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About the Institute

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.

November 8, 1939

Prof. Ernest C. Smith,
Curator of Herbarium,
Department of Botany,
Colorado State College,
Fort Collins, Colorado.

Dear Professor Smith:

In continuance of my letter of November 6, and in more complete reply to your letters of October 10 and 12, I am glad to enclose herewith list of the determinations of the willow specimens recently sent me. I was very glad to have your three-page discussion of many of the individual specimens.

In these determinations I have gone no further than to attempt to separate specimens referable to *S. monticola* from those referable to its variety *padophylla*. I admit that there is still the possibility that there is some *Salix Barclayi* in the Rocky Mountains of Colorado. To settle this question will require still more study of these and earlier specimens. Such study I cannot give for at least a month.

I especially appreciate your discussion of the differences observed as recorded in your notes and your interpretation of what these differences mean. In general I agree heartily with your conclusions. I would like to go a little farther, however, into the philosophy and psychology fundamental to taxonomic botany. To be brief I will have to be somewhat dogmatic.

No two plants of any so-called species are alike. Frequently no two shoots on the same plant will be exactly alike. Our descriptions, therefore, must represent an average of many shoots on a single plant and many plants of a single species. It follows that most specimens will not match the average description exactly.

Because of the great diversity of expression in the different individuals of a species, it is only natural that some specimens, in some of their organs, will present expressions which place them

dupl. in letter, + 5 predominant *padoph*

close to or actually into the average description of a variety of that species or even a closely related species. For example, you yourself in discussing the differences between *monticola* and *padophylla* (whether regarded as species and variety or as two species) permit subsessile aments in both. In *monticola* this subsessile condition would be the extreme from the normal sessility. In *padophylla*, this subsessile condition would be the extreme in the other direction, representing the least progress in the production of a peduncle.

I believe it would be most helpful to taxonomic botany if we could stop more often to consider the chemical reactions within the plant, the physiological results these produce, and the morphological expressions caused by these processes. Our taxonomy is based wholly on the morphology but underneath the morphology is the chemistry and physiology, and the expression of the plant as we meet it on any given date is the sumtotal of the chemistry and physiology of the plant in that season up to that specific date. Add to this the fact that our specimens are merely fragments of the whole plant and we begin to realize the difficulties of exact morphological descriptions.

In most of the animals with which we are familiar, most organs are paired and the two members of each pair develop rather equally. In plants there is no pairing but multiple development of organs. From chemistry and physiology we know something of what starts the development in spring, what keeps it growing, what transfers the food stream from one budshoot or ament to another, etc., etc. But we know nothing about these influences on the fragmentary specimens of a willow plant which we collect. We know, however, that processes may be slow or rapid, or first one then the other, that they will be checked on one shoot, one leaf, or one ament, while allowed to continue to greater lengths on another. Knowing these things we can only wonder that there is as much uniformity among the multiple examples of a single organ on a plant as we actually find. For example, it is not at all uncommon to find aments from 2 to 6 cm. or from 3 to 10 cm. long on the same shoot! Why are they not all the same length? If humans reacted that way we would have children from 3 to 10 feet high in most of our families.

Like the children, the ament or leaf is born with very small compass and elongates and broadens thereafter. While the rachis of a willow ament is elongating as it does after the bud opens, why should not the peduncle elongate, and if all aments do not reach anywhere near the same length, why should all peduncles be any more uniform? The answer is that they are not. As a matter of fact, there is almost no such thing as a sessile ament. Many willow species are described as having sessile aments. Some individual aments are truly sessile but the majority of them have peduncles of measurable length.

Dr. Fernald described *S. coactilis* as differing from *S. sericea* by about five characters. Recently I studied some 200 sheets of *S. sericea* and found that about a third of them overlapped the limits of *S. coactilis* in one or more of the five characters. This does not necessarily mean that both species are not valid. It means that we must not be too dogmatic about the limits of variability within any one species and we must expect some overlapping in the range of any one or all characters as between two species or a species and its varieties.

Another factor to be considered is that evolution is always in progress. Also it always is progressing in all directions. Sometimes progress is faster than others and sometimes it is completely arrested after a period. Now if *S. monticola* is a species and *padophylla* is a variety or another species closely related to but differing appreciably from it, we cannot believe that all the evolutionary processes in *monticola* were devoted to producing a variation in the direction of *padophylla*. These changes also were producing variation in the direction of narrower leaves as well as broader, in the direction of more sessile or shorter aments as well as more pedunculate or longer aments. Therefore, we should expect to find all kinds of variation. Evolution does not produce species and variations as we understand them but instead she produces multiple variations. We take the major variations in one direction, describe them and say this is a new variety or a new species or a new genus. That does not mean that the individuals which compose it are alike; it merely means that we have lumped those that varied most clearly in that given direction and left out those that did not vary quite far enough to get in. In other words, our species and varieties are almost wholly our own mental conception and not products of nature. This is no criticism of man's attempt to classify; it is the only thing he can do when dealing with dead fragments with a lens and a measure, but when he works this way he should not be worried by the fact that not everything will fit into the box he makes.

In discussing development I should have mentioned that on several of your specimens which you note as having the younger leaves narrowed at the base, a careful inspection will show that the base was in process of broadening when the specimen was picked. In the development of the leaf from the bud the apex broadens first and the base last. Oftentimes the undulating or slightly folded condition of the tissues at the base of the leaf show that the stretching process was underway but not completed. On such a twig a few leaves sometimes may be found in which the base has about completed its development and will be broadened or rounded while the others still are cuneate.

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I will pick out for you some representative specimens of *S. pseudomonticola* Ball for your study. I am sorry that I do not have duplicates for distribution. As soon as I hear from you in reply to my inquiry of November 6 regarding the disposition to be made of this material, and especially of the mounted sheets therein, I will be ready to ship specimens of *pseudomonticola* to you.

In your letter of October 12 you referred to your No. 1321 from Joe Wright Creek as being baffling because of differing leaves and longer and more slender peduncles with more leaflike bracts. No. 1321 as sent to me does not have any aments and I am wondering if you are referring to No. 1323. As this specimen was collected on August 8 it is not surprising that there has been an increased maturity of the bracts at the base of the ament.

Cordially yours,

Carleton R. Ball,
Executive Secretary

Colo.

November 25, 1940

Dr. Ernest C. Smith,
Curator of the Herbarium,
Department of Botany,
Colorado State College,
Fort Collins, Colorado.

Dear Dr. Smith:

On my return to Washington I find your letters of November 8 and 14 and my secretary's acknowledgment of the former. I have also the package of willows and have looked them over with much interest.

I note your problems in getting ready for publication and can sympathize with you in your questions for final decision before submitting the manuscript. I will say frankly that anything I may say now will be subject to revision in that monograph on North American Willows toward which I am working. In the last busy years I have been able to determine only incoming material and publish occasional novelties but not to monograph even a single section of the genus. I am accumulating notes and material, however, which will make monographing much more rapid than if I had to tackle the job from the beginning.

Another thing which I wish to say in all candor is that determinations made 40 and 30 and even 20 years or less ago are not necessarily my determinations of today. My knowledge of the genus and the diversity of its forms has grown with the years and I know a lot of things now that I did not know once. This, I suppose, is a natural evolution but one which Schneider completely overlooked when he took me to task for things I had done in the early nineteen hundreds.

As to the distinction between the sections *Gordatae* and *Commatae*, I would say that style length is one of the best characters. Style length, however, differs with the degree of development of the individual capsule, with the vigor of growth, and to some extent with environment. Styles are likely to be longest just after fertilization and to shrink somewhat as they dry. Styles are longer on vigorous plants or plants growing vigorously at flowering time than they are on less vigorous plants of the same species in the same environment.

Styles of the *Commutatæ* are longer in northern latitudes than they are in the northern United States. *S. Barclayi* and *S. commutata*, for instance, may have styles 2½ mm. long in Alaska and only 1½ to 2 mm. in the northwestern United States. This is preliminary to saying that *S. pseudocordata* and its forms seem to fit more nearly into the *Cordatæ* than into the *Commutatæ* in spite of their relatively long styles. I am guided in part by the knowledge that *S. myrtillofolia*, a far northern species, closely related to *pseudocordata*, also has elongated styles but is still more divergent from the *Commutatæ*.

Young leaves of *S. petiolaris* often are entire throughout the range of the species. Occasionally full grown leaves on fruiting branches will be subentire but the leaves of seasonal shoots always will be serrulate or serrulate-denticulate.

I did not know that whole plants of *S. Geyeriana* failed to show a glaucous under surface for the leaves. Young leaves of many species do not show glaucescence until fully expanded and sometimes not until a little later than that. In your area the branchlets of *Geyeriana* usually are pruinose while those of *S. petiolaris* are not.

The section *Longifolias* is wholly North American, apparently recent, and still very plastic. Of all its component species, *S. exigua* seems to be the most plastic and most diverse in character and appearance throughout its wide range. It is for this reason that different aspects of the species have received numerous specific names and that several varieties now are recognized. Probably more varieties must be recognized when a complete monograph is prepared. Some of the Rocky Mountain material which I have determined as *S. interior* *pedicellata* in past years really belongs to *S. exigua* or some of its varieties. This applies, for example, to all of the I. M. Johnston collections from the Pike's Peak area and to some other Colorado collections.

S. interior ranges from the Gulf of Mexico to the lower Yukon Valley. The mature leaves normally are glabrous. Young leaves often are pilose with silvery, shining, and rather elongated hairs. They never have the short, gray pubescence or pubescence of *S. exigua*. *S. interior* has two recognized varieties. Variety *Wheeleri* has short, broad leaves, usually rather heavily pilose. Variety *pedicellata* has narrow leaves and corresponds somewhat to variety *stenophylla* of *S. exigua*. The pedicels of the capsules on which the name was based are not longer, on the average, than those of the species. This variety has very much the same range as the species. It occurs with the species in the Great Plains area and apparently does not penetrate the mountains or perhaps even the foothills in Colorado. In Wyoming and Montana it extends further west because the Plains extend farther west as the Continental Divide shifts westward. I am not sure just what you mean by your statement that you hope I will retain Rowlee's name. I have always recognized *S. interior* Rowlee although I cannot recognize several other names that he applied in his monograph of the section after a very brief study and with wholly inadequate descriptions.

- 3 -

Your mounted specimen from North Park labeled *S. exigua* *tenerrima* Schneider is really *S. melanopsis tenerrima* (Henderson) Ball. As I have noted on a correction label, this variety is found in Idaho and adjacent portions of Utah and Wyoming, together with northwestern Colorado. Your specimen comes from east of the Continental Divide from which area I have seen only one specimen before. The other specimen is L. H. Goodding No. 66 collected between Dillon in Summit County and Kremmling in Grand County in 1938. It is almost exactly identical with your specimen as are some others from western Wyoming.

As to the names properly applied to sections of the genus, I am not an authority. Schneider has done much more bibliographic research than I. I do not know the priority of the various section names, if section names are subject to the so-called law of priority. Personally, I think that the botanical law of priority is punk. It is supposed to achieve uniformity and consistency of usage. As a matter of fact it has flooded botanical literature with new combinations made by men who know nothing whatever about the plants whose names they were changing but were interested primarily in getting their names attached to a new combination. When any so-called law has this affect it is worse than no law at all because it produces anarchy under the name of law. In the world of abstract ideas priority is not recognized. We are always glad to say that a certain idea originated with Socrates or Pliny or Gaylussac but we do not insist that he was the first one who developed it, or that his name must be mentioned every time the idea is mentioned, or that we would have to mention somebody else every time if we discover that it had been developed by an ancient Hindu or Chinese. All this is by way of saying that I do not yet know what section names I will use when I monograph the genus.

Without considering any priorities, I would think that *Glaucæ* would be a desirable name for the species of the group containing *S. glauca*. *Discolores* based on *S. discolor* would be a good American name for the species of the group containing *S. Caprea* of Europe. *Comutatae* is a more expressive name for the section because the species represents the middle of the section where *S. adenophylla* stands at one extreme. I do not know if I originated the section *Rostratae*. It is expressive, although rostrate capsules occur in the *discolor* group as well. These remarks, as you will see, have nothing to do with priorities.

I do not know whether Schneider's section *Wolfianae* is justified or not. The species probably is more nearly related to *S. lasoclepis* and its varieties which Schneider also assigns to a new section, than to the *Cordatae* with which it usually has been associated.

These comments may not help you much but they are the best that I can offer at the moment. I am returning your mounted specimens and one unmounted specimen under separate cover. The three unmounted specimens which were not marked "return" are identified as follows:

- 1316 *S. exigua lutescens* (Narrow leaves on rapid top growth;
(Rydb.) Schn. wider leaves below).
- 1317 *S. exigua lutescens* (Rydb.) Schn.
- 1318 *S. exigua* Nuttall (Broad and relatively short leaves, somewhat
resembling those of *S. interior wheeleri*
(Nebb).)

Cordially yours,

Carleton R. Ball,
Executive Secretary

Colo.

February 11, 1942

Professor E. C. Smith,
Curator of the Herbarium,
Colorado State College,
Fort Collins, Colorado.

Dear Professor Smith:

In an endeavor to straighten out some puzzles regarding specimens you have sent me from time to time, I have just rearranged our correspondence over the last several years and the duplicate file of identifications which I keep arranged by States. In doing this I have discovered two letters from you dated April 14 and May 8, 1940, which seem to have received no reply. I am sorry for this neglect. These letters are concerned primarily with twig colors of various species, a subject which we have discussed in both earlier and more recent letters. Twig color would seem to be influenced by many factors. Among these are age of the plant, age of the particular twig, progressive variation through a given season, exposure of individual plant, vigor of growth which in turn is dependent on various external conditions, and possibly some relation to soil type and therefore to chemical intake.

These factors refer to conditions in nature. In addition is the effect of drying processes while converting nature's handiwork into a herbarium specimen. As I have said elsewhere, the changes in color which take place in drying are affected by the age of the branchlets, the vigor of growth at the time of collection, and the pressure applied, and the frequency of change of driers or by the effect of the oxygen which reaches the dried specimen and influences the final color.

Of all the factors occurring in nature, it is probable that progressive development during the season is the single greatest influence on branchlet color. Take the case of a human being; flesh white in spring but nut brown in autumn if sufficient sunbathing is utilized. Or take the more permanent case of the Hindu population of India which is just as Aryan as we are but which has a skin color very much darker than that of even the Mediterranean races (Italian, Spanish, Portuguese). Anthropologists tell us that the skin color of the Hindu is a longtime environmental effect.

