practically uniform in the different altitudes; yet in higher altitudes we find some species, which are not found in an altitude of 3000 to 4000 m. Some species probably will disappear in high altitudes, and in order to find out the fact, careful observations will be necessary.

For an example we are showing a composition of the different species of a meadow near Moreno, which was about 10000 qm large. The soil was a little moist, but we could walk over it without getting our feet wet. We made the investigations on Dec. 19th. and found the following species:

Triglochin maritimus var. deserticola forms a thick carpet which is intermingled with the following plants: Werneria pygmaea (many), Hypsela oligophylla, Plantago tubulosa and Eleocharis melanocephala (a few), also Juncus Lesueurii (standing by themselves and raising their culms a few dm above the ground.

Heterothalamus acaulis, Arenaria revularis, Scirpus atacamensis and Distichlis humilis grow in a little dryer places, such as small mounds and other elevations.

Here and there small brooks flow through the meadows; naturally the soil becomes more moist and we find yet other species, thus changing the composition of the species; in those places we find: Cotula pygmaea, Hypsela oligophylla, Plantago tubulosa, Mimulus luteus and parviflorus, Colobanthus alatus, Juncus stipulatus, Eleocharis melanocephala, as well as Crantzia lineata, Ranunculus Cymbalaria and Cardamine flaccida subsp. minima the last three species are frequently submerged in the water of the brook, thus forming a transition to the proceeding formation.

However, Hypsela formations are frequently not so rich in species as the mentioned examples. For instance, the banks of a brook near San Antonia de los Cobres (3500 m above sea level) were covered with a Hypsela formation 2 - 3 m wide, which consisted of the following species: Triglochin maritimus var. deserticola (frequent) Crantzia lineata and Distichlis humilis (plenty) also Heterothalamus acaulis (scarce).

The following list shows all the species of a typical Hypsela formation which I found:

Heterothalamus acaulis
Cotula pygmaea
Werneria pygmaea
Hypochaeris stenocephala
Hypsela oligophylla
Plantago tubulosa
Mimulus luteus
Ranunculus Cymbalaria var. exilis
Colobanthus alatus
Arenaria rivularis
Calandrinia occulata
Juncus Lesueurii
" depauperatus
" stipulatis
Mimulus parviflorus
Limosella aquatica
Gentiana limoselloides
" podocarpa
Crantzia lineata
Cardamine flaccida subsp. minima
Ranunculus Cymbalria
Elocharis melanocephala
Scirpus atacamensis
" acaulis
" nevadensis
Sporobolus fastigiatus
Distichlis humilis
Poa annua
Triglochin maritimum var. deserticola

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Furthermore, the following species were found only in higher altitudes:

Distichia muscoides near the Cuesta del Acay, also on the Nevado de Chañi; in both places at an altitude of about 4500 m ;

Luzula racemosa f. humilis:on the Nevado de Chañi, about 4500 m above sea level;

Scirpus desarticola: near the Cuesta del acay, about 4300 m above sea level,

also a small Crucifera species with yellow flowers, which so far has not been determined (see below in the systematical part): in the vicinity of Chorrillos (about 4500 m above sea level) and near Incachuli (about 4800 m above sea level).

The Hypsela formation is generally well delimited, and quite a characteristical formation in the territory. Sometimes, we find points of contact with the Salicornia formations which varies according to the increase or decrease of the salt in the soil. As we have mentioned before, it approaches also the Potamogeton formation through species which have partly land forms and partly water forms. Generally speaking, however, they are pretty well delimited.

In connection with the Hypsela formation we wish to mention another one, which has a higher and more luxuriant growth, and these plants are quite characteristical on edges of ditches, in fields and meadows near Moreno. I have only noticed them in places, which had been artificially made by men, such as ditches, fields, meadows etc. etc., and for this reason I just mention them in connection with the other hydrophilous formations, without discussing them in detail. The species which belong into this class differ from the types of the Hypsela formation by a higher growth with elongated axis as shown in the following list of species:

Rumex crispus	Juncus Lesueurii
Sisyrinchium chilense	Eleocharis palustris
Scirpus nevadensis	Bromus unioloides
Carex macrorrhiza	Hordeum secalinum var. chilense
Poa annua	" andicola
" laetevirens	Triglochin palustre

The Hypsela formation is conspicuous by the fact that all species which belong to it are green all the year round; the fresh green shows off distinctly against the more or less gray color of the rest of the vegetation. Furthermore, it is characteristical by its thick growth, and by developing a strong subteranean system and also by the fact that the parts above the ground are reduced to a minimum. Juncus Lesueurii only deviates from this rule, it has straight upright culms, which are one or two dm long, Scirpus nevadensis has culms 1 dm long. Besides these two species, there is no other one among the typical Hypsela formations of which the parts above the earth are longer than 1 dm or perhaps a few cm.

The rosette-type is found almost exclusively, and it is more or less sharply defined. The flowers or the inflorescences grow on very short stems, for example, on Ranunculus Cymbalaria (up to 4 cm long), Juncus stipulatus and Eleocharis melanocephala (1 - 3 cm), Poa annua and Triglochin maritimum (2 cm), or the stems are entirely missing. The compositae (Cotula, Werneria pygmaea, Hypochaeris stenocephala are fine examples; the most interesting one of them is the species Heterothalamus acaulis, which has not yet been described (see table IV, Fig. 4) as a representative of a genus, which distinguishes itself by high growing, shrubby forms. Furthermore, Hypsela oligophylla has to be mentioned; a large part of its petiole is lying under the ground in such a way,

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that the small oval leaf blade hardly raises above the surface of the ground; the flowers grow on short (hardly 0.5 cm long) stems, which grow from the leaf axis and hardly raise up to the surface of the ground, in which the lower part of the tube is hidden; furthermore, Plantago tubulosa produces stemless spikes with one or two flowers from the axis of the rosette leaves; Arenaris rivularis, Calandrinia occulta, Juncus depauperatus, Scirpus acaulis and atacamensis are also good examples, because they belong to genera, which usually have flowers or inflorescences with long stems.

The position of the flowers and inflorescences, which they occupy on account of the short stem in such a dense, coherent carpet, seems to act unfavorably to the pollination and distribution of the seeds. I observed that ants, which crawl round the ground, help to transfer pollen on Crantzia lineata and Hypsela, flies also perform this act on Hypsela. 1)

1) The ants crept entirely into the Hypsela flowers, while the flies entered them only with the front part of their bodies; the pollen attaches to the back of the visitors. The flowers are proterandrous; the emission of the anthers takes place in the usual way as in all Lobeliaceae.

Ranunculus Cymbalaria was visited mostly by small ants and small flies, but Heterothalamus acaulis attracted only flies. In spite of my careful investigations, I never saw the flowers of the Mimulus species, which have a proterogynous irritable stigma and which are typically built for entomophilous pollination, visited by insects. In older flowers the lobes of the stigma are less irritable, the filaments grow longer, so that the anthers get into a position of equal length with the stigma, thus making self-fertilization possible.

Plantago tubulosa is well adopted to anemophilous pollination; this plant exposes its anthers 2 cm above the vegetative carpet on filaments, just as we find conditions with Litorella.

In order to expose the fruit, it is often necessary that the stems of the flowers and inflorescences grow longer during the post-floration. In Cotula pygmaea the stems of the flowers, which during the time of blossoming hardly do exist, grow up to 1.5 cm, when the fruit ripens; in Hypsela oligophylla this stem often grows longer too, so that the fruits are raised just a little above the surface of the ground. The blossoms of Colobanthus alatus and the inflorescences of Scirpus atacamensis, which at the time of blossoming are hidden between the rosette leaves, grow a stiff, 1 - 2 cm long stem during the stage of fructification, thus exposing the fruits very well. Plantago tubulosa and Gentiana podocarpa behave in a similar way. In the first plant, the part which lies between the ovary and the calyx --- the gynophore --- grows 2 cm, or even 3 cm long, in the latter plant, it grows up to 2 cm long. 2) Another example for this peculiar behavior is Gentiana sedifolia, which is closely related to Gentiana podocarpa and is at home in this territory, but I have not observed it myself, but I am sure that this species can be classified with the Hypsela formation according to existing reports.

However, species with elongated, above ground axis are not entirely missing, but their shoots are creeping along the ground. Cotula pygmaea has a strong, ramified stem, several cm long, which is creeping above the ground; it withers from behind (meaning the part which grew first) and often has internodes, which are up to 1.5 cm long; usually, however, they are much shorter; this

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stem is kept to the ground by means of a strong root system more than 1 dm in length, which grows out of the nodes. Similar conditions exist in the Mimulus species, in this case, however, the internodes are usually more elongated and may reach a length of a few cm up to 7 cm. The roots of Cardamine flaccida are also lying horizontally above the ground; these are more slender and have internodes 1 0 1.5 cm long. Ranunculus Cymbalaria and var, exilis have stolons, which radiate from the leaf rosette; they obtain a length of 2 - 3 dm and have internodes ½ - 1 dm long; they grow shoots with roots out of the axis of the cataphyll. --- All these species have one thing in common, namely, they grow in moist places very close to the water of the brooks (see page 21), or in open places.

The subterranean parts are, as we have mentioned before, well developed. Only a few species are annuals. Poa annua, Gentiana podocarpa, with a fine main root, about 0.5 dm long, belong into this category, perhaps Colobanthus alatus as well, having a slender main root, from which numerous lateral roots grow (biennial or perhaps perennial). Poa annua is an annual and frequently a perennial; specimens, which had been collectd at the beginning of the vegetation period still showed withered inflorescences from the passed year. These specimens had grown in thick and more compact lawns and in closer vegetation and differed from the others by shoots, which developed short, fine stolons. 1)

1) Bonnier (I) states, that Poa annua can be a perennial in high altitudes of the Pyrenees (see Costantin, I. page 166).

All the other species of this formation are definitely perennials, namely in different ways. Hypochaeris stenocephala has a strong tap root, which sometimes measures up to 1 cm in diameter. This plant is very closely related to Plantago tubulosa. The main root,however, is short and cone shaped, but its main functions is taken up by the numerous, 1 dm long, straight and strong lateral roots; finally the main root dies. In consequence of the steady, but very slow monopodial growth, which is followed by a disintegration of the lower part (first on the main root, but later on also noticible on the older part of the stem), the plant has during an older stage a stem, which is approximately 1 cm long and 6 - 8 mm thick, which carries at the top a dense leaf rosette with axilar inflorescences, and it has a system of long lateral roots at the lower end. Sometimes we find a ramification of the rhizome, but very rarely.

In contrast to these species with vertical rhizome, there are quite a number of species with more or less horizontally creeping rhizome. Werneria pygamaea and Triglochin maritimum var. deserticola have stronger, short but less ramified prostrate stems, which are lying closely under the surface of the ground. Their root system consists of numerous, long, thick, white not ramified roots; one of the collected specimens of Triglochin has such roots, which are 22 cm long, although not all of them could be taken out of the ground.