- 2 -

I agree with you that the general description of twig color in the *Commatatae* must be revised. Many or most of them probably are yellowish in the spring in nature and become progressively darker through the season. As you yourself have learned by observation and experience, the yellower they are in nature the more likely they are to discolor either by seasonal exposure or by the drying process. As to the color of twigs in other species, even those which have purplish, dark brown, or black 1-year and 2-year branchlets, the seasonal shoots often are yellowish. This holds for ~~✓~~ species like *S. subcerulea*, *S. bella*, and *S. Geyeriana*, and others which have pruinose branchlets. The pruinose exudation does not show up as plainly on the yellowish young shoots as it does on the dark colored older shoots, partly because it is not as dense and partly because the color contrast is not as great.

I should have said earlier in the discussion that there probably is considerable variation in the internal metabolism of different species of willows and perhaps of different plants of the same species. There certainly is considerable difference in the same plant at different seasons of the year. How much these differences influence the final twig color in the drying process in preparing herbarium specimens I do not know, but probably enzymes within, as well as lack of oxygen without are a potent factor in determining the final appearance. This may be equally true in nature. In human beings some skins burn and others tan. There is no reason why this should not be equally true in plants.

Too little is known about anther color in nature. A few species have been described as having reddish or violet anthers. In most species the anthers are yellow. In some they discolor somewhat in drying either because of poor drying processes or because of the exact stage of anther development at the time of collection, the result being different shades of brown. We certainly need field records of anther color at flowering time, and determination of whether the color persists or whether the final color is yellow through the removal of the original anther color thereby permitting the pollen yellow to show through. Almost nothing is on record in this field.

In your letter of April 14 you asked for duplicate specimens of *S. melanopsis*, *S. Farrae*, *S. monochroma*, *S. Wolfii*, variety *Idahoensis*, *S. Barclayi*, and *S. Drummondiana*. I am sorry that this request also was neglected. I will endeavor to determine quickly if I have any duplicate material on these species and if so will be glad to send it to you.

Cordially yours,

Carleton R. Ball,
Executive Secretary

P.S. In one of your more recent letters you asked me for ^{an} additional copy of my paper describing *S. pseudomonticola* variety *padophylla*. Did I send it to you? My reply does not indicate.

CRB

Mr. Ernest C. Smith,
Curator of the Herbarium,
Colo. State College, Ft. Collins

June 11, 1945

Dear Mr. Smith:

Your letter of May 22 has been received, as well as two earlier letters. I have had too many jobs lately, and willows have been neglected. Also have had to travel in connection with the Proposed Missouri Valley Authority and other social-action projects. Expect now to get back to willows. This merely answers some of your queries on page 2 of May 22.

1. S. candida in Colo. I have no record of its occurrence in your State. It has been collected in Albany Co., Wyo., at Centennial Valley, by A. Nelson, No. 3684. It has been found once in the Black Hills of So. Dak., at Deerfield by McIntosh, No. 729. In ~~western~~ northeastern So. Dak. it has been found once at Sisseton, Roberts Co., by Over, No. 16315, and twice in Marshall Co., at Buffalo and Red Iron Lakes, Over Nos. 15438 and 17297, respectively. All of these are in my herbarium.

2. S. interior var. pedicellata (Ands.) Ball. is separated from the species by narrower leaves but not by length of pedicels. Of course, one has to consider ~~the~~ width in relation to length, or the leaves of juvenile, or depauperate dry-land, plants might sometimes be placed in the var. pedicellata by reason of narrow leaves alone.

3. S. pseudolappaceum and so-called varieties. I do not accept S. pseudolappaceum itself, let alone Kelso's so-called varieties. It is merely one expression of the S. glaucops complex. The original species is S. desertorum Rich. When we delimit that, we then can determine what to do with all the other specific names which have been applied, including S. pseudolappaceum. Fernald has erected a series of 6 varieties for S. cordifolia Pursh, the eastern counterpart of S. glaucops. I have determined many hundreds of specimens and while there is doubt about some of them, it does help to sort such a complex in that way. Probably that will be the final procedure in S. desertorum.

4. Yes, I have seen Kelso's paper on Creeping Willows of the Central Rocky Mountains. Two things are wrong with him. He began naming new species, varieties and form before he had studied the genus Salix and knew anything about its variation. I can make scores of novelties by his methods. "any others have done so, but they have not advanced our knowledge of Salix relationship. Secondly, in comparing his entities, he refers to them by common names which he has assigned and which mean absolutely nothing to any one else. Therefore, we must consult some earlier publication in order to discover what species he is using in comparison. Is that science? Or selfishness?

5. S. lucida in Colorado. It will be necessary to compare collections from Cheyenne Wells, Cheyenne Co., Colo., with great care to be sure that it is S. lucida from the east or S. caudata var. Brynatiana from the Rocky Mountains. The possibilities are a toss-up. That is Smoky Hill River drainage, the very headwaters in fact, which would make floating down from the west almost impossible. On the other hand, S. lucida does not occur in the Arkansas R. basin farther east, and is credited to Nebraska only once, and may be an ornamental introduction. It does reach the Black Hills sparingly, like S. petiolaris, S. candida, and other. Carton received. Cordially yours

Carleton R. Ball, Collab.

COLORADO A & M COLLEGE

Roy M. Green, President

FORT COLLINS, COLORADO

November 21, 1947

Also 1 of Nov 18

Dr. Carleton R. Ball,
3814 Jocelyn St., N W.,
Washington 15, D. C.

Dear Dr. Ball:

Your letter of November 16 reached me today. With the information contained in my recent letter and Kelso's publications in hand you can get a pretty clear idea of the man. In Leaflet No. 34 he reduces well recognized species and varieties to varieties of S. cordata in complete ignorance of what that name actually represents. With no clear idea of S. Barclayi, evidently ignorant of Anderson's description of var. hebecarpa, he makes 7 varieties, some with names already established (S. pseudomonticola and var.), some with latin diagnosis, some merely with a number, a brand new name for S. pseudocordata, etc. His S. Barclayi var. resurrectionis (fig. in No. 36) is matched by several of my specimens (typical var. radophylla except for small size of leaves). In the figure of the type the prevailing leaves are not "obovate", but "oval".

He has had only six specimens of ^{miniz, three of} S. monticola sent to illustrate variations in form, called by him (at least two of them) S. pseudocordata (his S. Barclayi var. 7). The other three were late season forms sent without names, probably the ones which came to you.

I hoped to get material ready for you in case you could take time to look at it, so it could be sent in my absence, but it has been impossible to do so. I shall return about January first. My address will be 408 Littleton St. Houston 9, Texas and I shall be pleased to know whether you care to see my recent material.

Cordially yours,

Ernest C. Smith

Ernest C. Smith,
Department of Botany
and Plant Pathology.

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Prof. Ernest C. Smith,
Herbarium, Dept. of Botany,
Colorado State College,
Ft. Collins, Colorado.

3814 Jocelyn St., N.W.,
Washington 15, D.C.

December 29, 1947

Dear Professor Smith:

Your two letters of Nov. 18 and 21 were promptly received and I am glad to have the information therein. I had intended to reply long since but before I got out of the jam of other matter, I got a case of flu from which I am just emerging.

I have tried to help Kelso, not by criticizing what he has done, bad as it is, but by asking questions and suggesting lines of study (variation of different organs through the season or the year) which would be interesting and incidentally would teach him something about variation. He ignores all questions, states that he already has made exactly those studies, and accuses me out as an inhibitor of all good work by others. The old crazy story. And that's that.

Of course, no one can know what are the entities he is publishing until they type material has been seen. How any will ever get to see any of his material, I do not know. The same holds for any species which he claims to have collected. In his last letter he said that he "knew perfectly well what the willows were" that he sent to our Director of Personnel. Insanity or suicide, or both, with his days.

Now as to your 1947 collections, I will be glad to go over them at any time you care to send them on. If you made notes on leaf glaucousness at time of collection, I hope you will see that these are on the lobes, especially of those which seem to green beneath now. Remember the trouble we had long ago about twig color in *S. monticola*? I have recently had some of Ewan's collections from Colo. during past several years. On his label for *S. Monticola*, he said "twigs beautifully yellow" but on the specimen there was scarcely a tinge of yellow. (That "twinge" was from my flu).

You speak of having foliage specimens of possible *S. balsamifera* which must wait for another year of collecting. They should be carefully determinable from leaves alone.

I discussed the differing shape of the "earliest" (basal) leaves on the different kinds of twigs in willows in two of my papers (illus. Plant Organs and Core Plant Study). They always are shorter and more broadened in proportion at tip than later leaves on the same twig. Your description of aberrant *monticola* specimens would indicate a stoppage of food to those later leaves while they were developing. As the tips broaden first, any later lack of nutrients would keep the bases narrow. Such lacks may be caused by drought or by too rapid growth on some other part of the plant when there was not enough food for all parts.

Hope that you have had a good time in Houston, including a merry Christmas, and that the New Year may find you back home for a real new year of work and joy.

Cordially yours,

Carleton R. Ball

P.S. I note that you say you were sending some of "also's papers. Did you send them? Did I return them? I have no recollection. I got all the Dept. Library had and then wrote Kelso for some others containing willows. These he sent and I paid him two dollars for them. If I have any of yours, I want to return them, pronto.

OVE

(Bry)

(1)

Copy of penciled notes filed with letter of Dec. 29, 1947
but not included in letter. (W.A. Archer, June 1962)

E. C. Smith:

Have been going thru your letter^s of past 3 or 4 years. They form almost a flood. Some have not been answered. In that of Nov. 18, 1947, you say that because I had not replied you had (sent) a lot of Sect. Glaucæ to Raup. I appreciate his reaction.

Please remember that I serve 48 States plus Alaska and all the Canadian Provinces. In each State are several institutions, some Federal agencies and private collectors. The same goes for the Canadian Provinces. Colo. A. & M. is only 1 of more than 100 agencies I serve. Sometimes 2 or 3 packages are received in a single day. I have to be fair to all, which makes me seem unfair to you.

In yours of Nov. 18, 1947, you suggest the possibility that Kelso collected *S. monochroma* and *S. Farrae* in Colo. *S. monochroma* possibly may occur in extreme NW Colo. but doubtful. *S. Farrae* has not been found by collectors in Utah, or Wyoming, same in Idaho and Mont., so I would not worry about them. And *Farrae* is glaucous beneath.

In no willow is the beak of the bud consistently flattened and curved outward, as you give for Bebb in his *S. monticola*. That happens only when the bud scale elongates and the contained leaves or ament do not develop fully. Then the unfilled tip dries and warps. That has nothing to do with taxonomy but is possibly physiological.

(See following 3 pages of notes)

Ball is justified. The file includes
nearly 300 items. Letters often
of 3 or more pages.
w a archer
may 1964

Professor E.C. Smith,
Herbarium, Dept. Botany,
Colorado A. & M. College,
Ft. Collins, Colorado.

3914 Jocelyn St., N.W.
Washington 15, D.C.

February 23, 1948

Dear Professor Smith:

Your three letters of Jan'y. 8, Jan'y. 21, and Feb'y. 2, and the two packets of willows were safely received. I have separated the specimens from both packets into two groups, as follows: 1, *Commutatae* (*S. monticola*, *S. pseudomonticola*) and *Miscellaneous*; 2, *Glaucæ* (*S. brachycarpa*, *S. "glaucops"*, *S. cordifolia* (?)).

I inclose a list of determinations for those in Group 1, *Commutatae*, arranged in numerical order. Some notes accompany the determinations. Some will appear in this letter. I inclose also a separate list of the determinations of collection by Harrington, Harrington and Smith, and by Boyd. This prevents getting those numbers mixed with yours in the records.

Closely-related species, like *S. monticola* and *S. pseudomonticola*, are much harder to separate by fragmentary specimens (which most are) than are more distantly related species. That is why you are confused (as I or any one must be) by the various collections you have made. Seven or eight sheets from a single plant on the same day, and showing all the variations in twig and leaf, are worth more than 70 or 80 sheets from 70 or 80 different plants at different times, but that is what most specimens are and some have to be.

I know of no constant vegetal character which certainly identifies var. *pedophyll* without aments.

That papillose appearance on leaf's seems to be wholly physiological in origin. It can be seen occasionally on leaves of practically any of the large-leaved species, if the upper surface is free from hairs. It is especially noticeable on capsules of those having glabrous fruits.

Most vigorous sprout leaf's of *S. pseudomonticola* have the large spreading teeth at base, noted in the original description. Especially vigorous growth of *S. monticola* shows the same proliferation, occasionally as do other large-leaved species. In species having glands on the petiole (as *S. fragilis*, *S. lucida*, *S. lasiantha*, etc., these glands become branched and sometimes foliaceous on vigorous growth. Variation is the universal law of nature.

There seems to be an unusual amount of mix-up on collection numbers in this lot. 29 of your collections are determined herewith. Two, or 7%, have no numbers, and hence can be referred to only with difficulty. Three, or 10%, have a choice of two numbers (1495 or 1895, 1862 or 1863 A, 1863 or 1863 B). In two cases, or 7%, there are two different (or labels) with the same collection number (2051 and 2068). These represent about 25% of the total. Any suggestions as to the correct usages in these cases will gladly be entered in the records.

It seems extremely desirable to assign collection numbers at the moment of collecting in the field. They then are entered in the field notes. This would prevent most omissions and duplications, and also would make the numbers have the same order as the collection dates, which is not now always true.

I much hope that your dream of more study and collecting keeps coming true for many more years than 1948. Its fine to be 84 (I'm only 75) and they say that the first 100 years are the hardest. Go to it.

As soon as I can study the *Glaucæ*, I will report on them and also return the specimens you wish to have back.

Cordially yours,

Carleton R. Ball

copy in file

COLORADO A & M COLLEGE

FORT COLLINS, COLORADO

November 19, 1948

Dr. Carleton R. Ball,
3814 Jocelyn St.,
Washington, D.C.

Dear Dr. Ball:

I am enclosing a tentative key to the alpine and subalpine species of willows growing in Colorado. It is not satisfactory but the best I can do after several seasons of intensive study. I shall be glad of any criticisms or suggestions that you make. While your problem in this group is a much larger one I hope you may get some suggestions from this more limited study.

With best wishes, I am

Cordially yours,

Ernest C. Smith.

Ernest C. Smith,
Department of Botany
and Plant Pathology

Of course these are only a part of the alpine willows of Colorado, just the four or five species which are so difficult to put into a key.

E.C.S.

Nov. 19, 1948 p 2

Key to plants with staminate aments

Shrubs rarely over 1 m. tall; primarily alpine and subalpine, but under special conditions growing at altitudes as low as 7500 ft.

Anthers less than 0.5 mm. long, mostly globose; leaves not glaucous beneath; pubescence dense, the twisted hairs sometimes tomentose

18. *S. brachycarpa*.

Anthers 0.6-0.8(10) mm. long, oblong-ellipsoid or suborbicular; leaves glaucous beneath; pubescence of leaves and twigs longer, looser, straight.

Leaves elliptic, lanceolate or oblanceolate, 2.5-3 times longer than broad.

Scales of aments mostly broad, obtuse, dark brown or black; pubescence on upper side of leaves tardily vanishing

19. *S. pseudolapponum*

Scales of aments usually narrow and acute, light-brown, or with light-brown base and tips red- or darker-brown; leaves at first or very soon glabrous or nearly so

20. *S. glauca* var. *glabrescens*

Leaves oval, obovate or oblanceolate or ovate, bases rounded to subcordate or even cordate, 1.5-2.5 times longer than broad

21. *S. cordifolia* vars.

Key to plants with pistillate aments

Capsules and ovaries hairy

Shrubs rarely over 1 m. tall, but under special conditions growing at altitudes as low as 7500 ft.

Styles evident, 0.5-1.5(2) mm. long; twigs and leaves at anthesis pubescent, tomentose or pilose; aments on short leafy peduncles.

Aments 1-2(3) cm. long; ovaries at anthesis 2-3 mm. long, pilose; capsules 4-5 mm. long

18. *S. brachycarpa*

Aments 2-3(4) cm. long; capsules 5-8(10) mm. long

Leaves, except on sterile twigs 2.5-3.5 times longer than broad.

Scales of aments broad, obtuse, dark-brown to black; styles of capsules rarely cleft

19. *S. pseudolapponum*

Scales of aments narrow (usually), light brown or with tips red or darker-brown; styles often cleft, with the bifid stigmas resembling the antlers of an elk

20. *S. glauca* vars.

Leaves 1.5-2.5 times longer than broad, oval, suborbicular, ovate or obovate, base rounded, subcordate or cordate, rarely broadly cuneate

21. *S. cordifolia* and vars.

Nov 19, 1948 p. 3

Key to plants by their vegetative characters

All leaves with entire margins

Erect shrubs rarely more than 1 m. tall, sometimes depressed or bent, rarely even prostrate; primarily alpine and subalpine, but growing under special conditions at altitudes as low as 7500 ft.

Twigs of the season pubescent, pilose or tomentose, the leaves tending to become glabrous, at least above, as they mature, at least in the varieties.

Leaves mostly elliptic, lanceolate or oblanceolate, but larger and broader in proportion on vigorous sterile branches; 2.5 to 3.5 times longer than broad.

Petioles rarely over 3 mm. long, shorter than well-developed buds; leaves with apex abruptly short-acute or obtuse, base obtuse; rounded or cuneate; pubescence of twisted hairs

18. *S. brachycarpa*

Petioles longer: leaves with more definite acute apex; pubescence of longer, straighter, more pilose hairs.

Average mature leaves 2.5 by 0.6 cm. to 3.5 by 1.2 cm.; stipules wanting.

19. *S. pseudolapponum*

Average leaves slightly larger or broader in proportion; stipules present

20. *S. glauca* vars.

Leaves mostly oval, varying to orbicular, ovate, obovate or broadly oblanceolate; 1.5-2 times longer than broad

21. *S. cordifolia* and vars.

Prof. Ernest C. Smith,
Dept. of Botany, Colo. A. & M. College,
Ft. Collins, Colorado.

3814 Jocelyn St., N.W.,
Washington 15, D.C.

13 ~~April~~ May, 1950.

Dear Professor Smith:

(about *Longifolia*)

Your letter of April 26 has been long neglected, largely by reason of severe cases of epidemic virus flu by both of us, and by preparations for an operation which Mrs. Ball will have today. Now I will try to point out certain general facts, and then answer specific questions.

1. *Salix* is recent (young) geologically, and therefore extremely plastic and diverse in appearance. That makes hard work for students and a paradise for the taxonomists.

2. The eternal emphasis on floral characters in descriptions and manuals focuses student attention on the purely temporary characters and neglects the much more permanent characters of vegetal organs. Is it better to be able to recognize a plant at all seasons, or to recognize the flowers and not know the plant?

3. It is this long-continued wrong emphasis that has filled our herbariums with immature flowering specimens and made it difficult for even a specialist to know what a given specimen is. One fifth as much collecting, made from tagged plants, and showing the characters of one individual throughout at least one year would be worth infinitely more, and would relieve uncertainty.

4. If we get to know the vegetal differences, we then can recognize what species or variety is bearing the difficult floral characters. I do not discount the value of floral characters, but they are temporary and secondary. When we describe a person, we do not include the sexual organs, or how it looked when a baby.

5. The common practice of recording floral characters by relative length of one to another is plain foolishness. The rate of elongation of the different organs is not the same, even when conditions are favorable. You can see that plainly in a single ament, oftentimes. When one or more conditions (temperature, nutrition, etc.) are unfavorable, the relative differences become greater. Glandular structures (leaf, petiole, and floral glands, including style and stigmas) are much more influenced by environment than are other tissues. An organ that is twice as long as another today may be three times as long two days later or 4 times as long in a week from now. Compare floral glands and ~~gm~~ capsules pedicels in a single ament.

6. Serrulation of leaf margins is a product of many factors, and varies from leaf to leaf, and also on the same leaf at different times in the season. It is the effect of relative growth of leaf tissue (paranchyma) and vein tissue (vascular). We don't know all of the reasons but we do see all of the effects. So, on the same plant, some leaves will be almost entire, some sparingly serrulate, some denticulate, and some spinulose (in the *Longifoliae*). The too, the glands on the serrulations make them appear more prominent, and these glands often drop off as they become mature. This makes the serrulation less distinct. But it occurs differently on different leaves because all of them are not of the same age or degree of development on the day when you collect the specimen. And leaves of different ages have not developed under the same external or internal environment.

PS 5. I should have asked if the relative length ~~length~~ and width of organs (head, neck, torso, arms, legs) is the same in baby as in the same person when it becomes an adult. Yet many persons describe the characters of juvenile plants and assume that these will be the characters of the adult. And what ridiculous errors they publish. See Rydberg's description of the swollen tip on the capsule of his *S. stenophylla* (*S. exigua* var. *stenophylla* (Rydb.) Schn.)

I go to hospital now. Will discuss *S. exigua* and *S. interior* shortly.

Cordially yours

7. Pubescence (hairiness) is one of the most striking and most variable characters of willows. On young leaves it may be dense and silvery, for example. But as the leaf enlarges the hairs become more thinly scattered because of increasing area, and because some drop or are brushed off in handling. Color is largely a light reflection. Hairs weather and are less reflecting as they darken and as they become thinner (more widely spaced) and as the background changes color and texture. When they cease reflecting sharply, they are much harder to see. If you will examine closely, in strong light, those leaves you have recorded as "glabrous" and supposed *S. interior*, you will find a thin puberulence over the entire area but not easily seen in weak light.

8. *S. exigua* and varieties have this fine puberulence or pubescence on young twigs and on leaves and petioles and usually buds also. They never lose it entirely. *S. interior* never has it. If hairy, its leaves are long-haired (pilose) and become entirely glabrous, as well as more veiny.

9. The appearance (characters) of leaf margins varies in the same way. The rate and relative vigor of growth of lateral veins ^{of} of the blade tissue (parenchyma) varies greatly under different conditions, even in the same season. The vein tips may be exceeded by the blade tissue and the margin is entire. Or the vein tips may outgrow the blade tissue and the leaf become serrulate or even spinulose. But it will not be alike on two different plants, or even on two twigs of the same plants, or even on two leaves of the same twig (upper and lower, for example). Then there are the glands. If the vein tips do not protrude, the glands may be sessile on the margin, or part or all of them may fall off. If the vein tips stick out, the glands will be on them (glandular-serrulate or glandular-spinulose), unless and until they fall off.

10. The flower scales in all willows tend to be broad and relatively obtuse while in the bud and as the aments emerge. After that, the shape may change little or much, so that they end up all the way from obovate, oval, or ovate to oblong, lanceolate, oblanceolate, or linear and long acuminate. Many of these shapes may be seen on the same plant as the different aments open and age, and several of them in the same ament sometimes.

11. You have seen a lot of children grow from babyhood to maturity. Can you take unnamed pictures of one of them at successive ages and be sure that they represent a single individual? The shape of external organs and the color and/or texture of others changed steadily. Hairiness varied likewise. Just consider the changes in length, character, and quantity of hairs on the human face and top of head throughout life. Do these changes make different species or varieties?

12. Ament numbers. The *Longifoliae* often produce more than one ament on a single lateral twig. But no species is consistent in this, depending on environmental conditions. A woman may produce 6 or 8 successive single babies and then suddenly produce twins or triplets. She still is the same woman. Sows ~~sows~~ produce a litter of 5 or 8 or 11 pigs in different years. It is still the same sow.

13. I hope that the above discussions will help you to see why a study of material collected in successive months or years from the same tagged plant would tell you ten times as much as detailed study of numerous unrelated fragments. After all, science is dedicated to discovery of the truth, not to series of isolated observations.

OVER

Cordially yours

P.S. I neglected to note that if a plant is suddenly set back by insect-defoliation, mowing, burning, or browsing, it may put out midsummer or autumn foliage of different shape and usually denser hairy. In such case, a plant of *S. interior* may closely resemble a very hairy *S. exigua*. Aint nature wonderful?

I could go on, but would better stop before I get shot.

Digitized by Hunt Institute for Botanical Documentation

may please

Prof. Ernest C. Smith,
Dept. of Botany,
Colorado A. & M. College,
Ft. Collins, Colorado.

3814 Jocelyn St., N.W.,
Washington 15, D.C.

8 September, 1950
(second letter)

Dear Professor Smith:

In continuation of my letter of this morning, I have looked up other willows received from you but determinations not completed and have found two lots.

One was sent with your letter of Oct. 14, 1948, and had not been opened, let alone determined. It contained several specimens of *Communtatae* and miscellaneous, and a lot of *Glaucæ*, labelled *S. brachycarpa* and probably mostly that species. I have determined all but the *Glaucæ* and inclose the list of determinations. You will note that one has no Number, as noted by you on the sheet but it also has no label or label data on the sheet. If your specimen has a label, I would like a copy. If not, the notes given on the sheet may help to recall where and when it was collected. The two specimens to be returned have been placed with the two from the lot listed in this morning's letter, and to them will be added those in the third package and all returned tomorrow or Monday.

The other of the two neglected lots was that sent with your letters of May 8 and 21, and Feb. 2, 1948 (apparently two packets). Of these, I had determined the Sect. *Communtatae* and miscellaneous and sent you the determinations on Feb. 23, 1948. The specimens of these which were to be returned to you had been separated from those to be kept by me but had not been returned. They will be mailed soon, with the four from the two later lots, as mentioned in the preceding paragraph.

The specimens of Section *Glaucæ*, from all of these shipments will be studied soon and determinations sent and the requested specimens returned to you.

Now I have a sad story to tell. When I opened the package of material sent by you in Jan.-Feb., 1948, I found that insects had been at work. The package was wrapped and in the bottom of a closet here at my home. Apparently both herbarium beetles and the tiny mites which eat leaflets had both been busy. At first, I supposed that the bugs had gotten in while I was working on the determinations sent you on Feb. 23, 1948. Packages are continually coming in and some carry live bugs. But when I opened the packet of Oct. 14, 1948, its specimens had been eaten also. It had been wrapped very carefully by you and sealed tightly on all the edges with broad bands of gummed brown paper. It was airtight and insect-proof and there were no holes in the wrapping paper where insects had gone in or out. So it seems clear that the eggs or larvae were in the material when it came.

I have cleaned it thoroughly and found only one living larva of the herbarium beetle. I am running all of the retained *Glaucæ* through the poison box but will not hold up the return material of the *Communtatae* and miscellaneous for that purpose. However, I would suggest that you poison it on arrival. I am very sorry that this has happened. Some of the specimens are very sadly injured altho all of them are still useful.

On Sunday, I will run through all of your letters of the last three years and see if there are inquiries which remain unanswered, other than those regarding these 3 or 4 shipments of willows. I am glad that the lot of *S. exigua* went back promptly. There were no *Glaucæ* in that shipment.

One problem in the *monticola*-*pseudomonticola* complex is to make sure when the broad more or less ovate leaves on late summer shoots stop being lanceolate *monticola* and start being ovate *pseudomonticola*.

Cordially yours,

2-2 1-5
Professor Ernest C. Smith,
Dept. of Botany, Colo. A. & M. College,
Ft. Collins, Colorado.

3814 *Sanchez* *et al.*
Washington 15, D.C.

25 September, 1950

Dear Professor Smith:

I note your new Texas address, and will use it in all letters after this one. You surely are entitled to retirement and a lot of fun with your grandchildren. Here's wishing you the greatest of joy in the coming years.

Regarding the specimens of Glaucæ in the four shipments of Colo. willows, of which I have determined the Commutatae and Miscellaneous, I am happy to report that I have given them undivided attention for the past two weeks. Unfortunately, it has been a period of rain with almost no sun and not favorable for the best microscopic study of minute bodies. There are three successive stages in this study

Because all of the shipments contained material from about 1933 up to recent years, I first arranged the material collected by you in sequences of years and numbers (where numbered). Those by others collected were separated from yours. In some of your material there are two quite different specimens under one number and in such cases I have entered the number twice. In one case, the label No. was 500 and the sheet No. was 510. *which is right?*

Next, I have studied each specimen thoroughly, under the lens, and have described its essential characters and probable reasons (frost and drying effects) for certain aberrant characters. At the same time, a tentative determination was made, subject to later study and comparison at the herbarium, in better light. This listing in numerical order, and writing of descriptions, has been completed in this tentative condition, and I now am typing it for use in the further study. Any changes in the names applied will be reported later. At present, I have listed them as *S. brachycarpa*, *S. pseudolappinum*, and the broader-leaved relatives of the latter as *S. "glaucops"*, pending revision.