Eleocharis melanocephala can be considered as a type for another group of plants, which, on account of their great number and particularly on account of the large number of individuals, play the most important rôle in the Hypsela formation. On Eleocharis melanocephala the rhizom is lying deeper than on the two former species (approximately 3 cm under the surface); same is finer and it streches out longer distances. The vertical part of the link is not ramified on its lower, 2 cm long part, however, it shows a profuse ramification above ground, so that small fascicles develop there. This condition makes the plant look like numerous, small fascicles,

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which grow on stems about 2 cm long of an unusually ramified, creeping rhizome. As regards the main axis, many Gramineae, semi-Gramineae and Juncus species (Sporobolus fastigiatus, Distichlis humilis, Scirpus atacamensis, deserticola and acaulis, Juncus depauperatus and stipulatus) conform in this respect, also some Dicotyledoneae (Hypsela oligophylla, Crantzia leneata and Arenaria rivularis). The interesting Heterothalamus acaulis, which is shown on table VI. Fig. 4 is closely related to them. The ramified stem, which creeps horizontally about 8 cm or more under the surface grows monopodially, sends more or less lateral shoots vertically towards the surface of the ground. A few cm under the ground, they are ramified in a few vertical axis, which are a little slanting or arched; the part, which is lying under the ground is formed by 3 - 6 mm long, scaly cataphylls, which soon fall off the internodes and which end on the surface in a thick foliage leaf rosette and carry a sessile, terminal blossom. After the blossom has faded away, the stem on which it grew, dies.

The last mentioned species are characteristic to the Hypsela formation by their rich ramification, and far creeping strangely entangled rhizome, which is the cause of the solid carpet. It is almost impossible to separate the different species at all from this compact chaos. 1)

1) I have even seen that the rhizome of one species has drilled holes through the rhizome of another species, and then grew through it. (Distichlis through Heterothalamus).

Furthermore, we find the previously mentioned species intermingled in this chaos.

The Hypsela formation is, however, quite common (wide spread) in the Andes. We read in the travelling impressions by R.A.Philippi about the Hypsela formation in the alpine area of the Atacama desert, although the author has not emphazised this condition. In the northern part of Chile this formation corresponds with the " meadows of the high mountain valleys " so called by Pöhlmann (I), and which, according to his statements, are found there at an altitude of about 3500 to 4500 m. However, Pöhlmann has summarized different formations under this name; it is quite evident, that he has placed this category into the one which we called Potomogeton formation, he also mentions amongst other species Myriophyllum elatinoides and Lemna minor. Furthermore, he does not delimit the related halophile formation, but he mentions **Frankenia** triandra, which is so characteristic of the last mentioned species.

The Hoffmannseggia- the Cactus- and the Azorella formation.

Perhaps it would be advisable to discuss these three related formations at the same time; all of them take up an enormous part of the Puna, and considered as a whole, they give it a peculiar appearance; they are all xerophile brush formations and have numerous species in common. Yet they can easily be distinguished by the fact, that some characteristic plant formations are present or absent. The Hoffmannseggia formation 1)

1) The name of this formation is only provisional, and probably will be replaced some time by a more suitable one. However,, Hoffmannseggia gracilis is, from what I have seen, the most obvious species of those which are confined to this formation.

is only found in sandy soil and only there, where the sand is not too fine to form sand dunes. Therefore, it is found in the real high plateaus, but also on mountain slopes, which are covered with sand or fine gravel. All stony or rocky places, however, are covered with Cactus formation, especially the mountains which surround

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the high plateau. However, this Cactus formation is also found in other stony soil. Although these two formations sometimes form transition forms, they are generally remarkably well delimited one from another. We can always notice a distinct line in these places, where stony hills border sandy plains; probably we can most easily recognize them on the distribution of the cacti.

The Azorella formation is not so well delimited. Since same is only found in the highest altitudes, and is subject to the prevailing severe climate, it differs in the composition of species and physiognomy from the Cactus formation in such a way, that it will be practical to discuss it separately, although there is no distinct boundary line between them, but both pass from one into the other in a hardly noticible manner. This takes place in different altitudes in different places, therefore, we are not able to state a definitely exact altitude. However, we can determin this altitude at about 4000 and 4500 m above sea level. The upper boundary line is about the same as that of the Phanerogamae and it is situated on the Nevado de Chañi at an altitude of 5500 - 5700 m, although in its typical form it reaches only up to an altitude of 5200 m.

I hesitated in compiling the Azorella formation, for a special study will be necessary, especially in regard to the distribution of the species, since we will find perhaps, that it can be divided into different formations.

The three formations can be called " brush prairies " " Strauchsteppen ", on account of their general physiognomy. The pictures (table II - III) give us a fine conception of the Hoffmannseggia formation. 2)

2) See illustrations in the recently published travelling descriptions by Fl. O'Driscoll (I).

This formation consists partly of shrubs, partly of herbs and a few Gramineae. The shrubs are all ½ to 1 m high and are growing separately by themselves, with intervals between them measuring but a few meters, so that the bare sandy soil can be seen between them. Only a few herbs and Gramineae can be found in these bare spots. Very few of these herbs and grasses grow, and they have no effect upon the general physiognomy of the vegetation. The Hoffmannseggia formation does not assume specific close formations; the white sand can everwhere be seen. There are absolutely no mosses and lichen. It is extremely interesting to notice the general conformity with this formation and certain brush plains in the African desert, such as, for example A. Schenk (in G. Karsten & H. Schenk, Pictures of vegetation, Table 26 - 27) show them.

The distribution of the species varies very much in different places; in some places one or a few species of shrubs may predominate, in other places other species may be predominant in regard to a general impression. For example, we give a description of the habitats of the following groups;

On the sandy plane near Morena (on Nov. 12th.) we found the following species: Shrubs: Lippia hastulata (1 - 1.5 m high; many), Fabiana viscosa (0.5 1 m; many), Chuquiraga atacamensis, Patagonium Hystrix and Senecio viridis (0.5 1 m high; here and there), also Tetraglochin strictum and Mulinum ulicium (0.2 - 0.3 m; in a few places). Between these few shrubs only the ½ m high grass Pennisetum chilense grows, and pressed to the ground we find the two herbs Hoffmannseggia gracilis and Euphorbia ovalifolia var. dentata.

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In connection with the Hoffmannseggia formation we want to mention a rarely found plant, which, however is quite prominent when we see one. This is the well known Pampa-grass (Cortaderia Selloana (= Gynerium argenteum)), which I noticed in two places of the territory, namely near Moreno and at the foot of the Nevado de Chañi. This Pampa-grass grew in gigantic lawn patches near brooks or in dry brook beds between the Hoffmannseggia formation, 1 to 2 m high and 1 to 2 m in diameter (Table III, Fig. 2.).

In regard to the general physiognomy, the Cactus formation is very similar to the just described Hoffmannseggia formation and consists of a stony shrub plane, as table IV, Fig. 1 and table V, Fig. 1 show. It is formed by a number of shrubs, which have the same thorny brushwood appearance as the shrubs of the Hoffmannseggia formation; these plants vary, however, in regard to their height from 1 meter to one meter or a few dm, but they usually increase in height towards the hilly land or towards the mountains. They grow between the stones or out of crevices in rocks, one here, one there; we find the herbs more numerous in regard to species as well as in regard to individuals, but here as well, they do not form a continuous cover. Furthermore, we find occasionally a few mosses between the stones, but this fact does not change the general physiognomy of the formation; the same conditions hold good for some crustaceous lichen and foliaceous lichen, which are growing profusely on stones or rocks. The reason why this formation differs mostly from the others, and why I have chosen this name, is the profuse appearance of cacti of different types. We find Opuntia growing in dense masses, shaped like a hemisphere one meter high, (Table I), also in isolated spherical Echinocactus species, and in certain spots we find large numbers of columnar Cerens Pasacana, 5 - 8 m high; this is the tallest plant in the territory (Table IV, Fig. 1).

The following two lists show the composition of the Cactus formation.

I. On a stony hill near Morena, about 3500 m above sea level (Nov. 16th.). The shrubs are 1 - 5 dm high and consist of: Fabiana denudata, Lycium fragosum and confertum (many) Chuquiraga atacamensis, Bougainvillea patagonica and Ephedra americana v. andina (few), Verbena seriphioides and Lycium decipiens (isolated). The following plants form semi shrubs: Buccharis petrophila (many) and Salvia Gilliesii (isolated); Gramineae: Triodia avenacea (many). Here and there we find plants which are forming carpets: Opuntia sp.; in isolated places Echinocactus sp. Furthermore we generally find Tillandsia pusilla on old twigs of all shrubs. Lichen and mosses are rarely found in crevices and between stones.

II. On a sunny mountain slope near Huancar, at the southern point of the Salinas grandes, about 3400 m above sea level (Nov.20th). The slope is formed of large and small, sharp cornered stones, and partly of massive rocks; crevices and small holes between the stones are covered with fine sand. The vegetation consists of the following shrubs: Chuquiraga atacamensis, Heterothalamus boliviensis var. latifolus and Patagonium sp. (all plentyful); Cacti : Echinocactus sp. and Opuntia sp. (occasionally), Opuntia grata (isolated); furthermore of the following semi-shrubs, herbs and Gramineae: Salvia Gilliesii, Panicum Friessii, Pennisetum chilense and Pappophorum caespitosum (plentiful); Acanthonychia polycnemoides and Pellaea ternifolia (scarce); Diplachne dubia (isolated).

In certain spots, in a little humus soil, which collects between

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the stones at the foot of some shady, steep lopes, we find a vegetation of more numerous species than the before mentioned two examples. In such a place at the foot of the Nevado de Chañi (on Dec. 16th.) we found the following numerous species: Stevia minor, Erigeron sp. Baccharis petrophila and polifolia, Filago lasiocarpa, Gnaphalium erythractis, Schkuhria pusilla, Tagetes multiflora var. rupestris, Mutisis Philippii, Cahptalia similis, Lycium confertum, Solanum infundibuliforme, Salvia Gilliesii, Eritrichium falcatum, # Cuscuta microstyla, Philibertia Gilliesii, # Oxalis carnosa, # Cotyledon peruviana, Descurainia canescens, # Spergularia andina Acanthonychia polycnemoides, # Chenopodium foetidum f. pumilum, Tillandsia pusilla, Aristida nana, Munroa squarrosa and decumbens, Eragrostis nigricans, Ephedra americana var. andina, # Woodsia montevidensis, Pellaea ternifolia and nivea, # Nothochlaena peruviana, also # Cheilanthes pruinata. 1)

1)The species which are marked with # seem to be characteristical for the location, and have never been found in other places.

Although the territory is situated above the normal timberline, trees are entirely absent. It is appropriate to mention here in connection with the Cactus formation the only representative of the tree form, --- the small peculiar apple tree Polylepis tomentella, the " Queñoa ", which we find in small sheltered woods in narrow, tranquil little valleys. However, these " Queñoales " are a scarcity; I heard of them only from other people in the vicinity of Cochinoca and Rinconada. I personally have never noticed them, and this is the reason why I list them in connection with the Cactus formation, although it would perhaps be better to discuss them separately. Polylepis tomentella is a small tree about 5 m high, with a crooket, irregular trunk, and three pointed or pinnate, leathery leaves, which are covered with wooly hair on the lower side. The bark, which covers the branches of this tree is peculiar; it is formed of a thick layer of thin brown loosely connected membrans, between which there are empty spaces. The Queñoales are found up to 4000 m above sea level.

We are now comming to the Azorella formation and find, as we have already mentioned, that it is more closely in conformity with the Cactus formation, in other words, it is only a dwarfed replica. It is formed of isolated small shrubs (only one or two decimeter high). I noticed particularly Tetraglochin strictum. In the higher altitudes an important part of the shrub formation consists of species of the Senecio and Werneria genera, which have fleshy leaves and stems and a strong aromatic fragrance (S. graveolens and trifurcifolius, W. Lorentziana and Rosenii); furthermore, we find dwarf shrubs growing in thick mats, such as Pycnophyllum bryoides, dwarf-Verbenae and mostly Azorella monanthos. We mention particularly the interesting Leguminosae Patagonium occultum, which is found all over the Chañi; it is a dwarf shrub, whose thick, irregularly twisted branches are completely covered by the soil, and the small leaf rosettes and flowers without pedicels, hardly rise above the surface of the ground. --- We do not find any mosses and lichen covering the ground; only in isolated places do we find some stone liches. The Gramineae form here a more important part than they do in the Cactus- and Hoffmannseggia formation; they are found in bunches, a few dm in height, with hard, sharp leaves. In certain places we find them almost by themselves, with some small herbs or other small Gramineae between them.