I have typed the first 5 pages of this list (descriptive) and am inclosing copy. The specimens which are to be returned to you are indicated on the line after the tentative name, and also marked in pencil in the left margin. I will not send them back until the further study is made, unless you wish them sent now. They are tied up in packets and the bundle addressed to you, so that if anything happens to me, you will get them. I assume that they are to go to your Houston address.

Will finish this typing of the list as soon as possible and send you the remainder. These 5 pages probably are about one third of total.

As the material which I was to keep consists of small pieces, in many case, I am mounting it for safer and quicker handling in the coming fuller study. The mounting is about half done now and will be finished in two or three evenings. I greatly appreciate your generosity in this matter. Where you gave me permission to keep part of a specimen, I sometimes have done this.

When the mounting is completed, I will start the comparison of this material with the large collections from North America in my herbarium. The first item must be the determination of what *S. desertorum* really is, and then go on from ~~it~~ there to place the other Glaucæ in relation to *S. glauca* and its varieties and *S. desertorum* and many varieties. *S. brachycarpa* should stand. *S. pseudolappinum* may go out. When I get through, will give you any changes required to make the names in this list correct.

You may be interested in some notes on Section Glaucæ in general, and these I add on the following page.

Glaucae. The members of the Section are boreal or alpine and therefore subject to extreme temperatures and to occasional frosts throughout summer, as well as to heavy loads of snow and ice. They normally erect (whereas Ovalifoliae are normally prostrate) but the snow and are ice conditions bend them down more or less and cause the ascending, depressed, and prostrate (but not rooting) condition. The summer frosts discolor tender organs, including petioles. Worse still, they often stop the growth of floral organs, ~~reducing~~ and not of all alike but in proportion to their development when frosted. Hence we see the wide variation in capsules and ovaries, scales, and styles, stigmas, and pedicels, often in the same aments, and frequently on the same twig. All of this has to be taken into account in appraising the material received and collectors seldom give any information about these environing factors.

All of the Glaucae, so far as I know, have scales normally yellow at the opening of the aments. Thereafter darkening occurs progressively. Snow, frost, and poor drying increase the blackening. No species has "black" scales. If so described, it comes from basing species on a single collection, which is but a fragment of one plant of one sex, and shows conditions only on one date, plus what man did to it afterward. A variety "glabrescens" may refer to twigs, leafs, or fruits. In the case of *S. glauca* var. *glabrescens* (*S. glaucops* var. *glabrescens* Anderss.) the varietal names referred to the leaves only.

Von Seemen, who named *S. pseudolappomum*, knew nothing about American willows, so when Baker sent him some, he named a string of new species, all of which have been relegated to synonymy except this one and it may go when the study is made. But even he recognized that its scales were yellow on the lower portion and dark only at the tips (only the one specimen he had).

Floderus, of Sweden, is completely insane. He developed the idea that all willows are hybrids. Worse than that, he decided that he could recognize not only both parents in a supposed hybrid of two species, but all of the parents in what he claimed were hybrids of 3, 4, and 5 species and he put the whole list of names on his determination labels, but the four or five names seldom in the same order. Forsild, whose father and Floderus were schoolmates, sent Floderus the willows of the Canad. Natl. Herbarium, and they came back named as above. They could not be filed and so had to be put back just as they were before he had them.

Every geneticist knows that it is difficult to be sure of more than one parent in a hybrid, because it must be close to one parent in order to be fertile and reproduce. They know that it is absolutely impossible to sure of more than two, even with living material, instead of dried fragments of various ages or stages of development. That does not bother Floderus. When some one asked him how there could be so many hybrids and no parents present in the region, he glibly asserted that hybrids had new and different abilities and thus could migrate away from parent or kill them off. (And this universally!).

If you will send your material to Dr. Eric Hulten, Univ. of Uppsala, Sweden, he will make most of it into new species, one of which will be named for you. Dr. Raup named the spring growth ~~as~~ one species and the summer growth as another new species. Fernald has named several obvious hybrids as new species, and at least one juvenile stage as a new species. When will professional systematists ever learn that one fragment of one sex at one stage of development is not sufficient basis for a new species. (See Ball: More plant study: fewer plant species).

The great tragedy is the lack of tagged plants, collected from successive seasons of the year, and in different years. Several collectors are doing just this for me in different parts of the United States and Canada. We sorely need it for *S. brachycarpa* and *S. pseudolappomum*. I note that you were at the same spots in different months of several different years. What an opportunity. And we still don't know the range of expression of *S. brachycarpa* on one plant.

Erna Aron.

Genevieve Young

1242. *S. brachycarpa* Nuttall.

Shrub 0.4 m. tall on knoll above Poudre Lake, (Rocky Mtn. Natl. Park, Larimer Co.), at 10,759 ft. elev., E. C. Smith, 7-3-1939.

(Typical juv. specimen; old twigs grayish, many-noded, crooked, divaricate, 1-yr. pubesc., peeling; leaf half-gr., blades & bases broadening, hairy both sides, glauc. beneath; petioles short; stem. ams. ~~short~~ sht., 1 cm. long, blackened, frost-injured, esp. at apex; scales still obov., brown to dark-brown.)

1245. *S. brachycarpa* Nuttall.

Same as for 1242, of which regarded as pist. spec.;

Twigs similar but darker, peeled or peeling, 1-yr. with remnant-pubesc. leaf short, broadening, hairy, on sht. petioles, - sheet says: "early loss of hairs on upper side of leaf suggests *S. glauca glabrescens*" but lvs of most spec. of *S. brachycarpa* become glabrate with age and these are still densely but finely pubescent above; both spec. much-br. & tend to apical leafing (1242, 1245); aments tiny on sht. pedunc; old 1938 capsules 5-6.5 mm. long; scales blackened & short where frost-injured, paler br. & longer where not; many ovaries frost-injured.)

1236. *S. brachycarpa* Nuttall.

(Mounted; return)

~~MISSOURI BOTANICAL GARDEN HERBARIUM~~ Harrington and Smith, so listed with Miscellaneous Collectors. on separate sheet.

1441. *S. pseudolappaceum* von Seemen.

(Return pt.)

Shrub sht 1 m. tall, in soil kept wet from melting snow, from steep wooded slope on west side of Poudre Lakes, R.M.N.P., Larimer Co., at 10,759 ft. elev., E.C. Smith, 6-29-40. (typical juv. material, 1-yr. twig still pub., dark, subshining; leaf nerr. ellip., w/1 pubesc., gl. & still plane beneath; pist ams. to 2.5 cm. on very short pedunc., ovaries to 1 mm., styles sldr, 0.5-0.8 mm., most stigmas half as long, cleft at apex, (styles not cleft); scales from yellowish to brown to blackish, latter frost-injured, as are some leaf and ovaries.)

1475. *S.*

(*S. "glaucops"*)

(det as *S. cordifolia* var. *callicarpa* by ECS.) Erect shrub 8 dm. tall, toward Poudre Lake, Trail Ridge, R.M.N.P., Lar. Co., at 11,500 ft. elev. E.C.S., 8-3-1940. (much-br., older twigs yellowish-gray, wrinkled; 1-yr. yellowish if peeling or dark after peeling, with remnant-pub. behind buds; leaf much as *S. brachycarpa* but bec. glabrate beneath & snt reticulate & on longer petioles on one spec., but on the other leaf larger & more glabrate; fruiting ams to 3 cm., laxish, on pedunc. 1.5-2 cm. long, capsules nearly sessile, 4-5.5 mm.(ovar.) ; scales brown, obov. to oblanc.)

1531. *S. pseudolappaceum* von Seemen.

Shrub about 1 m. tall, on NW. slope of Trail Ridge, facing Specimen Mtn. R.M.N.P., Larimer Co., at 11,400 ft. elev., E.C. Smith, 7-19-1941.

(twigs, sldr, ascendg, new densely puberulent, 1-yr. sparse puberulent; older gray, not shining; leaf nerr. ellip., to 5 cm. long, w/1 pubesc., bec. glabrate, glauc., & veiny below; petioles now 5-8 mm., pubesc.; pist. aments small, 1-1.5 mm. long, in fl., on pedunc. 1-1.5 cm.; ovar. sldr. to 5 mm., & styles frosted somewhat & darkened; scales yell. to brown.)

1541. *S. brachycarpa* Nuttall.

(ECS. suggests as *S. cordifolia* var.). As 1531. *Shrub less than 1 m. high.* (Twigs very slender, grayish, new & 1-yr. puberulent; leaf very thin (as if shaded), broadly oval or ovate, hairy, 2.5-4 cm. by 1.2-1.8 cm.; pist. ams tiny, just coming in fl.; scales yell. to brownish; styles slender, 0.6-1 mm.,

1594. *S. pseudolappomum* von Seemen.

C. Smith 26-46-50

(Return) C

1 (C)

Shrub 0.7-1.5 m. tall, near lower lake, at about 10,000 ft. elev., Rainbow Lakes, Boulder Co., E.C. Smith, 7-12-1942.

Return Twigs ascending, leafy throat, 1-yr. grayish or dark, peeling or peeled; remnant-pubescent; leaflets to 3.5 cm., oblance., acute at apex, acute or some obtusish at apex, glauc. & hairy beneath; stem ams. 1.5 cm. but still short-pedunc., 0.5-1 cm.; scales yellow to brownish, not "black" as on sheet.

1634. *S.*

1 (A)
ft.

(det. by Raup as *S. glauca* or var. *glabrescens*; sugg. *S. cordifolia* var.)

Shrub trailing to depressed, on NW. slope, Fall River Pass to Poudre Lakes, R.M.N.P., Lar. Co., at 11,500 (or 11,600) ft. alt., E.C. Smith, 8-1-1943. (new twigs dark, thinly pubesc., 1-yr. shining, very thinly hairy to glabrous; leaflets 4-5 cm. by 1.3-1.9 cm., ellip-oblance, bases acute except apical, glabrate-glabrous, glaucous, & secondaries raised beneath, thinly pubesc. above; petioles slender, 5-10 mm. long; young fruit ams 2 cm. long, on pedicels unc. 1.5-2 cm.; capsules to 6 mm., subsessile; scales long, brown to darker, ovate, acute or subacute.)

1636. *S. brachycarpa* Nuttall.

B ?

1 (B)

Shrub 0.5 m. high, prostrate or depressed, in moist gravelly soil on NW-facing slope, on road from Fall River Pass to Poudre Lakes, R.M.N.P., at 11,300 ft. elev., E.C. Smith, 8-1-1943. (twigs divar., nodey, leafy on outer portion, new densely pubesc., 1-yr. remnant-pubescent; leaflets small, but oval & bases broadening, pubesc. on both sides, on very short pedunc.; pist. ams 1-2 cm. long, on pedunc. abt. 5 mm.; ovar. white-pubescent, styles just elongating; scales yellowish.)

1712. *S. pseudolappomum* von Seemen.

(Mounted; return) ?

fr with
1-5-8

Shrub 4 dm. tall, on slope just above timberline, as 1636, but 8-11-1945.

Br. ascending, short, stout, nodey, young densely pubesc., older peeling and discolored, with remnant-pubescent; leaflets discolored in drying, oblance., to 5 cm. long, hairy on both sides, glauc. below; pist. ams. not yet in fl., 1-2.5 cm. long, on pedunc. now 0.5-1 cm., lax at base; styles just starting, but varying on one older amt; scales stillobovate, and blackish (partly drying effect?).

1733. *S. brachycarpa* Nuttall. (det. as *S. pseudolappomum*) (Mtd., return) ?

fr with
H+ S1336

Shrub 2 m. tall, Summit Peak, W. Conejos Co., H. D. Harrington, 8-2-1945.

Br. crooked, stoutish, very divar., nodey; new densely pubesc., 1-yr. & 2-yr. grayish-br., not peeled, still densely but weathered pubesc.; leaflets 2-3.5 cm., oblong-oval, bases still acute to become round, to 1.4 cm. wide, densely short-pubescent. both sides, yell-green above, glauc. beneath, retic. suggested; stem ams. tiny (not 1 cm.), almost sessile; scales still obovate, dark (partly age?, as past fl.).

1904 (B?). *S. brachycarpa* Nuttall.

B

1 (B)

Shrub 8 dm. high, in wet meadow near Administration Building, R. M. N. P., Larimer Co., at 7500 ft. elev., E. C. Smith, 7-1-1947.

(very juvenile; twigs long, slender, peeling but pubesc. (1-yr.); leaflets young 1-2 cm. long, but bases broadening, densely pubesc.; stem ams. opening, 1 cm. long, on pedunc. 0.3 cm. plus; scales pale, densely hairy).

1917. *S. brachycarpa* Nuttall (not var. *antimima*).

B

1 (B)

Shrub about 1 m. high, in wet meadow, Longs Peak Inn. R.M.N.P., Larimer Co. E. C. Smith, 7-1-1947. (very juvenile, as last, and only very apical leaflets broadening at base, all broadish, short-pubescent. both sides at this stage; 1-yr. twigs peeling badly); ams tiny, not in fl. some stamens emerging; scales yellowish.)

1948. *S. brachycarpa* Nuttall. (not *S. pseudolappomum*)

C

1 (C)

Shrub 2-3 ft. tall, in close mats or thickets threaded by trails of deer & elk, on NW. slope facing Specimen Mtn., Trail Ridge, R.M.N.P., at abt 11,700 ft. elev., E.C. Smith, 8-1-1947. (short stoutish divar. nodey twigs, 1-yr. densely pubesc. until peeled; leaflets to 3-5 cm., ellip. to broadly so, bases broadening, few apical subovate, bases rounded, all densely pubesc. both sides; 2 stem ams., past fl., abt 1 cm., pedunc. short; scales oval, dark).

1949. *S. pseudolappomum* von Seemen(det. as *S. gl. v. glabrescens*) C

Shrub about 1 ft. high, depressed, western exposure, just below highest point on Trail Ridge Road, Trail Ridge, R.M.N.P., Larimer Co., E. C. Smith, 8-1-1947. (twigs much-br., stoutish, ascending, blackish, all peeling but remnant-pubescent; leaflets ellip-oblong. to 4.5 cm., acute at base, pubesc. on both sides; pist. ams 1.5-3 cm. on pedunc. abt 1 cm.; ovar. & yng capsules slndr. to 8 mm., on sht pedicels; styles to 1 mm., stigmas long; scales becom. narrow & acute, to 2 mm., dark now.)

1950. *S. brachycarpa* (?) Nuttall, var. *antimima* (Schn.) Raup ?? (Return) A

Prostrate spreading shrub, rising only a dm. or less above the ground, Trail Ridge, R.M.N.P., Larimer Co., at elev. 11,600 ft., E.C. S., 8-1-1947. (very decap., twigs stoutish, divar., reddish-black, subshining, nodey, new growth very little, but seas. twigs glabrous, yellowish becom dark reddish-br., some 1-yr. sparsely pubesc., older glabrous; leaflets eaten by herb. insects, 1-2 cm. by 8 mm., oblong. to narr. oval, but bases not yet broadened, most short-pubescent above but some becom glabrate, thinly pubesc. to glabrate beneath at this early stage, glauc. beneath & not yet reticulate, some sparsely glandular on margins; petioles sldr, glabrous to sparsely hairy, 2-5 mm. long now, yellowish; pist. ams. injured (frost)?, abt 1 cm. long on pedunc. 0.5-1 cm. long and less pubesc. than usual; ovar. 2-3 mm. and yng capsules 4-5 mm., very slender (both), and somewhat darkened, sht pubesc; styles 0.5-1 mm., sldr on ovar.; scales broadly to narr. oblong., yellowish to dark brown, esp. at tips. This spec. is too juvenile for certainty. It can be *S. br. var. antimima*, or a hybrid with *S. pseudolappomum*.

1955 A. *S. brachycarpa* Nuttall.

Shrub subprostrate, spreading, branches rising 1-2 dm. above the ground, on NW. slope by road from Fall River Pass to Poudre Lake, R.M.N.P., at 11,800 ft. elev., E.C. Smith, 8-1-1947. (divar-br., new twigs densely pubesc., 1-yr. bud & twigs somewhat so; leaflets ellip. or broadly so or the apical narr. ovate if base fully broadened and narr. obovate if not, 2-4 cm., pubesc. on both sides, glaucous below and bec. reticulate; 1 pist. ant., injured by frost, on 1-cm. pedunc., some ovar., capsules to 5-6 mm., darkened; scales light or darker.

1955 B. *S. pseudolappomum* (?) von Seemen.

Shrub depressed or prostrate, stems 3-6 dm. long, not rooting, on old road from Fall River Pass to Poudre Lake, exposure N-NW., ECS., 8-1-1947. (twigs short, stout, divar., peeling, some remnant-pubescent; leaflets ellip. to broadly ellip. to subovate, acute to broadened, to rounded at base, to 4.3 by 1.6 cm., short-pubescent both sides, pet. much as *S. br.* (1 of 1946); pist. ams 2-3.5 cm. long, on pedunc. abt 1 cm.; capsules tout, 5-6 mm., dirty-gray; scales small, dark, look as if early frosted, styles also. The leaflets intermediate between this and *S. brachycarpa*).

1961. *S. pseudolappomum* von Seemen. (det. as *S. gl. v. glabrescens* by) C

Shrubs 0.2-0.8 m. high, in this clump, on NW. slope facing Specimen Mtn Trail Ridge, R.M.N.P., Larimer Co., at abt. 11,700 ft. elev., E.C. Smith, 8-6-1947. (twigs slender, new & 1-yr. pubesc., the latter dark, and shining when peeled; leaflets narr. ellip. to 4 cm., acute both ends, hairy both sides, petioles 3-6 mm., thinly hairy; ams. 1.5-2 cm., lax, on pedunc. 1-1.5 cm.; capsules to 6 mm., sessile-subsess., scales yell. to br., srt elong.

1962. *S.* ("glancops") det. by ECS. *S. gl. v. var. A.*

Bent over by weight of late-lying snow, on lower edge of old road from Fall River Pass to Poudre Lake, R.M.N.P., Larimer Co., at 11,700 ft. elev., E.C. Smith, 8-1-1947. (These data on slip; the label data entirely different). (twigs sldr, many, subdivar., new pubesc., 1-yr. pubesc. before peeling; leaflets narr. to brdly ellip. or oblong., to 5.5 by 1.5-1.7 cm., becoming glabrous and veiny beneath; ams. 1.5-2 cm., on pedunc. ams. injured by frost & capsules swollen & distorted, to 6 mm. long; 1 cm. plus, scales broad, obtuse, dark.)

1966 A.

frag
on 73

("glaucops" or pseudolappomum) Ret. A
Shrub bent and depressed by weight of late-lying snow, (characters as collected except some leaves darkened in drying) by old road from Fall River Pass to Poudre Lake, at alt. 11,700 ft., in gravelly moist soil well above timberline, E. C. Smith, 8-6-1947. (twigs slender, ascending, 1-yr. thinly pubesc. Return where not peeled; leaves yng, ellip-oblong. to 4 by 1.3 cm., bases acute except 1 apical, hairy on both sides, glaucous & yng subrugose beneath; pet. slender, to 6 mm.; ams (2) 3-4 cm., on pedunc. 1 cm. long; capsules 4-6 mm., styles 0.5-0.8 mm., mostly gone (frost?), scales still above, br. to dk-br.)

1966 B.

1 (C)

("glaucops" or pseudolappomum) Ret. C
Shrub 2-3 ft. tall, in small or large mats, or thickets threaded by trails of deer and elk, on NW. slope facing Specimen Mtn., Trail Ridge, R.M.N.P., at 11,700 ft. elev., E.C. Smith, 8-1-1947. (twigs sht, ascending, new pubesc., 1-yr. also before peeling; leaves sht, broadish, 2-4 cm. by 0.8-1.4 cm., to brdly oblanc., pubesc. on both sides but soon glabrate & subrugose beneath, petioles 4-6 mm.; pist. ams in late fl., 1.5-2.5 cm., on pedunc. 1.2-1.5 cm., capsules 4.5-5.5 mm., stout, mostly sessile, scales pale to dk brown, not fully expanded).

1975. S. brachycarpa Nuttall (not pseudolappomum)

Return C

frag
with
1950

Depressed and partly spreading on the ground, on NW. exposure facing Specimen Mtn., Trail Ridge, R.M.N.P., at about 11,700 ft. elev., E. C. Smith, 8-1-1947. (twigs ascending, stoutish, new densely pubesc., 1-yr. pubescent or peeling, dark; leaves small, mostly narrow, ellip-oblong. but apical broadening at base, to 3 by 0.8 cm.; ams ~~stoutish~~ injured (frost?), about 1.5 cm., ovar. twisted, dehiscent, many not enlarged; scales small, pale to darkened; styles mostly not developed). (leaves densely pubesc. both sides, but some older bec. glabrate beneath).

1980. S. brachycarpa Nuttall. (not S. cordifolia or var. callicarpaea) Ret. A.

(A)

Shrub in dense thicket up to 1 m. high, on steep eastern slope, cirque east of Fall River Pass, near pumping station, R.M.N.P., at 11,150 ft., E.C. Smith, 8-2-1947. (This is the label on sheet returned)

Return

Shrub depressed, 0.5 m. high, in cirque east of Fall River Pass, R.M.N.P. little above timberline, 11,000 ft. elev., etc. (label on 2nd sheet, to keep)
(Twigs stoutish, divar., dark, new dens. pubesc., 1-yr. pubesc. but mostly peeled and shining; leaves short, narrow to brdly oval, to 3 by 1.6 cm., bases rounded to subcordate, pubesc. on both sides, glauc. & swt retic. beneath; ams. 1-1.5 cm., on sht. pedunc., ovar. 5-6 mm., scales yellowish, some elongated and narrow, acute.)

1983. S. brachycarpa Nuttall

1 (A)

Shrub 1.5 m. high, erect, the tallest in the center of a large clump, in cirque east of Fall River Pass on steep slope at 11,300 ft., R.M.N.P., E.C. Smith, 8-2-1947. (much as last but more divar. & nodey; leaves badly eaten by herbarium insects but larger, to 1.9 cm. wide; ams very small, almost sessile; few capsules to 5 mm., few styles longish.)

1985. S. pseudolappomum ?

1 (C)

(S. ps. or gl. v. glab., det. EOS) C
Shrub 1.5-3 ft. tall, in dense thicket, on NW. slope facing Specimen Mt., Trail Ridge, R.M.N.P., at about 11,500 ft. elev. E.C. Smith, 8-4-1947.
(twigs divar., new thinly pubesc., 1-yr. peeled, subshining, no remnant pubesc. discernible; leaves mostly oblanc., to 3-3.5 cm. by 1-1.2 cm., acute at base, 1 apic. broadng., thinly pubesc. to glabrate both sides, not yet very veiny beneath but glaucous; ams. 2.5-3 cm., on pedunc. 1.5 cm. long; ovar. to 5 mm., discolored (by frost?), styles to 1 mm. long; scales above to elongated and oblanc., yellowish to brown.)

2013. S.

(S. "glaucoops") Return A

2017 Return
w. 2017

Shrub prostrate, depressed, or erect, up to 1 m. high, in moist gravelly soil on lower side of road from Fall River Pass to Poudre Lake, R.M.N.P., at 11,500 ft. elev., E. C. Smith, 9-7-1947. (twigs ascending, new den. pubesc., 1-yr. gray-peeling or peeled & dark, shingling, with remnant-pubes behind buds; leaf ellip. to 4-4.5 by 1.2-1.6 cm., subacute to rounded at base, short-acute to bluntish at apex, apical 3-4 by 1.6 & oval-obovate, pubesc. on both sides, gl. with prominent secondaries beneath; petioles 4-7 mm.; ams fruitg, 3 cm. long, on pedunc. 1-1.5 cm.; capsules to 6 mm.

2017. S.

(S. "glaucoops") A

1(A)

Shrub prostrate to depressed, stems non-rooting, 4-7 dm. long, on moist rocky soil, beside road from Fall River Pass to Poudre Lake, R.M.N.P., at elev. 11,300 ft., E. C. Smith, 9-7-1947. (similar to 2013 but less br. & less leafy, and leaves to 5 by 1.8 cm. and nearly glabrous beneath).

1(3)

2033 A. S. brachycarpa Nuttall.

Shrub 0.6-1 m. high, in meadow bordering stream near headquarters of R.M. Natl. Park, Estes Park, Larimer Co., elev. 7500 ft., E.C. Smith, 9-7-1947.

1(B)

2033. S. brachycarpa Nuttall

Shrub 1 m. high beside stream west of bridge near Administration Bldg, R.M.N.P., Estes Park, Larimer Co., elev. 7500 ft., E.C. Smith, 9-7-1947. (The two above very similar and peculiar. twigs rather aldr & long, new brownish toward base but yellowish toward apex, the 1-yr drak, subshining, pubesc., in various stages of peeling, the few br. ascending or divar. The longer shoots have abund. normal summer leaf on seas. twigs on upper half of shoot but lower half bears only greatly delayed dev. of stem ams, as if prev. long buried in ice or snow. Stem ams less than 1 cm., unopened or few stemms just emerging, the pedunc. leaf 1-1.5 cm., narr. ellip-oblong, bases mostly rounded, glabrate-glabrous above, thinly pubesc. & glauces. below; scales broad & pale. The summer leaf are oval or ovate, 2-5 cm. by 1-2 to 2.3 cm., pubesc. both sides, veins or vnger subrugose beneath, bases rounded, truncate, or cordate. Some shoots intermediate between these 2 extremes.

2034. S. brachycarpa Nuttall.

1(3)

Shrub 7 dm. high, in moist alluvial soil of meadow beside stream near, as 2033. (twigs typical long aldr. subdivar., the longer with long internod leaf 2-3 cm. with rounded or apical with subcord. bases; ams dense, fruitg, 1.5-3 cm., on pedunc. less than 1 cm., apparently injured & ovar. never elongated (less than 5 mm.) but some extruding seeds; scales not visible, so not blackened).

2068. S. brachycarpa Nuttall.

(not var. antinima, as labelled)

1(2)

Shrub commonly under 1 m. high, this with central shoot 2 m. high, in wet meadow near Jefferson, Park Co., E. C. Smith, 10-4-1947.

(a wholly freakish specimen; a 12-cm. naked twig with dense apical cluster of twigs 5-7 cm. long and loaded with post-fruiting old aments 1.5-2 cm. long, with much seed-bearing cone but tiny leaf narr. ellip., 1-2 cm. by 4-6 mm., bases of apical broadened but no leaf broad, veiny beneath, more or less pubescent both sides; capsules 5 mm. long, slender. It would be very interesting to know what kind of growth the tall central shoot had).

2069. S. brachycarpa (?) Nuttall

(or S. "glaucoops") Return A

f. (4)

with

2068 Return

(label says S. planifolia; my 1948 annotation label says "S. "glaucoops") Shrub 2-2.5 m. high, beside brook near Jefferson, - as 2068.

(twigs long pubescent summer shoots; leaf narr. to broadly ellip.-lenc., 3-5 cm. by 1.2-1.7 cm., bases rounded, pubesc. above, and thinly pubesc. or the older glabrate and strongly reticulate beneath. The inclusion of leafy twigs which had borne aments earlier, would have helped to an understanding of this specimen).

2140. S.

(S. "Glaucops" Return.

C

(det. by EGS. as *S. glauca* L. var. *glabrescens* (Anderss.) Schn ?)
Shrub at first spreading, then ascending, at last erect, in "clumps",
Trail Ridge, towards Poudre Lake, R.M.N.P., at 11,700 ft. alt., E. C.
Smith, 7-27-1948. (twigs ascending, new pubesc., 1-yr. thinly pubesc. or
Return glabrous & shining; leaf ellip. or ellip-lance. or oblance., to 4-4.5 by 1.3-
1.5 cm., or some apical narr. obovate & 3.5-4 by 1.6 cm. & some bases ending,
pubesc. both sides or older bec. glabrate beneath, glaucous; aments frtg.,
laxish, to 2-3 cm., on pedunc. 1 cm. long; capsules to 7 mm., sht-pedunc.;
styles to 0.8 mm., stigmas ptly cleft; scales oblance, yellowish to dark-br.;
gland sldr., to 1 mm. long.