Toward the upper boundary line, the Azorella formation changes very much. There we find some chrarateristic species, which are

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not found in lower situated places; they are growing more sparcely here at great intervals, between stones and in crevices; in the higher altitudes the number of individuals decreases. In an altitude of 5500m we find only very few of them; once in a while we find a plant in an altitude up to 5700 m, this is the boundary line of the Phanerogameae, and there I studies the highest regions of the Nevado de Chañi. A phanerogamous plant cannot exist in higher altitudes. On the mentioned mountain in the upper region of the Azorella formation (5000- 5700 m above sea level) I collected the following species: Sencio trifurcifolius, glacialis and iberidifolius, Werneria Rosenii and Lorentziana, Calycera crenata, Viola sp. Malvastrum obcuneatum, Oxalis incana, Hexaptera cuneata and Calamagrostis tenuifolia. Malvastrum obcuneatum, Hexaptera cuneata and Viola sp. were found in the highest regions.

According to Drudé (I page 410), the highest boundary line on earth for Phanerogameae is in the Himalaya mountains (Karakorum, about 35° northern latitude) where the brothers **Schlagintweit** still found some in an altitude of 6038 m above sea level. Schimper mentions (I. page 753) Saussurea tridactyla Sch. Bip. as an angiospermae, which grows in the highest altitudes; we find it (in western Tibet) up to 5800 m above sea level. The highest habitat for Phanerogameae, which I know in the new world, is on the Nevado de Cachi (25° southern latitude) where the small Draba Mandoniana Wedd. (= Braya cachensis Speg.) has been found in an altitude of 5800 m above sea level (Spegazzini, I & III). Then follow the just mentioned habitats on the Nevado de Chañi. Attention should be paid to the fact, that the mentioned habitats are not lying near the equator, but all of them in the vicinity of the tropic of cancer (Wendekreis). We are stating here the following data in regard to the boundary line of the Phanerogameae, in the Andes:

2°	s. Br.	Chimborazo	5200 m:	Senecio Hallii Hier.(Meyer, I).
16°	"	Sorata	5700 "	Malvastrum flabellatum Wedd. and Deyeuxia glacialis Wedd. (Hemsley and Pearson, I).
24°	"	Nevado de Chañi	5700 "	Malvastrum obcuneatum, Hexaptera cuneata and Viola sp.
25°	"	Nevado de Chañi	5800 "	Draba Mandoniana (Segazini, I and III).
33°	"	The Aconcagua area	4115 "	Acaena laevigata Ait.; up to 3960 m: Hexaptera cuneata, Viola Montagnei Gay, Verbena uniflora Phil.; Adesmia sp.(Fitzgerald,I).
34°	"	Maipo	4000 "	Oxalis? (Guessfeldt, I).
37°	"	Chillan	2200 "	Nassauvia revoluta Gill., Senecio species, Oreobolus clandestinus Phil., Caltha andicola Gay
54°45'	s.l.	The Martial mountains near Ushuaia	1290 "	Saxifraga biscuspidata Hook.f., Empetrum rubrum Vahl and Deschampsia parvula (Hook.f.) Desv(?)

In order to give a more comprehensive idea about the distribution of the species, I have made out a list of the species, which I have found in the formations that have been discussed; in this list the letters h, c and a indicate, whether the species belong to the Hoffmannseggia- the Cactus- or the Azorella formation.

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c Stevia minor
c Eupatorium prasiifolium var.
c Gutierrezia Gilliesii
h Nardophyllum armatum
c Erigeron sp. var
h c a Heterothalamus boliviensis latifolius
h Baccharis microphylla
c " petrophila
c " polifolia
c Filago lasiocarpa
c Gnaphalium purpureum
c " erythractis
c Encelia suffrutescens
h Heterosperma pinnatum
h c Schkuhria pusilla
c Tagetes multiflora var. rupestris
a Senecio graveolens
a " trifurcifolius
a " glacialis
h c a " iodopappus
a " iberidifolius
h " tarapacanus
h c a " viridis
h Fabiana viscosa
h Nicotiana crispa
c Salvia Gilliesii
h c Verbena seriphioides
c " asparagoides
h " microphylla
h c Lippia hastulata
h c Heliotropium brachystachyum
c Eritrichium falcatum
h Phacelia pinnatifida
c Ipomoea minuta
c Cuscuta microstyla
c Philibertia Gilliesii
c Buddleia Hieronymi
h Bowlesia pulchella
a Azorella monanthos
h a Mulinum ulicinum
c Cereus Pasacana
c a Echinopsis pygmaea
c Echinocactus sp.
h Opuntia subterranea
c " purpurea
c a " andicola
c a " grata
h c a " sp.
c Mentzelia parvifolia
h Cajophora coronata
c " heptamera
a Viola sp.
h a Malvastrum antofagastanum
a " obcuneatum
c Euphorbia ovalifolia
h " " var.dentata

h Senecio viridis var.radiatus
c " glandulosus
a Werneria cochlearis
a " Rosenii
a " Lorentziana
h c a Chuquiraga atacamensis
c Plazia daphnoides
c Mutisia Philippii
c subulata
h Trichocline auriculata
c Chaptalia similis
c Hypochaeris elata
a Calycera crenata
h Mitrocarpus brevis
a Plantago sericea pumila
c Castilleja fissifolia var.
c Bartsia Meyeniana
c Lycium confertum
c " fragosum
c " decipiens
c Solanum infundibuliforme
h c a " pulchellum
h Jaborosa crispa
c Fabiana denudata
c Dalea Hofstenii
h Neocracca Kuntzei var.minor
a Astragalus modestus
h " Orbignyanus
h " unifultus
a Patagonium occultum
h c " Hystrix
a " spinosissimum
h c a Tetraglochin strictum
c Cotyledon peruviana
a Hexaptera cuneata
h Lepidium bipinnatifidum
c Sisymbrium stenophyllum
c Descurainia canescens
a Anemone major
c Stellaria cryptopetala
c Spergularia villosa
c " andina
a Pycnophyllum bryoides
a Reicheella andicola
c Acanthonychia polycnemoides
h Calandrinia punae
h Portulaca rotundifola
" perennis
h c Bougainvllea patagonia
h c Guilleminea illecebroides
" gracilis
h Alternanthera microphylla
h a Gomphrena umbellata
h a Chenopodium frigitum
c " foetidum f.pumilum
h Pilostyles Berterii
a Urtica echinata

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c		Oxalis carnosa	c		Peperomia peruviana.
	a	" incana	c	a	Haylockia andina
h		Hypseocharis pimpinellifolia	h		Eustephiopsis speciosa
h	c	Prosopis ferox	c		" latifolia
	c	Krameria Iluca	c		Tillandsia pusilla
h		Hoffmannseggia gracilis	c		" capillaris
	c	Panicum Friesii	h	c	Munroa squarrosa
h	c	Pennisetum chilense	h	c	" decumbens
h	c	Aristidia nana	h	c	Diplachne dubia
	a	Stipa saltenis	h	c	Eragrostis nigricans
	c	" plumosa	c		" andicola
	c	" pungens	h	c	Ephedra americana var. andina
	c	" caespitosa	c		Woodsia montevidensis
	a	Calamagrostis chilensis	c	a	Pellaea ternifola
	a	" tenuifolia	c		" nivea
	c	Triodia avenacea	c		Nothochaena peruviana
h	c	Bouteloua humilis	c		Cheilanthes pruinata
	c	Pappophorum caespitosum	c		Polypodium macrocarpum

As we have emphazised on page 12, the climate is characteristical on account of a distinctly delimited dry season --- June to September ---; this season is identical with the colder period of the year, and it is contrasted by a rainy season, which is relatively more moist. In the former one the climate is unusually dry, and this conditions a xerophile adaption of the flora, namely in such places, where no edaphic moisture conditions are added. However, the hunidity of the air does not become so low during the warm season in the summer, as we find it there in the winter; the humidity is not less than in Sweden during the spring, which is the dryest period of our climate.

Therefore, we find in the Hoffmannseggia-, Cactus- and Azorella formations numerous species, which have adapted themselves to this humidity distribution, namely by throwing off their transpiration-surfaces during the dry period. This can be seen, when they shed their leaves in winter and by the development of new leaves at the beginning of spring. In order to be able to determin, which species shed their leaves, it is necessary to study the flora in the winter; I have not been able to do this, since I came into this territory at the beginning of spring. However, the number of the species is probably small; but I am sure that I can classify the following species with the category: Eupatorium prasiifolium, Salvia Gilliesii, Fabiana viscosa, Prosopis ferox, Patagonium Hystrix and Spinosissimum. The herbs behave in a similar manner, the herbaceous part of which dries up down to the base, as for instance Stevia minor, Valeriana Hornschuchiana, Heliotropum brachystachyum, Hoffmannseggia gracilis, Dalea Hofstenii and others, all of which have a perennial rhizome. The hibernation can be accomplished by subterranean tubers or bulbs; numerous representatives belong into this category, amongst other: Solanum fundibuliforme, Ipomoea minuta, Oxalis elegans, Anemone major, Portulaca rotundifolia, Guilleminea australis, Peperomia peruviana, Herbertia pulchella, the Amaryllidaceae and the Allium species.

The annual species probably form the most important category of those plants, which are verdant only at certain periods. They are represented by different families as for instance:

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Compositae, Boraginaceae, Polemoniaceae, Malvaceae, Euphorbiaceae, Zygophyllaceae, Oxalidaceae, Leguminosae, Crassulaceae, Cruciferae, Caryophyllaceae, Portulacaceae, Amarantaceae, Chenopodiaceae and Gramineae. It is not always an easy task to determin, whether we have an annual or a biennial or possibly a perennial plant; in order to be able to determin this condition it will be neccessary to spend a long time in the territory. However, I believe that not less than 35 species of the three formations belong to the type of the annuals.

It is interesting to compare the profuse occurrence of the latter in these formations with that of the rest of the formations in the territory. They are entirely absent in the Potamogeton filiformis formation, also in the following Lampaya- Patagonium arenicola-, Lepidophyllum-, Salicornia- and Sporobolus arundiaceus formations. Only in the Hypsela formation we find, as we mentioned before, Gentiana podocarpa, Poa annua and the possibly annual plant Colobanthus alatus. As far as I know, only Malvastrum antofagastanum, Chenopodium frigidum and a doubtful annual Viola species grow up into the Azorella formation. These conditions show that the annuals are almost exclusively confined to the two xerophile plant formations on solid, stony and sandy soil at a relatively low altitude above sea level. The number of annual species, which have been found in the territory amount to about 10 %; this is a remarkably high number, if we compare it with corresponding conditions in other alpine areas. Wilczek (I) states, that the annuals in the Swiss Alps amount to only 4 % of the flora, in our Scandinavian alpine region they do not amount to more than 2 %.