2141. S.

(S. "Glaucops")

C

Shrub at first spreading and then ascending, the branches to 0.4 m. long;
on NW. slope facing specimen Mtn., Trail Ridge, R.M.N.P., at about 11,400 ft.
elev., E.C. Smith, 7-21-1948. (intermediate bet. *S. brachycarpa* & *S. "glau-*
Return *cops*"; twigs ascending, new pubesc., 1-yr. peeled & shining, with remnant-
pubesc.; leaf brdly ellip. to narr. oval, larger 3-5 by 1.5-1.9 cm., bases
broadened but mostly acutish, or some rounded & obovate apical truncate; pet.
stoutish, 5-8 mm.; leaf sht pubesc. above to older glabrate, pubesc. only on
veins beneath, becom. glabrous & veiny; glaucous; aments 1.5-2.5 cm. long,
pn pedunc. 0.5-1 cm.; capsules to 5 or 5.5 mm., subsessile-sessile; scales
elongating, mostly broadly oblance, obtuse, br. or dark br.; a few narr. to
brdly lahc. stipules to 2 mm. long.) *S. cordifolia* ? E.C.S.

2142. S. *brachycarpa* Nuttall

Mounted; Return.

C

(det. by EGS. as *S. cordifolia* var. *wallicarpa*). Shrub 2 dm. tall,
somewhat leaning, on NW. ~~exposed~~ slope, Trail Ridge, R.M.N.P., at 11,700 ft.
elev., E.C. Smith, 7-27-1948. (twigs ascending, stoutish, new 6-8 cm. long,
Return pubesc., 1-yr. to 10 cm., reddish, thinly old-pubesc., shining; leaf brdly
ellip to oval, to 5 by 1.7 cm., pubesc. both sides, apical bases broadly rnded
astill developg, some blunt at apex, petioles 4-7 mm., some darkened; pist.
aments 1.5-2.5 cm., on pedunc. 0.5-1 cm.; capsules 5 mm., discolored; only
part of styles & stigmas developed).

2144. S. *brachycarpa* Nuttall.

C

Shrub 1-3 ft. tall, in dense copse threaded by trails of deer and elk, on
NW. slope facing specimen Mtn., Trail Ridge, R.M.N.P., at bout 11,600 ft.
elev., E. C. Smith, 7-27-1948. (typical depauperate growth; twigs short,
Return stout, divaric., nodey, 1-yr. & 2-yr showing remnant-pubesc.; leaf to 2
cm., by 8 mm., crowded, densely short-pubesc. both sides, glaucous & some
bec. glabrate beneath, most bases already broad, rounded to truncate; tiny
stam aments less than 1 cm., on pedunc. ~~in~~ 4-5 mm., bases apparently frosted
& scales dark).

2148. S. *brachycarpa* Nuttall. (detd EGS.)

Mounted, Return.

B

Shrub 4 dm. tall, part of scrubby mat, on NW. exposure towards Poudre
Lake, Trail Ridge, R.M.N.P., Larimer Co., E.C. Smith, 7-27-1948. (other
Return label reads: "one of many in a thick mat", "NW.-facing slope", and "at
11,500 ft. elev."). (Typical depauperate sprangly growth; twigs short,
divar., close-noded, with leaf crowded above, new densely pubesc., older
thinly or peeled; leaf to 2.5 cm., mostly not yet broadened at base, hairy,
with revolute margins; pist. aments short, frosted (some 1947, on naked twigs).
over. 4-5 mm., old capsules to ~~3-4~~ 6-7 mm.; Sm. says: "scales black, broad
apex rounded". but some are pale to brown; aments 1-1.5 cm.

2169. (2272 & 2311) same plant). S. *brachycarpa* ?? (or "Glaucops")

C

Shrub 2-2.5 m. tall; apparently belongs in the Glaucos; characterized by thick,
very light-colored branches and twigs and small stiff leaves. Edge of seepage
area just west of Red Rock Lake, Boulder Co., at 10,000 ft. elev. EGS, 8-8-1948
Return 2272. Shrub 2 m. tall, notable for the thicker, much lighter-colored stems in sharp
contrast with all other willows of the area, near Red Rock Lake, Boulder Co.,
at 10,000 ft. ~~alt.~~ alt., E. C. Smith, 8-21-1949. No. 2311 not received.

Does this note on sharp contrast mean that no other Glaucos there had this
color? Note on sheet: "Except for the pale shiny bark, I should refer it to

2169 & 2272 cont'd. *S. brachycarpa*, probably X

G

(specimens of both years peculiar for grayish (old) to yellowish-red stems (younger), probably caused by some local condition (perhaps mineral); subshining; new pubescent to become glabrate, 1-yr. dark-reddish to 2272 all yellowish; leaves ellip. to ellip-lanc., 4.5 by 1.4 cm., acutish, bases mostly rounded, young short-pubescent on both sides, become glabrate and finely reticulate beneath, on 2272 become broader, some to 1.7 cm. wide, broadly planar. some with Rhytisma; pist. aments in young fruit, 2-2.5 cm. long, on pedunc. abt 1 cm.; capsules 4.5-5.5 mm., subsessile to lower pedicels 0.5-1 mm.; scales light brown; on 2272, capsules to 6.5 mm. but older, also many darkened & pedicels more apparent and scales dark brown.)

2170. *S. brachycarpa* Nuttall

D

(no label). Braizard Lake, Boulder Co., E. C. Smith, 8-8-1948.

(D) (twigs stoutish, subsessile, dark, leafless & semi-noddy below, new pubesc., 1-yr. with only thin remnant pubesc., not shining; leaves ellip. or broadly oblong-ellip., to 4 by 1.5-1.4 cm., acute to acutish, bases rounded on all upper but none ovate, densely hairy both sides, still almost plane beneath; heavily fruited, aments 1.5-2.5 or 3 cm., on pedunc. mostly 0.5 cm.; capsules subsessile, to 6 mm., some discolored; petioles 4-7 mm., reddish-brown). Scales pale or dark-tipped.

2192. *S. pseudolappaceum* (?)

B

(B) Shrub 2 m. high in open meadow where willows are heavily browsed by elk and deer in fall and winter. Moraine Park, R.M.N.P., Larimer Co., elev. 8000 ft., E. C. Smith, 9-19-1948. (twigs stout, ascending,

1-yr. twigs ascending, stout, 15-20 cm. long, reddish, shining but still more or less pubesc., new growth just started, pubesc. along entire twigs; leaves too juvenile but shape, veins, pubesc. suggest *S. pseudolap.*, none broadening yet; petioles & pedunc. still short; pist. aments not yet open, to 1 cm. plus; scales yellowish.)

2232. *S. brachycarpa* Nuttall

C

(C) Prostrate, then ascending, 2-4 dm. long, on NW slope facing Specimen Mtn., Trail Ridge, R.M.N.P., Larimer Co., at about 11,800 ft. elev., E. C. Smith, 8-6-1949. (twigs short, stout, shining, stem ascending, new & 1-yr. pubesc.; leaves small, ellip-oval to ovate, to 3 by 1.4-1.7 cm., bases broadening to round, or apical truncate & subcordate, pubesc. both sides; petioles short; few stipules lanc., 1-2 mm.; pist. aments to 1 cm. on pedunc. to 5 mm.; young capsules to 5 mm., tips seem injured.)

2233. *S. brachycarpa* Nuttall.(det. by EGS as "*S. cordifolia* var.") C

(C) Shrub spreading and ascending, stems 0.5-1 ft. long, not rooting, on NW exposure toward Poudre Lakes, Trail Ridge, R.M.N.P., Lar. Co., at 11,800 ft. elev., E. C. Smith, 8-6-1949. (stems stout (probably browsed), nodey, dark, 1-yr. pubesc.; leaves not mature, ellip., oval, or obov., broadening, mostly do., very densely pubesc., to 3.5 by 1.7 cm., petioles short; 1 tiny stam. ant., apically frosted; scales dark.)

2239. *S. Shrub* rising less than 1 m. from the ground, *S. pseudolappaceum* ?

G

(G) the underground stem rooting at nodes (as 2233); much-br., twigs short, divar., crowded, 1-yr. pubesc. to glabrous; leaves ellip., acute at both ends to broadly so, to 4 by 1.5 cm., puberulent above, glaucous & almost glabrous & finely veined beneath; fruiting aments 3-4 cm., on ped. 1-1.5 cm.; capsules to 6 mm., some frost injured; scales yellow to light brown).

2242. *S.*(*S. "glaucops"*) Return

D

(D) Shrub less than 1 m. tall, somewhat depressed, on slope of Trail Ridge towards Poudre Lakes, R.M.N.P., at abt 11,800 ft. elev., E. C. Smith, 8-6-1949. (Much-br., twigs ascending, new pubesc., 1-yr. thinly pubesc. or peeled, reddish, shining, also 2-yr.; leaves ellip. to broadly ellip-oblong, or suboval, some discolored (1 Rhytisma), 2-4 by 1-1.9 cm., densely pubesc. above, densely to become glabrous, glaucous beneath; acute at both ends; petioles 5-7 mm., some darkened; stipules to 2 mm. long; pist. aments frtg., 2-3 mm., many over. not developed, capsules to 6-7 mm on short pedicels; styles to 1 mm.; scales dark, still obovate.)

2249. *S. pseudolappomum* von Seemen.

(or "glaucops")

D

1 (D)

Shrubs at first trailing but not rooting, then ascending, erect in middle of copse and then nearly 1 m. tall. Trail Ridge near old road to Poudre Lake, R.M.N.P., Lar. Co., at 11,700 ft. elev., E.C. Smith, 8-6-1949. (The old stout stem reddish-yellow, suggesting the freakish 2169-2272 but darker, twigs stoutish, short divar., dark, 1-yr. mostly thin pubesc., all nodey; leaf ellip., acute both ends (or apical broadening at base), to 4 by 1.4 cm., on pet. 4-7 mm., pubesc. both sides, glauc. & becom. glabrate beneath, veins straitish, little retic.; frtg. ams poorly devel., 2-3 cm. on pedunc. abt 1 cm.; ovar. in all stages, best devel. capsules to 7 mm., styles to 1 mm., entire, cleft, or rarely divided, stigmas bifid; scales obovate-oval, dark, elongating; gland sldr, capitate, abt 1 mm. long).

2252. *S. pseudolappomum* von Seemen.

C

1 (C)

Shrub 7 ft. tall, center of a group ranging from 2 feet at the margin to this extreme at center, on NW. slope facing Specimen Mtn., Trail Ridge, R.M.N.P., at about 11,725 ft. elev. E.C. Smith, 8-8-1949. (twigs slender, erect, with long internodes, dark, 1-yr. thinly pubesc. or peeling & remnant-pubesc., some 2-yr. & buds also; leaf narrow ellip., to 4 by 1.2 cm., acute both ends or apical bases broadening, some blades & pet. blackened, hairy both sides, glaucous beneath; pet. to 5 mm. yet; stam. ams past fl., abt 1.5 cm. on pedunc. to 1 cm.; scales mostly still obovate, blackish (frost or drying).

2254. *S. pseudolappomum* von Seemen (oe *S. brachycarpa* Nutt.) (Return D). C, D.

to D

1 (C)

Return

Shrub less than 1 m. tall, part of a clump or mat. as 2252, but 11,700 ft. (Much as 2252 but leaves smaller and hairier, looks like depauperate *S. brachycarpa*; leaf beginning to broaden at base, margins revolute; pist. ams. 1.5-2.5 cm. on pedunc. 1-1.2 cm.; capsules to 6 mm. on D., some sessile, ams a little laxer and caps. to 6.5 on C., styles to 1 mm.; gland sldr., capitate, to 1 mm.; scales in both elongated, yellowish to dark.) "scales narrow, very light brown at time collected". EGS.

2255. *S. pseudolappomum* von Seemen. (Return)

Return

Shrubs 2-3 ft. tall, in dense mats threaded by trails of deer and elk; as 2254. (Much-br., twigs short, stout, divar., nodey, 1-yr. peeling or peeled, with faint remnant-pubesc.; leaf very small, to 3 by 0.8 cm., acute both ends, pubesc. both sides ~~hmk~~ while young but becom. glabrate to glabrous beneath; pist. ams 1.5-2.5 cm. (1 old of 1948), not devel. & aptly frosted; styles & stigmas not fully dev., some broken off (frosted?); capsules to 5 mm.; scales small, broad, brown to black. "scales light brown; tentatively *S. glauca glabrescens* Schn." EGS.

2257. *S. pseudolappomum* von Seemen.

D

1 (D)

(det. by EGS* as *S. glauca glabrescens* (Anderss.) Schn.). A spreading, ascending shrub, which, in the center of a dense copse, may reach a height of 3 ft. or more, this specimen with radiating stems about 12 to 18 inches long, on NW.-facing slope toward Poudre Lake, Trail Ridge, R.M.N.P., as last.

Twigs short, slender, ascending, ~~msw~~ pubescent, 1-yr. thin, so, dark, or peeled and shining; leaf not crowded, narrow ellip., to 5 by 1.4 cm., acute both ends, pubesc. both sides, or becom. glabrate below; petioles to 7 mm., some darkened; pist. ams in late flower, 2-3 cm. long, some well devel. on pedunc. 1-1.5 cm., some poorly devel., on pedunc. 0.5-1 cm.; capsules to 5.5 where devel., short-pedicelled; gland long & very slender, to 1.2 mm. long. scales brownish where well devel. to blackish where poorly developed.

Prof. Ernest C. Smith
408 Littleton St.,
Houston, Texas.

3814 Jocelyn St., N.W.,
Washington 15, D.C.

29 September, 1950.

Dear Professor Smith:

This is my first letter to your new home and I trust that it finds you there and happily settled with your grandchildren and their parents, and having at least a little sunshine. We have almost none for 3 week now, but still hope.

I am still pounding away on list and descriptive notes on *Colo. Glaucæ*, preparatory to fuller study. Herewith is the 2nd installment (pp. 6-10) covering Nos. 1942 to 2069, or the collections of 1939-1947. Those of 1948-1950 will follow, as also those of other collectors.

I had No. 1336, by Harriman and Smith, in this list, where it seems to belong numerically, but discovered that it was collected on June 27, 1945, instead of in 1939 or 1940 as were these just before and just after it. I therefore have placed it in the list of Miscellaneous Collectors, which will come later. However, I now discover that Harriman No. 1733 is included in this list and it was collected on Aug. 2, 1945, just before your No. 1712 of Aug. 11, 1945. I seems hardly likely that his and your 1336 and his 1733 could have been collected at so nearly the same day. Is there an error in either number or date for one of these?