It is natural that the above mentioned species have not protected their assimilating surfaces so well against transpiration as the evergreen species, although the dryness of the air, supported by strong winds is sufficient to cause a certain dgree of xerophilous adjustment. For example, if we compare the above mentioned Eupatorium and Stevia with the Chuquiraga species (green in winter), such as Nassauvia axillaris or the two Baccharis species prolifolia and Grisebachii a.s.o., we notice immediately the thinner, looser and larger surfaces of the leaves. We could make similar comparisons in other different families; for example we cite of the Umbelliferae the fading Bowlesia pulchella and Azorella monanthos (green in winter); of the Caryophyllaceae we cite the annual Drymaria cordata, and the Pyconophyllum species, which have small, scaly leaves, such as we find on withered mosses; of the ferns we cite Woodsia montevidensis with thin, fading leaves, and the Pellaea species which have thick, stiff, leathery leaves. a.s.o. This condition can clearly be seen in the anatomical structure, but I am going to discuss this matter later on. We do not deny the fact, that the stated examples have been especially chosen; they show, however, that a part of the species with generally little xerophilous tendencies, can stand the climate, if they reduce their transpiration surfaces during the most severe period. However, we cannot classify these plants with the tropophytae, in other words with those, which are in one period xerophilous and in another period hydrophilous, although they are forming a transition to the former ones.

We shall also say a few words in regard to the rest of the more important plant types of the three plant formations in question. It seems to me unnecessary to describe all the different representatives with xerophytous tendencies in detail, since this question has lately been the subject of careful investigations. However, I think I should not entirely omit some more important types, which are characteristic for the territory, since they are more typical

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for the vegetation of the territory, than any other plant type of the other formations.

As we might expect, a general characteristic in regard to the subterranean system is its very strong development. Generally we find a strong, perennial tap root growing straight down. For an example, we mention the root of a Fabiana shrub, which grew vertically down and was over 2 meters long, while the parts, which grew above the surface of the ground were only about 2 dm long. A Trifolium Matthewsii specimen had a tap root of at least 40 cm length and 1 cm in diameter, while the axis above the surface of the ground were only 1.5 cm long. We state the following plants amongst the herbs, which had a strong, yet not a swollen tap root: Tricholine auriculata, Calycera crenata, Heliotropium brachystachyum, Dichondra argentea Malvastrum obcuneatum and saltense, Portulaca perennis Guilleminea illecebroides and pusilla, Gomphrena acaulis and others.

It is interesting to compare the variations in the habitats of this plant type in the different formations. This type is entirely absent in the Potamogeton formation. In the Hypsela formation, only one representative has been observed, namely Hypochaeris stenocephala; this plant is a remarkable exception in the structure of the species which we find in this formation. If we disregard the shrubs, there is only one representative (Atriplex andina) in the Salicornia formation (we are going to describe it more in detail further on), in the other formations it is entirely absent. It seems as though the tap root type amongst the herbs in the Puna is only found in xerophilous shrub formations in solid (not movable) soil; there, however, it forms a very important part.

When the main root dies, a system of very long and strong lateral roots develop. For example, we find this condition in a number of Gramineae, which are growing on stony mountains, in crevices and between stones, such as Panicum Friesii, Pappophorum caespitosum, Triodia avenacea, Eragrostis andicola and others; a bunch of long, strong, white, straight lateral roots starts at the base of the stem of these plants. A Pappophorum individual, whose culm was hardly 1 dm long, had lateral roots almost four times as long. It is hardly necessary to mention, that these lateral roots tried to absorbe the moisture from deeper soil just as the deep-growing tap roots did.

In regard to the shoot, we find the rosette-type as well as the type with elongated internodes in the herbs, the shoots of the latter type are lying on the ground or are standing up; this type is not found frequently. For example the following plants belong into this category: Stevia minor, Mentzelia parvifolia, Cajophora heptamera. Of the rosette type we mention particularly Calycera crenata, Malvastrum obcuneatum, Oxalis incana, Viola sp. and others, which can only be found on the boundary line of the Phanerogamae. The leaves are in most cases pressed against the ground, if there are any flowers or inflorescences with pedicels, they are also bending towards the ground; fine examples are: Tricholine auriculata and Hoffmannseggia gracilis. However, the most common species are those with shoots lying on the ground and those with elongated internodes; they are numerous in herbaceous plants (Mitrocarpus brevis, Solanum pulchellum, Heliotropium brachystachyum, Alternanthera microphylla, Guilleminea species and others), and they are also prominent amongst the annuals(Tribulus terrestris, Chenopodium frigidum, Gomphrena umbellata, Munroa decumbens, Bontelona humilis, and others.)

The lingnose plants are very numerous. Added to the semi shrubs, their number in all formations in the puna is about 90 %

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or they represent about ¼ of all species of the territory; they are not only found in the Hoffmannseggia- the Cactus- and the Azorella formations, but they are particularly numerous outside of these formations. We have mentioned before that Polylepis tomentella is the only representative of the tree form. All other lignose plants are either shrubs or semi-shrubs. The highest one, Prosopis ferox reaches a height of about 2 m, but it is so rarely found (either in the Hoffmannseggia as well as in the Cactus formation) that it plays from a physiognomically point of viw no rôle; in all my excursions I noticed it isolated only a couple of times. Disregarding these, the shrubs generally grow from 0.5 to 1 meter high, but their height decreases on top of the mountains and on windy spots a.s.o. There are many shrubs of different families; the physiognomically most important ones are the Compositae, the Leguminosae, the Solanceae, the Verbenaceae and the Rosaceae; the rotation in which we have stated them also indicates their importance.

The shrubs particularly distinguish themselves by crooked and twisted stems; on high plateaux they are standing erect, but on the mountains they are pressed down to the ground. Often their stems show more or less irregular, peculiarly formed cross sections; on Lippa hastulata and Patagonium species especially; these cross sections are flat and tape-like or irregularly split, as can be seen in table IX. Fig. 13 - 15; this condition may be caused by the fact that the branches remain united with the main stem for a long time, and separate from it only late.

Different shrubs show, on account of short shoots and numerrous, thick ramifications, a mat (stroma)- like or cushion-like, often thick and compact growth, although this type is physiognomically not very prominent, in any case, not as much as we often read about it in descriptions of the Puna. To this type belong a few Verbena- and Patagonium species; the two Pycnophyllum species which grow in more incoherent mats, and mainly the Umbelliferae Azorella monanthos, whose mats (stroma) can grow over one meter in diameter and ½ meter high; they grow so compactly, that the tips of the shoots can be removed only with a knife or with an ax. Even two Cacti --- Opuntia grata and andicola --- form compact hemispherical clumps of nearly 1 m in diameter (Table I).

We emphazise the frequent occurrence of assimilation-short-shoots (Assimilationskurzsprossen), which show a xerophilous character. For example, Prosopis ferox, Bougainvillea patagonica and others. This condition often stands in some relationship with prolepsis (hurried development), as for instance in Nassauvia axillaris, Verbena species, Tetraglochin and others, all of which soon change the leaves of their longitudinal shoots into prickles, which support assimilating short shoots, which in Nassauvia and Verbena seriphioides are formed of very losely sitting small leaves, and remind us of the tips of the shoots in Azorella.

The shrubs of the three formations are frequently acanaceous, as is mostly the case in dry regions. The acanaceous species are not in the majority, but they become prominent by the large number of individuals, and since there are very many acanaceous Cacti in the Cacti formation, the general appearance of the vegetation is acanaceous. This thorny condition develops in the following way. In Nardophyllum armatum, Proustia pungens, Lippia hastulata, Fabiana Friesii, Lycium decipens and fragnosum the ordinary tips of the branches harden and become thorns; in certain Patagonium species and in Bougainvillea particularly the short shoots develop into thorns, and in other Patagonium species (for example Clarenii, Nordenskiöldii) the axis

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the axis of the inflorescences soon develop into thorns. On others we find the leaves sharp and prickly, as for instance those of the Chuquiraga species and Mulinum ulicinum, or only certain leaves are transformed into thorns (Verbena species, Tetraglochin and others. In Prosopis ferox the stipules are transformed into thorns.

Of course the transpiratiing surfaces are very much reduced on account of the dry climate. However, it would lead us too far to discuss here all kinds of leaf types, which we find in the different species; furthermore, it would be more or less a general repetition of the statements which have been made by other investigators in regard to the xerophytae. It will be sufficient to point out that the leaves are always of small dimensions, and that they are generally stiff and leathery, this is especially the case in shrubs; furthermore, that succulency is very frequent, but we shall have to say more on this subject further on. We find acicular, filamentous and scaly leaves everywhere, also leaves of which the edges are rolled in or rolled out. We find leaves, which roll up at certain periods amongst the Gramineae. Ephedra americana v. andina and Fabia denudata have no leaves at all. We have mentioned before that numerous species shed their transpiration surfaces during the worst dry period.

In regard to hirsuteness we can say that we find woolly hairs as well as flat lying silky hairs quite often. Most of those of the first category grow hairs only on the lower side of the leaves, as for instance Gutierrezia ledifolia, Nardophyllum armatum, Baccharis ledifolia and Grisebachii, Mutisis ledifolia, Trichocline auriculata, Chaptalia similis, Salvia Gilliesii; the number of those which have hair on both sides is smaller (Filago lasiocarpa, the Gnaphlium species, Buddleia andina and others. We find leaves with flat lying silky hairs on Nassauvia axillaris, Plantago sericea, Verbena microphylla, Dichondra argentea, Evolvulus sericeus (only on the lower side, the upper side is smooth), Evolvulus villosus, Tribulus terrestris, Oxalis incana a.s.o.

Furthermore, we wish to mention, that the hirsuteness on the plants here is relatively slight in comparison with the plants growing in the northern part of the Andes with its humidity in Paramos (extensive fell-fields in South America); Goebel (I) emphazises this especially. In many cases this coat of hair is partly replaced by the more plentiful occurrence of glandules and succulence in our territory. We find glandules in many plants as glandular hairs, as for instance in Senecio species, in Caleolaria bartsiaefolia in Nicotiana and Patagonium species and others, partly depressed (sunken) glandule points, as for instance in Baccharis- and Fabiana species. All these species secrete resinous substances which cover the green parts more or less and decrease transpiration. (see Volkers, I. p. 138). When these plants are pressed, they stick to the paper and leave a good impression on the paper, which consisists of a resinous substance. The Hoffmannseggia-Cactus- and Azorella formations distinguish themselves by a strong aromatic fragrance, which is caused by this resinous secretion. In the rest of formations we only find this fragrance in the Lepidophyllum formation; the two Lepidophyllum species contain so much raisin, that their freshly cut green branches burn briskly when lit with a match.

The number of succulents is unusually large for an alpine region. The succulence shows more or less in the leaves or in the entire shoots, namely in representatives of the most distant families. These are numerous in the Compositae, especially in the Senecio- and Werneria genera, also in the Portulaceae and the Chenopodiaceae;

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Naturally all Cacti are succulent. However, we find some examples in other families, as for instance in Calycera crenata, Oxalis carnosa, Dalea Hofstenii, Cotyledon peruviana, Hexaptera cuneata, the Spergularia species, Pepromia peruviana and others. We are going to show further on, that the salt contents produces succulents within the haplophilous formation, but the number of them is not large; the total number of the succulents in our territory is about 50, in other words about 1/7 of the total number of species. This high number is remarkable if we consider the conditions within the Paramos in the northern part of the Andes. Goebel (I. p. 13 & 42) says, that there are no Cacti there and he only mentions the single succulent Echeveria. We need not mention that the profuse occurrence of succulents in our territory is caused by dryer climate. However, it is peculiar that the highest situated Phanerogamae vegetation is found on the Nevado de Chañi, which is mostly enveloped by clouds and hidden in fog, and consists mostly of succulents (Senecio- and Werneria species, Calycera crenata, Hexaptera cuneata).