In No. 1962 the data on a slip in the sheet appear to be correct and I have used them herein. The date and other data on the typed label are entirely different and must refer to some other collection. This does not look like an early summer specimen. This specimen will be returned to you later.

Where two specimens of the same number have been sent, I find that the reading of the label data often does not agree. Similarly, the label data and the handwritten notes on the sheet show discrepancies. With No. 1121, three different elevations are recorded.

In the list previously sent, I called attention to No. 500 or 510. In both specimens, A and B, the labels read 500 but the containing sheets read 510, a & B, respectively.

I am interested in your discussion of *S. brachycarpa* var. *antimima*. Schneider was interned over here during World War I. Sargent got him placed at Harvard and set him to work on Willows. He knew little of American species, was required to get out one paper a month, with new species in it. Under those conditions, he naturally recorded uncertainties on every age. *S. chlorolepis* has glabrous twigs, leaves, and capsules. He knew nothing of *S. brachycarpa* and its variations, so when he saw the northeaster specimens with narrowish glabrate leaves, he made them a variety of *S. chlorolepis*, from which species they differed markedly. Raup, knowing little more, saw that it was close to *S. brachycarpa* and so transferred there, postulating a narrow-glabrate variety. Most of the Quebec material is just as hairy as that from the Rockies, and that hold for as far as Iceland. The variety may not be tenable but I must study all of the material at once. Your 2033 and 2033 A are perfect *brachycarpa* on the new twigs and perfect *antimima* on the old twigs. How come?

of the same shoot.

More anon.

Cordially yours,

Carleton R. Ball

408 Littleton St.,
Houston 22, Texas,
March 7th, 1951.

Dr. Carleton R. Ball,
3814 Locust St. N.W.,
Washington 15, D.C.

Dear Dr. Ball:

The package of willows and your letter with the extensive notes have been with me for several days. Just now I am reporting only their safe arrival and thanking you for your great kindness. Later, after more study of the notes and specimens I will write more at length.

I still have seven specimens, some mounted and with the herbarium stamp, which I would like to send you if it will not trouble you too much.

As to those you have already dealt with my purpose was twofold - not only to secure aid, but also that some puzzling material might be preserved for future students of the group. Our College at Fort Collins is primarily interested in serving farmers and stockmen and can not give space for any but "typical" or at least "representative" specimens available for general exchanges. Difficult material calling for further study should be in your herbarium, so marked, whether you are permitted to "follow up" or whether that is reserved for another. Otherwise I would not have so burdened you.

With heartfelt best wishes,

Sincerely yours,

Ernest C. Smith

408 Littleton Pl.,
Houston 23, Texas,
March 13, 1951.

Dr. Carleton R. Ball,
9874 Jocelyn Pl., N.W.,
Washington 15, D.C.

Dear Dr. Ball:

Since a long talk with you face to face is impossible I am inflicting a long letter upon you and presenting some of my conclusions on sweated frosts based on fifteen years of field experience with Colorado willows.

1. Variations from representative forms of accepted and ^{well} known species and varieties, which one hesitates to provide with a new name and is inclined to include in a somewhat modified and enlarged description of an already named variety or species.

A. In many, perhaps the majority of such cases these variations seem to me to be due to variations in the ecological factors. On a given specimen and on a group of specimens of *Salix*, the authors in some years are pure yellow in others years they have been strikingly tipped with red. Sweated frost of most of leaves or fruits (key characters) due to frost, mechanical injury or disease, has been observed to change both size and shape of these organs as well as surface appearance. Where a species has a wide range of distribution in latitude or altitude there is a great change in the complex of ecological factors which are conventionally ^{indicated by} ~~called~~ "life zones" in one of which different genera as well as species take on somewhat the same form which is similar for all and different from that of any in a different zone. (*Salix planifolia* var. *monica* at 11,000 ft. and at 7500 ft.) (Leaves of willow species generally at Estes Park at 7500 ft. the year a late frost killed half-grown leaves and the growing season for the leaves and twigs that followed was shortened by

three weeks or more.)

In Colorado the zone where the complex of ecologic factors produces the greatest similarity of appearance is in the willows is the alpine, of the so-called "erect" forms all are about the same height, any one of them may become prostrate, but not rooting, by weight of late falling heavy snow. all on N.W. slope of Trail Ridge are ~~these~~ in dense thickets threaded by trails of deer and elk and are heavily browsed. The distinction in twigs of *S. pseudodapporum* and those of *S. drachycarpa*, sometimes quite evident here often disappear, the straight twigs, long internodes and even the color, ~~resembling~~ ^{simulating} those of those of *S. drachycarpa*, ~~are~~ ^{the form of} ~~simulating~~ ^{these factors in} this zone which One phase of the light effect, but which is not often, if at all, ~~mentioned~~ ^{mentioned}, is the "larger proportion of ultra-violet rays."

B. In some cases these variations seem to me to be due to genetic factors. These are definitely "intermediates". Proof of hybridism can be proved only by progeny tests. It is antecedently only "probable".

However, horticultural hybrids have been common in this genus for a hundred years. Whether the parents were "pure lines" or not is not particularly important. Of certain hybrid willows the chromosomes have been counted. (A Swedish Journal & in English Medical Journal.) Cited in memoranda at Colo. A. & M. A. I believe W. S. Best produced several hybrid forms, but can refer to no publication of his to that effect.

Moreover, the probability of hybridism is increased by some facts observed in the field here in Colorado; sometimes the staminate and pistillate forms are not found near each other, but the pistillate plant of one species and the staminate form of another may be close together. In a canyon near Fort Collins I noted only last summer a growth of *S. imorata* about 15 ft. long and 8 ft. wide with only pistillate aments. It was more than half a mile from the nearest member of the species and that too was pistillate. The spread by purely vegetative growth is as

lounding. In the case just mentioned all the stems³ started from a single root, new stems and roots started from proliferating branches or rhizomes. ~~An~~ even more extensive growth of a single sex was observed in Big Thompson Canyon, the species being *S. exigua*. This time nearest plants of the opposite sex were even further distant.

In an open meadow in edge of Estes Park Village this proliferation by branches above or just below the surface of the ground takes another form. In a mature cluster of *S. monticola* nearly circular, 15 ft. tall in its center, with diameter only slightly less, there are nearly one hundred stems, all bearing ^{distillate} aments of one sex. Staminate "clusters" are present in the same meadow but so also are staminate plants of three other species of approximately the same height.

Above timberline there is about a 50-50 chance that a plant of *S. pseudolapponum* (distillate) will receive some pollen of *S. brachycarpa*. That any seed resulting from this should germinate and produce a plant which should mature under the present conditions on the N.W. slope of Trail ridge may well be questioned, but that such a union may at an earlier date have started one of the "intermediates" in one of the present dense "clumps" is at least a reasonable idea.

2. I am familiar with certain forms which belong in the Glaucae and can arrange Colorado forms into several groups with some quite definite characters for each group, but the more I work with these the less sure I am of the proper names to give them.

S. cordifolia means nothing to me now. The original description seemed to cover most of the Glaucae forms with leaves oval and base rounded or cordate. The seventeen sheets from Canadian National Herbarium had a few that resembled our commonest broad-leaved forms but all bore name var. *callicarpa*. Some had very large leaves and aments 4-5(6) cm. long, with ovary 5 or more mm. long; others had

leaves almost orbicular and anthers 1.5-2 mm. long with 4 ovaries (some what developed) 4 mm. long, some had all leaves large, mostly ob lance to obovate, a very wide variety. Then Fernald's treatment came to my attention. The specimen named by him *S. cordifolia* var. *callicarpaea* for the most part did not agree with his description of the variety. ~~The same~~ ^{Some} agree with his var. *pusilla*. Evidently his identifications indicated his treatment in *Rhodora*. The specimens we have in the

first called *S. cordifolia* var. *callicarpaea* do seem to agree with Fernald's description and key. Do you still feel inclined to credit this variety to Colorado? The three specimens collected by Baker in Colorado which are in the herbarium at Iacumie, Wyoming, except for size agree pretty well with Fernald's description of var. *pusilla*, but some are a little longer and some are slightly acute. They were labeled *S. padophylla*, but have the ovaries of the *Glaucæ*.

The group we have called *S. pseudodappnum* is now the one which seems to me best defined and most easily delimited. But the original description was from an immature description of one sex only. Also, as you suggest, some other, earlier, name may refer to this.

S. brachycarpa apparently breaks up into at many forms as *S. cordifolia* or somewhat less. Your description of this species in the "New Manual of the Rocky Mts. Flora" (1909) is pretty conclusive and with a few changes (size of leaves, capsules and styles) might be made to cover present knowledge of the species and varieties, followed by a brief key: *typica*, var. var. *forma*. I begin to doubt var. *aristata*. In the whole group the tendency is, with the exception of *S. glauca typica villosa*, for the pubescence to diminish and sometimes to disappear in the late season.

So far as descriptions of *S. desertorum* have come my way (Anderson and Schneider) they have seemed to shut out Colorado material, though Schneider brackets *desertorum* and *pseudodappnum* together, as signing longer peduncles with leaves glabrous or subglabrous to *S. desertorum*.

The description of *glaucops* by Anderson is not at hand. My recollection is that it is separated from *S. glauca* by styles entire (or sometimes cleft part way) and by narrow leaves. var. *villosa* he says is only distinguished from *S. glauca* with difficulty, presuma-

by the absence of "styles cleft to base", while var. *glabrescens*, has less dense pubescence and this tends to disappear in the late summer season.

If this recollection is correct the term "glaucopt" can, under the code, be used only for a form which agrees with his description and has narrow leaves. If the term is used for any other purpose it is "invalid". If one thinks Anderson's term "invalid" in the first place as not clearly pointing to a definite entity supported by a representative specimen or specimens it still is ruled out for use as a name for something else. Anderson clearly did not recognize it as a species as he marked it as a "cross" and apparently meant that it existed only in the two forms - *villosa* and *glabrescens*.

Of course my memory may have played me false, but that of the code rule is clear and strong. One, of course, may still suggest raising a variety to "species" rank, but it must apply to the same entity as to the for which it was originally used for and not to something else. This, of course, does not apply to your temporary and unpublished use of the term.

Saxifraga glauca certainly does not occur in Colorado. Some specimens of *Alnus* which I have seen agree closely with Anderson's description, including "styles cleft to base and the "alcorn" appearance of styles and stigmas seen together.

3. Some notes on your annotated list of specimens sent to you by me.

Please understand that these notes are not a challenge of your determinations, but a natural first reaction by one distinctly an amateur, largely trained by your own friendly counsels, who does not yet recognize all the forces which produce aberrations which in some of your notes you explain in full. Further, I remember that in some cases, notably the oval-leaved specimens of the *Glauca*, I was frankly unwilling to attempt a name at all. Now to my comments.

No. 25. ♂ You note some characters of *S. pseudoappennin-*
1. twigs longish, straight. - - - perioles 5 mm (at anthesis),
peduncles 0.5-1 cm. To these I add "nodes not prominent, internodes on 1 yr. + 2 yr. stems 1-2 cm. long, early appearance of reticulation on under side of leaf".
I probably either appended no name or set it down

as "Intermediate" while you weighted the brachycarpa ^{from E. C. Smith 6}
acters. 13-11-51

- No. 1121. *S. pseudolappinum* ♀. My note "short styles", ^{anthers}
No. 1441. *S. pseudolappinum* ♀. My note "notched and some cleft"
These specimens have gone on to Fort Collins. My recollection is that I tentatively called this *S. glauca glabrescens*, associating with certain characters of the anthers, as well as the stigma, more noticeable in the former. Accepting your identification I may say that it is the first intimation to me that the styles as well as the stigmas of this species might be notched or even "cleft at apex". This had been noted several times in *S. brachycarpa* and perhaps should have been expected to appear occasionally throughout the *glaucae*. Had I been given another summer in the field and control of dates of visits to the station I might have been able to prove a combination of anther characters distinct from those of *S. pseudolappinum* though the name I was tentatively using might not be tenable.

- No. 1594. *S. pseudolappinum* ♂. My note "anthers small, not edipoid"

- No. 1961. *S. pseudolappinum* ♀. My note. This I had called *S. glauca glabrescens* tentatively. ^{1st} From the beginning I have had a serious and strong objection to any moderate use of the term "glaucae".

It was used by Anderson indefinitely - neither as species nor as variety, but as an intermediate term with sole reference to plants, briefly described as "green and glabrescens" and definitely marked by a cross X. ^{2nd} As to the name I used, the scales with the amount of yellow color in August, the large leaves, long peduncles, etc., correlated with other specimens of earlier date which differed more strangely from my concept of *S. pseudolappinum*.

It is usual, so far as I have observed, and as I have stated that in the *glaucae* the scales are uniformly light yellowish, light brown, or straw-colored. You have noted that the scales are often discolored. I have been able to follow several plants through from unopened buds to mature aments. The gamut of color in our Colorado plants runs from greenish to whitish in the bud to very dark brown at maturity, but does not approach these changes to a not proceed at the same rate or the same degree in the different species.

In *S. brachycarpa* the scales are narrow, oblong to narrowly lanceolate or oblanceolate, at most stages unicolored, yellowish or light brown.

In *S. pseudolappinum* ^{scales} dark brown very soon, a small crescent at the base being all the light color visible, later the whole scale is dark brown, often black through action of frost. In the first ^{few} specimens checked for me by you the scales were broadly obovate and so dark I called them black.

In my third group the scales at anthesis were hardly to be distinguished, ovaries, scales and long hairs very pale

from E.C. Smith 7
15-III-51

and uniform in color. As the ament developed the color began to deepen at the top, first yellowish, followed by light brown, then darker brown, never making the scales unicolor. In the staminate aments the anthers were large, bright yellow, more or less ~~clearly~~ clearly striped with red, beginning at the apex.

These forms were comparatively rare and were associated with slightly larger leaves and longer peduncles than those of average specimens of *S. pseudolappinum*. Also the scales were usually wider than those of *pseudolappinum* which in the pistillate form are not only quite dark at the stage of No. 1961 but also very narrow. In striking contrast to those of the staminate aments, so much so that it was hard for me to accept them as belonging to the species. That is something not given in the original description and left for later students to find out. While this explanation is questionable I still feel that there is an entity in the Colorado forms of the glaucous in which the aments are distinctly different from those of either *pseudolappinum* or *drachycarpa* and regret that the convincing demonstration must be left for some worker of another generation.

Perhaps this is the best place to say that, while I recognize the inefficiency of much of my collecting and sincerely regret it, sometimes collection from the same plant at different seasons is not necessary to establish certain facts. In Estes Park at 7500 ft only one form is found which you have called *S. drachycarpa* pa. This at first you called *S. pseudolappinum*. Specimens of this were all of one type, and while only one cluster of stems exhibited some twigs with very broad leaves the other characters were and are identical. The fact that collections from this "cluster" were made at early and late anthesis and also at maturity of fruit satisfies a "technicality" and adds nothing to the characters of the group. In the same way the broader-leaved specimens from Poudre Lake do cover more than one stage of development and do come from plants of a single form in a definite corner of the area. This not as an "excuse" but as a statement of opinion after pleading guilty on the main charge. I hope you have a full series of *S. drachycarpa* from Estes Park at 7500 ft. All were from meadows along streams which come together near the village of Estes Park, most of them from the same meadow, several from the same clump (all stems in the smaller clump from one parent root and of the same sex.)

No. 2141. *S. "glaucoptis"* ♀ Trail Ridge, 11400 ft. 7-21-1948. E. C. Smith
13-III-51
(*S. cordifolia*? as marked by E.C.S.) This is the common broad-leaved form of the *Glaucocae* growing in Colorado. See my notes on No. 1961. *A. F. Fernald*

Nos. 2169 + 2172 Except for light bark I should call this *S. glauca*, but was not ready. I knew this was not *S. glauca*, but was not ready to give it a name. This was Red Rock Lake (10000 ft.) was visited in 1950 on July 9th. Foliage was fresh to some extent, but pollen was mostly shed. Some other species also had the peculiar light colored bark which may be due to mineral in the soil. Some plants of this type were 12-15 ft. tall, a height unusual at this elevation. The thickness and toughness of the leaves is noteworthy. I still can not place it satisfactorily even in "*glaucoptis*". The living plants just look different from the representative forms of *pseudolappinum* and *bractycarpa*. This lake and Brainard Lake are nearly one hundred miles from Fort Collins and the last five or six miles are steep and rocky.

No. 2144. Trail Ridge, 7-21-1948. *S. "glaucoptis"* according to an earlier statement of your really means "postponement of final judgment". If so I heartily concur.

No. 2265 *S. pseudolappinum* tentatively *S. glauca glaucescens* by E.C. Smith. My note - Not typical or really representative as your notes also recognize "twigs short, nodey". Your notes "scales small, broad, brown to black". My original note "scales light brown", style very short, several cleft nearly to base, internodes short".

But enough of these matters. In the package recently mailed to you was a specimen from Park Co., Colo., collected by George H. Lane about the middle of August, my number being 2282 and date August 23, 1949, evidently collected within the preceding seven days and not fresh in press until received by me. This resembles the specimens of *S. bractycarpa* from Estes Park (7500 ft.) although collected at 9200 ft. It has one twig with broad leaves. This you may keep as I have a duplicate.

Lastly, I do not need to point out the wisdom of my advancing years (I shall be eighty seven years old come May 3rd). This rough manuscript with its blot, breaks, interlineations, etc., tells its own story.

yes I may point out the handicaps under which these 7 sheets were written - the absence of the books and some type-written material available to me in Fort Collins, the absence of a typist to make a clean copy of my corrected message, the absence of a good binocular microscope (of course my hand lens served, but for many years I used the more convenient form) and the presence part of the time of two active and inquisitive great grandchildren.

However, for the record I may say that after the first year after our meeting in San Francisco my material sent to you, including the very latest ^{was} ~~was~~ consciously not only appeals for help and instruction, but also "contributions to the common good". If a successor were available as advantageously ^{well} situated geographically as I was, he might also put in fifteen years of study of our local willows to good advantage. At all events I wanted the material which I could not handle effectively placed where it would be available to you and to those who will come after you.

I am glad you are to have Anderson's Alaska material. One sheet of his snatches very closely a sheet of *S. glauca* from Sweden, now in Herb. Colo. A.M.

With all best wishes and with deep appreciation of your great kindness and generous assistance,

Cordially yours,

Ernest C. Smith.

Prof. Ernest C. Smith,
408 Littleton Street,
Houston, Texas.

3814 Jocelyn St., N.W.,
Washington 15, D.C.

September 27, 1951.

Dear Professor Smith:

Your letter of Sept. 19, with 4 photographs from Uvalde Co., came some days ago and the packet of willows came today. I have given them immediate study because I am working under pressure and if I once laid them aside, no one knows what would happen. I inclose the list of determinations.

Those from Uvalde Co. all seem more or less stunted or depauperate in growth of leaf and aments. I seem to remember that west Texas had a severe drought this summer. If that is true, can you give me any figures on its severity and duration.

As you will see from my notes, all the specimens of *S. carolinian*^{ian} Michx. (*S. longipes* Shuttleworth, and var. *Wardii* and *venulifera*) are with short or narrow leaf, or both and the narrow one are not glaucous but only glaucouscent or less than that. I do not see why drought should affect glaucousness. Drying with an electric drier often destroys it but these leaves do not seem to have been so dried. Previous specimens of this species from Uvalde Co. were quite normal.

I wonder if there is an error in one of the first two numbers, collected on same day. Should both have been in the 2200s or both in the 2300s?

In my notes on the collections, I speak of attached specimens. There were 3 different lots of 2495, discussed in three separate paragraphs in my list. The first and thirtieth lots had two specimens each, one paper inside the other. The second lot was a single sheet. Do I understand that the three lots were from 3 different plants. Or was each of the 5 sheets from a different plant? Or were all five from the same plant? There is no more variation in the five than can be found on a single plant. The first two lots are called ~~SHRUBS~~ shrubs and the third is called a tree, but all have the same height "to 2.5 m. tall, as do Nos. 2500 and 2501. It is hard to understand why none of them was taller.

Can you give any reason why the specimens of 2491 and 2495 were so different in appearance from those of 2500 and 2501. Was it a matter of shade and sun, or of distance from water, or of north or south exposure?

Of your four photos, two are labelled Comcan, and two are Garner Park, but there is no labelling to indicate what willows in the collections sent me each one represents. I have not tried to study them yet.

I note the list of Texas willows from Flora of Texas.

- S. exigua* var. *nevadensis* has been found, I think.
- S. Goodingii* is represented only by the variety *variabilis* Ball (reprint sent)
- S. interior* var. *pedicellata* (Andersson) Ball occurs, mostly westward.
- S. "longipes"* (*S. caroliniana*) occurs also from Edwards Plateau to Uvalde Co.
- S. nigra* var. *Lindheimeri* Schn. is the commonest form in Texas. It varies from the species in leaves more narrowed at base and on longer and mostly glabrous petioles. There is no var. *falcata*. Falcate leaf occur on every plant in the U.S. in late summer and fall, if weather is good.

I hope that my contribution on the willows of Texas gets published soon in the new Flora of Texas by So. Meth. University. I am not sure whether it is in press.

Hot and dry, but am feeling fine,

Cordially yours,

P.S. Am I to return the specimens? Or to keep part of them, and if so which?

Carleton R. Ball

TEXAS

Prof. Ernest C. Smith,
408 Littleton St.,
Houston 22, Texas.

3814 Jocelyn St., N.W.,
Washington 15, D.C.

9 October, 1951.

Dear Professor Smith:

Your letter of October 3 is here and I am greatly pleased to have this additional information. I have added annotation labels to the specimens, quoting the statement of the Weather Bureau, and calling attention to the effects of the severe drought on the growth of twigs and on size, shape, and glaucousness of leaves.

I am especially glad to know that all of the specimens of 2495 are from a single plant. They give a very good picture of the different characters of of spring, summer, and autumn. These occur in a season of severe drought just as in normal seasons, but the results on all three stages are evident. Thanks for giving me the correct height and stem diameters. Will add these.

You did not answer my question about a possible error in the numbers of 2239 or 2340. These number are 101 number apart, altho collected on the same day, JUNE 23Z April 22, at Houston. If they were collected at the same time and place, it would seem more probable that they were just 1 number apart. Then the question would be whether they are 2239 and 2240, or 2339 and 2340. Please pardon my expressing these doubts, but many such cases have turned out to be errors in the haste of sending specimens for determinations, and the specimens were later distributed to various herbariums under these correct numbers.

Many thanks for permission to keep all of these specimens. To me they are really more valuable than normal specimens because they illustrate the struggle of plant against nature and the effects of severe drought. I plan to show that a meeting of our Botanical Society this winter and get a lot of others interested in watching plants in the field.

You state that you cannot find No. 2491 among the specimens you still have. You sent me one sheet, consisting of one twig with old fruiting catkins and one branching spring twig, both with greatly reduced leaves. They are almost identical with the same stage in No. 2495. I have not mounted it, and if you do not find your specimen of it, I will return this one to you. Neither twig is a "seedling".

I am not yet certain about the photographs from Concan. You say that both are from the same plant, from different angles and that the plant stood by itself in full sunshine. The two Concan collections are Nos. 2491 and 2495. But neither the one label for 2491 nor any of the labels for 2495 state that either number was a plant growing alone in full sun. Why not give me the number so I'll know which it was.

The most amazing thing in your letter is your statement that No. 2500 is "the same plant as from which I earlier sent you No. 2420". The label of No. 2500 (2 of them) do not state that No. 2500 is from same plant as No. 2420, which started all this excitement. And you did not mention that fact when you sent the recent shipment. I have now looked over No. 2420 and compared it with No. 2500, and they undoubtedly are the same. The June collection is more deceptive because not yet developed. The leaves are very small and very densely pubescent, while on 2500 they have expanded more and the pubescence is thinner because spread over more space.

Now as to the height of 2420-2500. Of 2420, you said "Several specimens 4 to 12 feet high". Of 2500 both labels say "Shrub 2.5 m. tall". In your last letter you say, after discussing Sargent and Schneider and their treatment of *S. longipes*, "My notes on the one collected in June are as follows." "Shrub about 15 ft. tall." Now 15 feet is about 4¹/₂ ~~unknown~~ meters, instead of 2.5 m., and is 3 feet higher than the 12 feet of 2420.

I am very glad to have the full notes on the "one collected in June" which I take to be No. 2420. Your notes show a very careful study of that specimen. In a normal year, however, the leaf will develop (in autumn) to be 5 or 6 in. long, and the aments may be 2 inches long or more, while the pedicels may be 4 mm. That is where "longipes" got its name.

Stipules usually are more variable than leaves, because they develop rather late and are influenced both by the demands of the fruit for nutriment and by adverse weather conditions. Stipules are characteristic organs on some willows, if and when they are present. Some arctic species have long linear stipules, often remaining attached until the next season, *S. pulchra* and its varieties have extremely linear stipules, so retained, while *S. Richardsonii* has narrowly lanceolate and long-pointed persistent stipules up to an inch long.

Here in brief are the queries made above.

1. Are numbers 2239 and 2340 correct?
2. Can you find a specimen of 2491. If not, I'll return the one you sent me.
3. What is the number of the willow in Concan photographs.
4. What is the correct height of 2420-2500?

With appreciation and good wishes, I am Cordially yours,

Carleton R. Ball

P. S. In copying your description of No. 2420, to paste on the sheet with it, I was greatly impressed by the extent to which the severe drought had been the cause of the characters you recorded.

Prof. Ernest C. Smith,
408 Littleton St.,
Houston 22, Texas.

3814 Jocelyn St., N. W.,
Washington 15, D.C.

19 October, 1951

Dear Professor Smith:

I have your letter of 15 October and thank you for the information given. I think that it clears up most of the points under discussion.

1. I have changed the number of 2239 to 2339, to accompany 2340.
2. I note that you have found additional material of No. 2491, and accordingly I have mounted my specimen and inserted it with the others. Thanks.
3. I note your statement that "The number of the Concan willow is 2487." The specimens I received from Concan are Nos. 2491 and 2495, both *S. caroliniana*. I have not seen any No. 2487 but would like to label these photos with the name of the willow shown. It is possible, of course, that *S. nigra* var. *lindheimeri* occurs at Concan just as it did in Garner State Park.

The most striking difference between the two is the much larger leaves of *S. caroliniana*, with their lower surfaces glaucous. *S. nigra* and variety have leaves only about half the size and green beneath. The severe drought of this year reduced the leaves of *S. caroliniana* in size until they look like those of *S. nigra* and also are only slightly glaucous in most specimens.

S. nigra usually grows in alluvial soil near streams. *S. caroliniana* favors rocky ground where soil usually has more clay and where less water soaks in. That is why it seemed so much worse affected by the drought. Your June specimen of *S. nigra* var. *lindheimeri*, No. 2421, was about normal in size of leaves and aments.

I wish that you would look carefully at your No. 2487, shown in the Concan photos, and tell me if it is *S. caroliniana* or *S. nigra* var. I then will label the photographs. In the pictures, the habitat looks about intermediate between the two favored by these species, but perhaps favoring *S. caroliniana*.

4. I have added annotation labels giving the amended heights as you have stated them. I also have noted the severe drought and its effects on annotation labels. You certainly have done a good job in the ecological field with these collections, and that is why I have been so careful to put on the explaining labels.

The dates of blooming at Houston and Uvalde Co., doubtless were affected by the lower elevation, greater normal humidity, and abundant ditch water. We get similar responses in all latitudes.

Collecting from the same plant throughout the year is one of the most valuable services a field man can perform for science. I am glad that you are doing it for the Houston oaks. One man in Idaho last year collected from tagged willow plants. From some he got as many as 10 or 12 collection, which enables one to really know something about them.

If Schneider said that *S. Gooddingii* had 3 stamens, he misleads students. The related sections, *Nigrae* (*S. nigra*, *S. Gooddingii*), *Triandrae* (*S. amygdaloides*), and *Bomplandianae* (*S. Bomplandiana*, *S. caroliniana*, et al), all have from 3-5 stamens, and occasionally more. The number varies in the different flowers of the same ament. *Triandrae*, of course, was named from a supposed 3 stamens, but it varies.

With appreciation of your generous contributions, and best wishes for the you in collaboration with the weather, the oaks, and the cytologist, if you can find on, I am
Cordially yours,