Finally I have to mention still another characteristic phenomenon, namely the often present profile position (perpendicular) of the leaves. Nearly all perennial Gramineae which are characteristic by strongly rolled up (being able or unable to unroll during damp weather) leaves with sharp tips pointing upwards. Stipa, Calamagrostis- Poa- and Festuca species belong into this category. However, profile position is also found with the Dicotyledonea. Examples amongst the shrubs are: Gutierrezia Gilliesii, Baccharis microphylla, Senecio Tarapacanus, glacilis, and iberidifolius, some Werneria species, and others with upward standing leaves; furthermore, Plazia daphoides, the upward pointing leaves of which are only found on the tips of the branches. They are built rather isolaterally, with palisade parenchyma on both sides, although with somewhat stronger and longer cells upon the upper side. The stomates are lying on both sides, somewhat stronger and more numerous on the upper side. On account of the position of the leaves, they create a calm (no wind) between themselves, while the lower sid e of the leaves is more exposed to the wind. We could mention numerous examples from other families.

Amongst the herbs we find several plants, whose axis are lying flat on the ground, whose leaves, however, grow in a right angle to them, if seen from above; for example Chenopodium frigidum. We find similar conditions in the cotyledons of several species, as for instance Tribulus terrestris and Chenopodium frigidum. The phenomenon is often seen in compound leaves, where the leaves assume a profile position. For instance, some Patagonium species with e elongated leaves, show this angular, upward profile position on the more or less horizontal rachis = (rhachis, the axis of an inflorescence or compound leaf or frond). Tribulus terrestris and Hoffmannseggia gracilis have turned their leaves into a nice profile position along the rachis, which is lying flat upon the sand round the leaf-axis. Both these plants have a rather isolaterally built, small leaves. The reason why this isolateral structure of the leaves is not caused by the profile position of them, but has to be contributed to the stronger development of the palisade parenchyma which is generally found with the Xerophytae, is that Tribulus terrestris in the Botanical Gardens of Upsala, had leaves which were constructed in the same way, although at that place they grew in a horizontal position.

We could say much more in regard to climatic adaptation of plants which belong to the Hoffmannsegiia- Cactus- and Azorella formations. Several peculiarities have been only briefly mentioned

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or have been omitted, and this is particularly true in regard to the anatomical structure of the species; I hope to be able to discuss this subject at an opportune time. May that what I have said here be sufficient, to give some conception of the most important types and the adoptations which we generally find in the three formations, and which are most conspicuous when we compare them with other xerophilous areas and alpine regions.

The Lichen Desert (Flechtenwueste).

This is the name which I have given to the formation, which extends from the upper boundary of the Azorella formation into the regions of perpetual snow, which starts on the Nevado de Chañi at an altitude of 5800--5900 m above sea level. The soil of this area consists of lose boulders, gravel or sand. The lichen desert is characteristic by the entire absence of Phanerogamae. Mosses are also entirely absent on the Nevado de Chañi ! Only a small foliaceous lichen (a sterile Gyphora species), five custaceous lichen, namely Lecanora varia βpolytropa (Ehrh.) Nyl., Acarospora chlerophana (Wnbd.) Mass., Acarospora tersa (Fr) Th. Fr.(?). a sterile Caloplaca- and a sterile Lecanora or Lecidea species, which are found isolated on rocks. These species also grow on rocks which tower over the permanent snow; we find them on top of a 6100 m high mountain. Schimper states in his " Plant-Geography " (p. 753), that the highest known habitat of lichen was on the summit of the Kilimandscharo at an altitude of 6010 m, where they were found by H.Meyer.

The lichen desert corresponds with the region, which Humboldt (I) called lichen-region in the tropical Andes. Gresebach (III) calls it the " naked-region " and by this expression he means a region where no Phanerogamae, but only lichen grow.

The cause, which prevents Phanerogamae to grow on the Nevado de Chañi, might be only partly the condition of the soil itself, which in part consists of lose boulders. In some places, there was, as we have said before, gravel and sand, and some plants surely could grow there. Neither the climate could directly be considered a cause for the absence of Phanerogamae, but in my opinion, the absence of Phanerogamae can be explained by the fact, that the region is often entirely covered with snow.

The Quicksand Formation.

Dunes sometimes form in some places of the territory which consists of shifting sand, and which are changed by the wind. For instance, we find them in a narrow valley between Mareno and the Salinas grandes, protected by a hill near Huancar, also many of them on the high plateau between Casabindo and Miraflores. In these places the vegetation was quite characteristic and probably different from all other formations. I noticed two quicksand formations in the territory, one of which near Morena and Huancar I had the opportunity to investigate, while I could only study the other one between Casabindo and Miraflores superficially.

The latter one, which I call the Lampaya formation on account of its characteristic plant, is mostly formed by Verbenaceae Lampaya medicinalis, a foot high shrub from the Ericaceae-habitus with leathery leaves. The rest of the vegetation in that region was very poor. The most important species are: Senecio sericeus var. Candolleamus and Astragalus unifultus, both covered with white wolly axis and leaves and about 2 dm high. The Lampaya- as well as the Senecio species were only observed in this quicksand area.

The other quicksand formations, the Patagonium arenicola for-

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mations were richer in species. We mention here a few places were they were found.

I. Near Moreno, Dec. 6th. 1901. The sand is fine typical shifting sand, lying in wavy formations, which are connected by the shrubs and grasses which grow there. The vegetation is very poor, much poorer than in the Hoffmannseggia formation. The shrubs are represented by Lippia hastulata and Patagonium arenicola (many), Fabiana viscosa and Patagonium Hystrix (isolated), Senecio viridis (isolated), also Chuquiraga atacamensis (isolated). Dicotyledonous herbs are entirely missing in the lose sand; we only find the following three grasses: Sporobolus arundinaceus, Panicum Urvilleanum (many and Pennisetum chilense (isolated). These grasses hold the sand in the hills in position. There are no mosses or lichen here.

II. Near Huancar on Nov. 20.1901. Large fields of quicksand had formed on the slope of a hill near the southern end of the Salinas grandes, which were covered with a thin flora or no flora at all in consequence of the changeability of the waves by the wind. The sand has covered a part of the Cactus formation, therefore some of the species of the Cactus formation have to be classified with the quicksand formation. Same is composed of the following species. Shrubs: Lippia hastulata, Verbena seriphioides, Patagonium Hystrix and sp. (many), Chuquiraga atacamensis (isolated) Nardophyllum armatum, Senecio viridis and Fabiana viscosa (isolated). Gramineae: Pennisetum chilense (many) and Sporobolus arundinaceus (isolated). Dicotyledonous herbs are entirely absent, also mosses and lichen.

We want to point out particularly Patagonium arenicola, Panicum Urvilleanum and Sporobolus arundiaceus. The two first mentioned species have never been found in other places than in the boundary regions of these quicksand formations. The latter plant, however, is also (we are going to discuss this later on) a characteritic plant of a halophilous sand formation; this plant is not found in any part of our territory but in sand and quicksand formations. However, there are not many places with quicksand and they are far from each other, therefore, the constant appearance of the Sporobolus species deserves so much more attention. This species is missing in the closely related Hoffmannseggia formation, but I noticed, how in some deep spots, which are sheltered by a hill or some other kind of protection where the quicksand can pile up over an area of a few qm, Sporobolus arundinaceus had found its way from far away. We also wish to state, that Reiche (IV) mentioned the appearance of Panicum Urvilleanum on sand dunes near Rio Maule in Chile (about 35° s.l.), also Kurtz (I) Sporobolus arundinaceus for the mighty quicksand formations at the foot of the Cordilleras in Mendoza, which we know by the name " Médanos ".

The shrubs which we find in the Puna are exceptionally high for this territory (about 1 m), and they are built in the same way. One peculiar characteristic of some of them --- Fabiana viscosa and especially Lippia hastulata is the fact, that they always seem to grow on stilt roots. Of course this condition has been caused by the wind, which has carried the sand away, thus uncovering a part of the root system; these false stilt roots are of the same great importance for the support of the respective shrubs, as the genuine stilt roots, which we find in other specimens in this region..

1) We find similar conditions in the alpine high plateau in Ecuador in the Chuquiraga species (Meyer, I. p. 143)

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As regards the Gramineae which we find in the quicksand formations, it is interesting that we find here in an alpine region mainly the same characteristic adaptation, which we know from the flora of our Scandinavian sand dunes of the sea shore. Their rhizomes reach deep under the surface of the soil, where they develop long stolons; we find the shortest ones in Panicum, on other species, which come into consideration, I dug up roots which were 1 meter long. We also find lateral roots which develop into similar stolons; in Sporobolus they sit on the side-faces of the rhizome, in Pennisetum they develop as white, cone-shaped buds at the lower side, which are directed perpendicularly downward, growing stolons, which at first grow downward, but then bend in large circles gradually upward toward the surface of the ground. Closely under the latter ones, they form many branches thus developing fasciles, which are surrounded at the lower end by a mass of withered, protecting leaf-sheaths. On Pennisetum the rhizomes are in most cases thickly covered with 5 cm long, brown, membranous sheaths, which must be pierced by the roots, and which develop mainly on the lower side of the rhizome on the nodes.

A few more words in regard to the structure of the leaves of these Gramineae. The leaves of Pennisetum and Panicum are generally of the same type; Fig. 1 shows this. Both can roll up, but only in the first kind do we find well developed hinged cells (cellulae bulliformes) on the bottom of the grooves on the upper side of the leaves. Furthermore, both have stomata on both sides of the leaves! While Pennisetum has only rough surfaces of the leaves, especially on the upper side, Panicum is rough on the lower side, where it is thickly covered with long, flat lying hairs that are pointing downward, while their upper side is only thinly covered with hairs.

On Sprobolus arundinaceus, however, the leaves are constructed after an entirely different, unusual type (see Fig. 2). These leaves are of a ligneous consistency, they are smooth and only the edges are covered with hairs, they are almost circular and on the upper side there is a kind of a groove; the edges of the leaves which border the groove bend more and more together towards the tips of the leaves, so that the groove becomes narrower. Finally the edges envelop the groove entirely, the groove continues a short distance in the leaf; from this point on the tip of the leaf is a few centimeter compact and three cornered. The largest part of the leaf is taken up by large cellular, parenchymatic, uncolored tissues. This tissue is covered with a small cellular epidermis on the morphologic upper side, which has very thick, outer walls, especially toward the edges of the groove; the cell layer, which lies next to the parenchymatic basic tissue has small cells with somewhat thick walls, especially toward the edges of the groove. There are no stomata in the groove! We find one here and there only on the edges, where the assimilation parenchyma bands of the lower side reaches up to the epidermis of the upper side. The morphologic lower side of the leaf is covered with a somewhat higher epidermis with still thicker outer walls. Toward the interior we find threads of chlorophyll tissues alternating with fibers of phloem, in the interior of which, most or all of the vascular bundles are embedded. We find many stomata in longitudinal rows outside the assimilation parenchyma; they are deeply sunken under the surface of the leaf. The assimilation tissue is mainly formed of short, cylindrical cells, which are lying in the longitudinal direction of the leaf; these cells emit short or long arms in all directions, in this way they are making a connection with the adjoining cells. In this way a fine, spongy parenchyma is formed, which is permeated

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by irregular air canals. The rush-like tip of the leaf is built like the just described lower side of the leaf; the epidermis of the grooved upper side of the leaf continues unchanged in the porous, blind continuation (appendage).

The Salicornia Formation.

The Salicornia formation is a formation which we find in our territory, generally in salt containing soils. With reference to the halophytes it corresponds with the hydrophilic Hypsela formation, and we find it in several places, for example near Moreno, Laguna Colorada, Cangrejillos and Tusle near Mina Concordia. Only a few species belong to the Salicornia formation; for example we found the following species in the vicinity of Moreno.

The most common species is Salicornia pulvinata, which covers most of the ground in form of small carpets and mats; between the plants we can see more or less the loamy, white salty soil. The color of Salicornia is yellow green, and the entire formation appears in this color. We find the following plants intermingled with the mats and also between them: Heterothalamus acaulis (many), Distichilis humilis (many), also Atriplex andina and Scirpus nevadensis (isolated),. Once in a while we find a mat which is formed of Frankenia triandra and can be seen for long distances on account of the dark green color of the leaves and the white color of the flowers. In every small hole, even if they are only a few cm long or large, in which a little water can collect during the rainy season, we find a carpet of Triglochin maritimum var. desertícola, and usually this plant crowds the previously mentioned species out. We find Juncus Leseuerii not quite as frequently in these holes; this is the only plant that grows a little above the low plant carpet.

The Salicornia formation often connects with the Hypsela formation and forms regular graded transition forms toward the latter, according to the decrease of the salt in the soil. Occasionally we see in places where the ground is a little hilly a more or less pure Hypsela formation on the upper part of the hills, while the lower parts and the places between the hills into which the water has washed the salts, the Saliconia formation grows. I noticed these conditions particularly in the Laguna Colorada. The Salicornia formation can gradually pass over into the next formation; this was the case near Moreno, however, the boundary line is usually quite distinct.

Besides the species which belong to the Salicornia formation in the neighborhood of Moreno, we should mention Werneria incisa, but it seems as they grow only at the higher places. This plant grew near Tusle in the southern part of the territory at an altitude of 4500 - 5000 m above sea level

One peculiarity for most of the species which belong to this formation is the very marked dwarfed condition of those parts, which are above the surface, and the very strong development of those parts, which are lying under the ground. High shrubs are entirely absent. Juncus Lesueurii and Scirpus nevadensis raise their stems up to 1 dm above the ground, and Werneria incisa grows about 0.5 dm high, but there is no other plant which surpasses the height of 1dm, a few of them do not even grow that tall. Atriplex andina has shoots, which are lying on the ground. The extreme reduction of Trglochin maritimus is very interesting, for this plant has inflorescences, which are only about 2 cm high; the three dwarf types, which we find in the genera Heterothalamus, Salicornia and Frankenia are also

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very remarkable.

The structure of Heterothalamus has already been described (see Table VI, Fig. 4). Salicornia pulvinata has shoots with extremely short sections, which are lying on the ground; on the lower side of the axis, a profuse development of deep growing lateral roots takes place. On account of a very abundant ramification out of the axis of the oposifolious, fleshy sheathing leaves, an extremly thick, mat-like vegetation carpet is formed, the bottom side of which is attached to the ground by numerous, strong lateral roots, which are growing strainght down. An individualization can take place by the withering of the axis. The assimilating, green parts of the shoots, which are lying above ground are only 2 mm long, and carry here and there the 2 mm long, sessile and terminal inflorescences.

Frankenia is an extremely ramified dwarf shrub, with a perennial main root, which, on account of the many shoots above the ground with a thick foliage, forms thick carpets. I have never seen any lateral roots in this species. The shoot sections on which the green, healthy looking leaves grow, measure only 1 - 2 mm in length. The terminal flowers have no pedicels; the fruits do not rise above the carpet.

Most of the species which are belonging to this formation are succulent as halophilic plants. The stems as well as the leaves of Atriplex andina, Werneria incisa and mainly Salicornia are fleshy and juicy. The leaves of Triglochin and Heterothalamus are formed in a similar way; the leaves of Triglochin have an almost circular sectional cut, those of Heterothalamus an oval one.

Probably the Salicornia formation is very common (widely spread) in the Bolivian, North Chilenian and North Argentinian Cordillera areas, where the soil is rich in salt. I want to mention, that I have found in the Museum at Kew, Frankenia triandra (a Mandon specimen), from Bolivia (" Viviniis Biacha inter Cautapa et Nasacara") mixed with Salicornia pulvinata, which has been overlooked so far, in other words, the two characteristic species of the Salicornia formations grow at the same place.

The Lepidophyllum Formation.

The Lepidophyllum formation is a halophilic shrub formation, formed exclusively by the two Lepidophyllum species quadrangulare and phylicaeforme. They grow about 1 meter high, they stand more or less closely together, but there are always bare spots or alleys between them. There is hardly any sub-vegetation; the ground between the shrubs is absolutely bare. Only in isolated spots, the small grass Distichlis humilis or mats of Frankenia triandra may grow occasionally. Perhaps we could determin a distribution of the two Lepidophyllum species in the formation, where L. phylicaeforme grows in somewhat damp spots; the leaves of the species are not as much reduced as in the former one. The two species remind us very much of Thuja- or Juniperus shrubs on account of their habitus, and we are surprised when we see on the tips of the branches yellow compositae heads. They are dark green all the year round, and they contrast very much with the rest of the Puna shrubs; they are covered with a sticky resinous substance, which is secreted freely.

The Lepidophyllum formation covers here and there large areas, for example near Morena and near the Salinas grandes, however, quite often we find it in narrow strips, following the brooks outside the

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Hypsela formation, separating this one from the Hoffmannseggia - or the Cactus formation, into which it passes over. The Lepidophyllum formation is remarkably well delineated, although the species of one area may be mixed with those of the adjoining area in those places, where they come close together.

It only grows in a fine sandy and a little loamy soil. For the purpose of making comparisons, we give an analysis of soil samples from the three sand formations: the Hoffmannseggia- the Lepidophyllum- and the Sporobolus arundinaceus formations. The samples were chosen from such places where the formation has a typical composition and is very large. Here are the results of the analysis:

	Evaporating water during the drying process (+ 105°C)	Salts which are soluble in water (dried at 175°)	Chloride (calculated as Cl)	Sulphate (calculated as Na_2SO_4)
From the Hoffmannseggia-form.	0.5 %	0.08%	0.01%	traces
" " Lepidophyllum - "	2.1 %	3.08%	1.70%	0.83%
" " Spr.arundinaceus"	1.2 %	18.56%	13.16%	4.19%

In the latter two formations we found furthermore traces of Ca, Mg, K and boracic acid; more boracic acid was found in the samples of the Sporobolus formation than in the Lepidophyllum formation.

This shows, that the salt contents is considerably larger in the Lepidophyllum formation than in the Hoffmannseggia formation, although it is small in comparison with that in the Sporobolus arundinaceus formation. In the first mentioned formation we find the greatest moisture.

Dusén (II) discusses in his work in regard to the vegetation of the Magellan Countries, the Lepidophyllum cupressiforme, which he found there in loamy and sandy soil, and which is related to the species, which we find in the Puna. There we find this plant only near the sea shore as a halophilic shrub. The bushes, of which Dusén produces a good picture, reminds us, from a physiognomical point of view, of the Lepidophyllum formation in the Puna, although the bushes never grow so close together in the Puna as in the Magellanic Countires. The Magellanic species resemble their alpine relatives in that they require a weak saline soil. " Although this plant is definitely a halophilic species, it cannot stand a more saline soil. The places where this plant grows have not enough salt, in order to prevent entirely the invasion of non-halophilic species. However, we find these only in isolated spots " (Dusén,(II) p.365).

The Sporobolus arundinaceus Formation.

At the edge of the Salinas grandes the sandy soil is very much mineralized with salts, and it looks as though it was frozen; when walking over it, it creaks. We can see the amount of salt in the afore stated analysis. This soil is covered with a very clear characteristic, far extended plant formation, which we may call Sporobolus arundinaceous formation on account of the great conspicuousness of this plant, which I have never noticed at any other spot in the territory. There are no shrubs where this formation is typical; the highest plant in the formation is the Sporobolus arundinaceus, a grass 2 - 4 m high, which holds the sand together; it has hard, yellow green leaves, and the entire country looks yellow green,

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because there are so many of these plants. Frankenia triandra is another prominent plant, which forms 1 meter wide, dense carpets or mats of dark green color. We find Distichlis humilis intermingled with these amts, or forming small carpets by itself, we also find Salicornia pulvinata, not quite as often. These four species are the only ones which I found in the typical Sporobolus arundinaceus formation. There are no lichens nor mosses.

In some places at the edge of the Saline, the wind has drifted the sand into dunes ½ to 1 m high. The soil of these dunes is less saline, and therefore a somewhat different vegetation grows here, even a few shrubs can grow on them in isolated spots in the Sporobolus formation. Chuquiraga atacamensis and Senecio viridis are found most frequently. Besides these plants we find less frequently a sterile grass with stiff, sharp leaves, forming broad bushes 0.5 meters high.

The Sporobolus arundinaceus formation is found at the edge of the great Saline in the middle of the high plateau. We find Sporobolus species as far as there is sandy soil, but where the white saline crust starts, which forms the actual Saline, this species can not exist. The same conditions exist with Frankenia triandra and Distichlis humilis. We find mats of Franenia on the white saline crust, which remind us of a frozen lake; when I was there (Nov.19th) they were in full bloom; also Distichlis, whose culms raise 1 - 2 cm above the saline crust; if we pull one out, we find its rhizome and its leaf sheaths covered with a thick layer of salt. The culms of Disichlis grow isolated in rows, on account of the rhizome which grows horizontally and below the surface of the ground. The farther we proceed in the Saline, the less mats of Frankenia and less culms of Distichlis we find. The first mentioned plant disappears first; Distichlis has the most power of resistance, but it cannot exist in places where the saline crust becomes too thick. There is no vegetation whatsoever in the middle of the Saline.

Cultivated Plants and Weeds.

The severe alpine climate naturally reduces the number of cultivated plants considerably; furthermore, the long dry season makes the care of some of these plants, which otherwise might readily grow in this territory difficult. The scattered population of the Puna usually had their homes and small fields near running brooks. The people make use of the water of these brooks by ingeneous water systems for irrigating their fields and pastures, which otherwise could not produce anything, since the rainfall is not sufficient. The cultivation of plants has not changed the vegetation of these areas, except in those places which we mentioned.

We name first of all the plants, which are cultivated " Alfalfa " (Medicago sativa), which is an important feed for mules and horses; barley (Hordeum vulgare), which is raised in some places is also used for feed. Potatoes, Vicia Faba and Chenopodium Quinoa are cultivated for human food. Maize can also be raised in protected spots, such as narrow valleys and sunny places, for example near Casabindo (about 3500 m), La Quiaca (about 3500 m), Yavi (3400 m above sea level) and other places; however, maize does not mature, as far as I know. 1)

1) Mayer (I) reports about Peru, that maize cannot be raised in higher altitudes than 12000 feet above sea level,and Medicago sativa not above 11000 feet.

At the present time, the maize production in this area is of little importance; a couple of hundred years ago, when the serves of the Incas lived there before the Spaniards conquered them and destroyed

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their culture, it was different. We can see from the ruins of the houses of the original inhabitants and the immense terrace constructions ---- we can also draw conclusions from those things, which were found in old graves ---- that maize was raised in large quantities, and this was made possible by imposing irrigation systems.

Fruit trees will not grow in this area. Sometimes, we see where attempts have been made with small peach trees; however, these trees cannot be raised, to say nothing about producing a profitable harvest.

I only saw a fine looking culture near Yavi. This place is situated about 3400 m above sea level in a little valley, well protected from winds and irrigated by a brook. Flax, which was in full bloom when I happened to be there on New Year's day, is cultivated in some spots; also wheat, a little maize, Medicago sativa, Lactuca sativa and Vicia Faba was cultivated; Vicia Faba grew just as well as in Europe, while near Moreno it did not grow higher than 1 - 2 dm. At Yavi, specimens of Salix babylonica and Populus canadensis, which were 5 - 6 m high, were raised; the two species were in full, green foliage on New Year's day.

Naturally a number of weeds, which came from the adjoining flora or have been imported by men from other parts of the country, also grow in these cultivated areas. Since there is a surplus of water when the fields and pastures are irrigated, a number of hydrophilic species have mixed with the weed flora.

We mention a few examples of the weed flora in the fields and pastures of our territory. In a Vicia Faba field, which was in full bloom on Dec. 14th., the following weeds were found: Lepidophyllum phylicaeforme (a few individuals, which had come from the adjoining Lepidophyllum formation) Solanum pulchellum Malvastrum antofogastanum, Medicago sativa, Chenopodium [illegible] Quinoa, Rumex crispus, Distichlis humilis, Bromus unioloides and Hordeum vulgare.

In a Medicago sativa pasture the following, rich weed vegetation was found on Dec. 14th. Lepidophyllum quadrangulare, Xanthium spinosum, Heterosperma pinnatum, Schkuhria pusilla, Solanum pulchellum, Heliotropium brachystachyum, Malvastrum antofagastanum, Erodium cicutarium, Hoffmannseggia gracilis, Medicago Berteroana, Melilotus indica, Astragalus atacamensis, Lepidium bipinnatifidum Amarantus oleraceus, Guilleminea illecebroides, Chenopodium Quinoa, Atriplex andina, Pennisetum chilense, Aristida nana, Bouteloua humilis, Eragrostis nigricans, Distichlis, Bromus unioloides, furthermore in moist places Rmexcrispus, Poa annua, Poa laetevirens and Triglchin palustre.

Those plants, which originally were not natives in the territory, but were brought in by men, are particularly interesting, because they have become more or less acclimatized. I think the following species belong into this category: 1)

Xanthium spinosum	Melilotus indica
Bidens bipinnata	Brassica Napus
Sonchus oleraceus	Capsella Nursa pastoris
Erodium cicutarium	Amarantus Blitum
Medicago sativa	" oleaceus
" Berteroana	Chenopodium Quinoa

1) is possible that the following species have been imported by men: Parthenium Hysterophorus, Tribulus terrestris, Nazia racemosa and Poa annua. As regards the latter one, it has originally been indigeous, but possiblyit has also

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been imported; in this case it came from two original places (see Kurtz II, p. 522). The way in which the others grow, shows that they have been imported by men; however, since they are also found in all valleys and the adjoining low lands, it does not seem impossible, that they were indigenous in the territory.

If we trace the origin of these imported species, we find, that most of them come from the old world. Into this category belong Xanthium spinosum 2) Sonchus oleraceus, Erodium cicutarium, Medicago sativa, Melitolus indica, Brassica Napus, Capsella Bursa pastoris, Amarantus Blitum and oleraceus. The following species originate in the New World: Bidens bipinnata (N. Am.) Medicago Berteroana, (Chile and Argentine), and Chenopodium Quinoa (Peru).

2) I support the most prevailing opinion (A De Candolle, I; Ihne, I and others), viz: that X. spinosum originates in the old world; according to Bentham (I), Heimerl (I) and others, the plant, however, is of South American origin.

Most of these plants are always found near human habitations, such as weeds in fields and pastures. Without any doubt, Erodium cicutarium is best acclimatized. Sometimes we found it miles away from human habitations. Probably sheep and llamas have furthered its distribution. We find it in fairly moist places (on the edges of ditches a.s.o.) with 10 cm long leaves and 18 cm long shoots, and also in very dry, sunny places, with shriveled leaves 2.5 cm long, and shoots 3 cm long, which are lying close to the ground. In the latter places we found it sometimes to be perennial.

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Flora of the Pampas of Patagonia

Two shrubs which are present in the flora throughout the entire range of the bushes, are the algorrobo or algorrobilla (Prosopis juliflora) and the jarilla (Larrea divaricata). The algorrobilla is an acacia, a bush of strong growth, characterized by the delicate foliage, strong brown thorns, and large beanpods of the family. Sheep and cattle eat the beans when ripe, and the large roots are dug for firewood. The bush is being exterminated by the latter practice in the vicinity of the railroad. The jarilla is a slender spreading shrub, with small stems and gray bark. It is without thorns. The flower is small and yellow. The delicate light-green leaves have the peculiar characteristic of turning on the stem so that they may all lie parallel and point very nearly north and south. It has been called the north-and-south bush and is sometimes used as a means of determining direction.

Associated with the algorrobilla and jarilla in the Bajo de San Antonio occur the chanar (Gourliea decorticans) and mata negra (Atamisquea emarginata), which are found rarely, if at all, at higher altitudes. The chanar is a small crooked thorny tree with smooth greenish to yellowish bark, which scales off. The little thick leaves of a grayish-green color are so few in number as to suggest that the tree could not afford any more. The small yellow flowers are followed by a fruit, which is relished by sheep.

The mata negra is a very handsome dense-growing bush, completely covered with small dark-green leaves. It appears to be an evergreen and is adapted to use as an ornamental plant in mild dry climates.

Mata cebo* (Monttea aphylla), or the fat bush, presents at all seasons a mass of leafless green stems of a decidedly lean and stripped appearance, but they are covered with a very inflammable substance, which gives rise to the name. It is said that the covering possesses no essential oils or properties of value. The shrub occurs widely throughout the plateaus of Rio Negro.

Una de gato (Chuquiraga erinacea), or cat's claws, takes its name from the needle-like greenish leaves with which the shrub is so covered as to present a thick mass of them and defy handling. The large yellow flowers are somewhat conspicuous.

Among the more useful species are zampa and tomillo, both of which are eaten by sheep. The latter is a relish in the desert fodder and is eagerly nibbled even by horses. Zampa, or sampa, is a salt bush (Atriplex sp.). It grows from a short twisted fibrous trunk half a meter to a meter high, with many closely aggregated branches and whitish-green foliage.

* "Palo de sebo," according to Hauman-Merck.

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It is exceedingly common in and rather characteristic of the lower, salty soils of the bajos, where it is associated with typical salt grasses.

Tomillo (Lippia trifida, Gay) is a strongly aromatic little shrub about half a meter high, bearing very small thick leaves that are set close about the stem. It has very small violet-colored flowers and may at once be recognized by its odor and taste, which are like those of a lemon verbena.

Proceeding westward, the growth of the shrubs on the coastal plain and plateaus is general, even up to 500 meters or more above sea; but the shrubs become stunted by cold in the higher altitudes, and they grow more widely spaced in the drier districts of the plains, for each plant spreads its roots to occupy a sufficient area to provide it with moisture and by absorbing the moisture prevents others from growing within its reach. Thus the density or sparsity of the shrubs is an indication of the abundance or scarcity of moisture. The western limit of the shrubs is irregular, as the bushes follow the valleys, while they disappear from the intervening ridges. The growth which is characteristic of the coastal plain dwindles 200 kilometers west of San Antonio and disappears from the plateaus about Corral Chico, but it is represented in the valleys from Corral Chico to Maquinchao and even beyond that toward Huanuluan and Anecon Grande, 400 kilometers from the coast. It may be said to be lacking after we pass this extreme western limit.

One of the most widespread and interesting plants of western Rio Negro and adjacent regions north and south grows in large round cushions like masses of intertwining branches, light green during the damper seasons, bright yellow when covered with tiny flowers, and brownish when dry. The branches of masses from 1 to 2 meters in diameter are connected by a single stem with a large woody root or trunk and are easily dislodged The stems above the root are all flattish, green, and many-branched and end in sharp points. They serve as leaves, there being no others. The interest in the plant lies in the fact that it grows on very open, porous sands and gravels, deriving moisture from the large amount of ground water stored beyond the reach of evaporation but within reach of its roots. The local name is neneo (Mulinum trifurcatum). It is said, and with certain reservations it is true, that alfalfa will grow where neneo does.

Another conspicuous plant, well known but not certainly identified, covers some of the arid hillsides of the western Pampas with large masses of brilliant orange-brown papillionaceous flowers in December and January.

The growth of native grasses is the most important element of the vegetation. Botanists distinguish many species, chiefly of the genus Stripa, which is widely represented among the bunch grasses of the western plains of the United States and also in Europe.

The native name "coiron" is applied to all the bunch grasses, which are very similar among themselves. They grow

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from the Atlantic coast to the Cordillera and from sea level up to 1,600 meters above sea. These grasses grow in large, strong bunches distinctly separated from one another; they reach 2 feet in height; the blades are rounded on one side and deeply creased on the other, so that they present a crescent-shaped cross section, and when mature the point becomes hard and spiny. Young shoots sprout from the tuft among the older ones and constitute the principal food of the guanaco, of the ostrich, and also of the domesticated herds.

There are several distinct varieties which grow along with the desirable coiron or in some habitats replace it. They are recognized by the herders, who apply the names coiron fino, pasto duro, and pasto amargo. The coiron fino is eaten by animals, but it is said not to be a nutritious fodder. The pasto duro is particularly spiny, while the pasto amargo is bitter, and neither of these is eaten except under stress of necessity.

The grasses grow among the shrubs in the Bajo de San Antonio, throughout the coastal plain, and up over the high plateaus. On the lava plateaus, with a few of the more conspicuous flowering plants, they form the entire flora. About Anecon Grande and all of the high plateau of western Rio Negro they constitute the chief element of the flora, and these places are most aptly described as grassy pampas, in contradistinction to the bushy pampas of the east.

That class of the vegetation to which we have applied the name herbs comprises the conspicuous flowering plants which are not shrubs and consists in very large proportion of members of the family of Compositae,

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Nierembergia, R. & P. "Cupflower"

Subshrubs and low perennial herbs with showy white or pale flowers; about 25 species from tropical and subtropical America, allied to Petunia and characterized by the long and very slender corolla tube. - Decumbent or creeping, sometimes erect, mostly glabrous, diffusely branched, the branches slender; leaves alternate, scattered, simple and entire; flowers white or pale violet, often with purple center, borne singly at or near the tips of the branchlets; calyx tubular or campanulate, 5-parted; corolla with slender elongate tube abruptly expanded above the limb with 5 broad lobes; stamens inserted on the upper part of the corolla tube, more or less exserted, 4 of them paired, the 5th smaller: capsule 2-valved, the valves mostly 2-cleft.

Peru ----- 1 species

Sessea, R. & P.

Trees and shrubs with leaves alternate, petiolate, oblong, false-stipuled, entire, frequently tomentose on the lower surface; inflorescences terminal, paniculate, calyx and corolla often stellate tomentose. Calyx tubular, 5-toothed, Corolla tubular-funnelform, limb spreading, 5-parted into oval lobes, Stamens 5, inserted on the middle of the corolla, not extending beyond the corolla. Stigma unequally 2-lipped. Capsule cylindric, 2-valved, valves bifid on dehiscence. Seeds few, linear-oblong.

Peru ----4 species

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Cestrum, L.

Shrubs and small trees of the American tropics, some of them planted in warm countries and grown under glass for the attractive and often very fragrant flowers; species about 150. -Leaves simple and entire, mostly narrow rather than broad: flowers in axillary or terminal clusters, tubular, not large but numerous or bright-colored, greenish, white, yellow, or red, the limb salver-like or trumpet-like, the long tube either enlarged or contracted at the throat, the 5-toothed calyx relatively short; stamens attached in the tube, included; ovary 2-celled, with 3-6 ovules in each cell, usually on a short stipe; style slender, stigma expanded and sometimes 2-lobed: fruit a small berry, often scarcely succulent.

Peru----- number of species.

Datura, L.

Large coarse erect plants, several cultivated for their great trumpetlike odorous flowers; a dozen to 15 species, mostly with strong-smelling herbage, in the warmer parts of the globe, but some of them widespread weeds. -Forking bushy annuals, shrubs, or trees, with narcotic principles: leaves large, simple, entire or coarsely sinuate-dentate: flowers large, axillary and solitary, erect or pendulous, white, red, violet, or yellow; calyx long-tubular, 5-toothed or spathelike, splitting lengthwise or circumscissile with the base shortly and broadly lobed, the lobes often acuminate; stamens inserted near the base of the corolla-tube, included or only slightly exserted; style long-filiform, 2-lobed; fruit a large 2-celled (falsely 4-celled) capsule, mostly prickly or spiny, usually dry and 4-valved at top but sometimes fleshy and bursting irregularly or indehiscent; seeds large.

Peru----- 2 species.

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Dunal in DC Prodromus

Nolana - 6 sp.

Dolia - 2 I, 14

Alibrexia - 1 I, 2

Grabowskia - 1 I, 13

Lycopersicum - 6

Solanum - at least 40, maybe many more genus has some 900 species
Bailey lists it at 1200 sp

Cyphomandra - 4

Bassovia - 1

Capsicum - 2

Saracha - 9 II, 38, 37

Physalis - 6 II, 39

Withania - 1 I, 17

Hebecladus - 4 I, 33

Salpichroma - 7 I, 28

Jaborosa - 1

Codochonia - 1

Dunalia - 2 I, 2

Chaenasthes - 3

Peruvian Solanaceae

Iochroma - 1 I, 30

Lycioplesium - 4 I, 29

Poecilochroma - 5 I, 34

Geniatus - 4 I, 4

Lycium - 1 II 64, 65, 66-74

Juanulloa - 3 II, 46

Dictyocalyx - 1

Datura - 2

Nierembergia - 1 I, 18, 19, 20

Sessea - 4 I, 15

Cestrum - 21 of ca 165 sp = I, 16
the genus

Bailey - Manual of Cultivated Plants

(Petunia axillaris - Argentina)

Fabiana imbricata - Peru - Dunal
gives it as Chile I, 17

Millan

Nicandra

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Peruvian Solanaceae

Cyphomandra	pendula Sendtn.	"In Peruviae Provinciae Panatahuanae nemoribus humidis"
	splendens Dun	"In Peruvia"
	viridiflora Sendtn.	"In Peruvia nemoribus"
	coriacea Dun.	"In Peruvia"
Bassovia	brachypoda Dun.	"In Peruvia"
Capsicum	pubescens R. + P.	"Affatim in Peruviae cultis, praecentim ad Panatahuanam provinciam et in Andium nemoribus"
	Conicum	"copiose in Peruviae cultis ubi vernacule Arnauchos et Aji Arnauchu vocatur"
Saracha	villosa Don	"in Peruvia"
	contorta Dun.	"in praeruptis Peruviae"
	biflora R. + P.	"Inter segetes Peruviae"
	procumbens R. + P.	"In Valle Canta Peruviae"
	umbellata Don	"In Peruvia"
	alata Dun.	"In Peruvia"
	dentata R. + P.	"In ruderatis Peruviae"
	pubescens Humb.	"In Peruvia"
	physaloides Gaertn.	"In Peruvia nunc per regiones temperatas et calidas totius orbis diffusa et passim subspont facta."
Physalis	viscosa L.	Peru, S. Brasil, Buenos Aires
	tomentosa Walth.	Peruvia Mexico etc.
	chenopodifolia Lam.	

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Physalis lanceifolia R. & P. Pranceae Solanaceae — In Peruvia, Mexico
prostrata Dombey — In Peruvia
maxima Mill. — " Peru

Withania subtriflora Dun. — " In Peruvia

Heteranthus umbellatus Miers — In collibus Peruviae, Lima
bicolor Miers — "In Peruviae Andibus umbrosis"
intermedius Miers — "Ad Parruchuco Peruviae"
sinuosus Miers — "In Peruviae provincia Chachapoyas

Salpichroma glandulosum Miers — "In Pasco Peruviae"
hirsutum Miers — "In Peruvia circa Pisacomam alt. 15000 ped.
ramosissimum Miers — "Ad Parruchuco Peruviae"
diffusum Miers — "In Andibus Peruvianus, ad
triste Miers — "in Andibus Peruvianis,
in Andibus Quitensibus
breviflorum ——— in Peruvia prov. Chachapoyas
cuspidatum — "in Peruvia"

Jaborosa integrifolia Lam — "in Peruvia"

Codochonia solanoides Dombey — "In Peruvia"

Dunalia acristoides Miers — "In Peruvia, circa Huanaco"
lycioides Miers — "In Peruviae prov. Canta Larma et Jauja
Chamaesthes fuchsioides ——— In montibus Peruviae prope Cuenza, Columbia, Ecuador.
Gesnerioides Miers — in Peruviae provincia Chachapoyas
Lycopersicum Peruvianum Miers — in Peruvia prope Loxam

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Iochroma grandiflorum Benth. also several species in Ecuador	"In Andibus Peruvianis ref. Ecuadoreum contentis
Lycoplesium Dombeyanum Dun	"Circa Tarmam in Peruvia"
obovatum Miers	"In Peruvia circa Tarmam, vulgo Espino
horridum Miers	"In Andibus Peruviae, circa Caxamarcam
Meyenianum Miers	"In Peruvia, circa Pisacomam
Poecilochroma punctatum Miers	"In Andibus Peruvianis"
frondosum Miers	"In Peruviae provincia Chachapoyas
guttatum Miers	"In Peruvia
maculatum Miers + two spp. Ecuador	"In Andibus Peruviae
Llobianum Miers	"In Andibus Peruviae"
Acnistus aggregatus Miers	"In Peruviae vallibus et praeruptis"
floribundus Don	"In Andibus Peruvianorum, alt 800 dep.
spathulatus Don	"Prope Huanuco Peruviae"
umbellatus Miers	"In Peruviae provincia Cantae, in provincia Chachapoyas Caxamarcae
Lycium salsum R. + P.	In Peruviae littoribus ad Surim sepes
Juanulloa parasitica R. + P.	"Supra truncos arborum in nemoribus Andium + arborum Peruvianorum + Mexici
grandiflora Dun.	"In Peruvia.
macrophylla Dun	In Peruvia circa Huasa-Huasa
Dictyocalyx Mercii Hook.	"In insulis Charles + Albemarle Galapagos, in Peruviae et Columbiae ins.

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Peruvian Solanaceae

Nolana prostrata L. (Curtis Bot. Mag 2: 731) "In Peruviae locis maritimis arenosis"

spatulata R+P. "In collibus Peruviae

inflata R+P. " In collibus arenosis Peruviae

coronata R+P. " In arenosis et saxosis collibus Peruviae"

atriplicifolia hortul. e D. Don (Bot Reg. 1827 t. 76) in Smith Prod. Flor. Graec. N. Gen. t. 305 "In Peruviae et Chili arenosis salsis maritimis

cordata Dun. "In Bolivia prope Arequipa; in Peruvia"

Dolia leptophylla Miers Sinclair from Bot. 1845, pl 4, p 217 "In Peruvia"

laxa Miers &c "Circa Canta in Peruvia"

Calibrexia revoluta Miers "In arenosis Peruviae; ~~Chart~~ in locis maritimis Lurin circa portum Callao"

Grabowskia Boerhaaviaefolia (W. Arn. " In Peruvia"

Lycopersicum pimpinellifolium Dun. "In Peruvia, in Brasilia"

regulare Dun ? (related to Peruvianum)

Peruvianum Mill. "In Peruviae aridis arenosis et ruderatis"

agrimoniaefolium Dun —— "In Peruvia"

hirsutum Kunth "In agris peruvianes prope Loxa Granatensium

cerasiforme Dun " In maritimis Peruviae

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Solanum hebephorum Kunth	"In Peruviae frigedis, alt. 1460 Lex."
apalophyllum Dun	"In Peruvia
muricatum Ait.	"Cultivae in Peruviae cultis
furcatum Dun.	"In Peruvia
Pentlandii Dun.	"In Peruvia, in Bolivia
chenopodioides Lam.	"In Peru
tuberiferum Dun	"In collibus arenosis et saxosis Limae et Chancay
phyllanthum Cav.	"In Peruviae cultis circa Magdalenam et in sabulosis Limae, Chancay, Lurin
pinnatifidum R.+P.	"In Peruvia"
senecioides Do	"In Peruvia"
multifidum R+P.	"In Peruviae collibus Cumana circa Pongo
mite R+P.	"In Peruviae nemoribus"
conicum R.+P.	"In Peruviae nemoribus"
diffusum R.+P.	"In Peruviae nemoribus
Endlicheri Dun.	"In Peruvia
ternatum	"In Peruviae nemoribus humidis
trifolium	"In Peruviae provincia Huayaquil"

p. 69 + 114 Tab. 112 1 { up to p. 120 (end of middle part of the Solanum

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Peruvian Solanaceae

Datura arborea L. — "In Peruvia ad hortos, verosimiliter et septus, in Chili."

sanguinea R. & P. — "In altis frigidis et rudenatis locis Peruviae"

Nierembergia petunioides Dun. — "In Peru."

Sessea stipulata R. & P. — "In montibus Peruviae Huanuco"

dependens R. & P. — "In Peruvia ad ripas fluviorum provinciae Tarmae."

Dombeyi Dun. — "In Peruvia"

vestita Miers — "In Peruviae Paramo de Quindiu, Quito, Hoosfunk"

Cestrum affine H.B. & K. — "In devexis montium Peruviae"

discolor Dun — "In Peruvia? Chicoplaya de Tarfalla"

lanugenosum R. & P. — "In Peruviae collibus arenosis ad Atiquipa prov. Camanae vicum."

tomentosum L. — "In Peruvia inter Soram et Vinayacam"

conglomeratum R. & P. — "In Peruviae praeruptis et aliis frigidis locis."

confertum R. & P. — "In Peruviae sylvis"

parviflorum Dun — "In Peruviae prov. Quito"

albo-punctatum Dun — "In Peruvia?"

heterandrum Dun. — "In Peruviae verosimiliter suderatis et sepibus passim"

atrovirens Dun. — "In Peruviae Prov. Quito"

strigillatum R. & P. — "In Peruviae nemoribus"

Lasianthum Dun. — "In Peruvia"

[illegible] — "In Peruvia"

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Cestrum	cancellatum Dun.	"In Peruvia."
	calycinum H.B.+K.	"In calidas Peruviae"
	longiflorum R.+P.	"In Peruviae nemoribus"
	servatum Dun.	"In Peruvia?"
	leptanthum Dun.	"In Peruvia humidis circa Limam."
	auriculatum L'Her.	"In Peruviae locis temperatis"
	Sendtnerianum Mart.	"in Mayna Peruviae"
	petiolare H.B.+K.	"in locis umbrosis Peruviae"

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