



Hunt Institute for Botanical Documentation
5th Floor, Hunt Library
Carnegie Mellon University
4909 Frew Street
Pittsburgh, PA 15213-3890
Telephone: 412-268-2434
Email: huntinst@andrew.cmu.edu
Web site: www.huntbotanical.org

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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.

Voss, E.G. *Salix* for Flora Michigan
Feb. 10, 1958

SALIX

WILLOW

The flower of a willow consists of a single pistil or 2-7 (occasionally more) stamens apparently in the axil of a small scale. The flowers are grouped in "catkins" or aments. Since the flowers are small and lack a perianth, the species are more difficult than in many genera to describe, with the added complications that the sexes are ^{on} separate plants and that in many species the flowers appear before the leaves. In addition, hybridization is not uncommon, so that the willows have a reputation for being unusually difficult to identify.

The general key below includes all species, and is based on characteristics of the flowers, fruit, and leaves; it includes fairly full descriptions of the species insofar as they differ from each other. It is intended to work with either staminate or pistillate plants, as long as leaves are present. In addition, supplementary keys are provided for staminate and pistillate plants of those species which may be found in Michigan (at least sometimes) with the flowers or fruit well developed before the leaves appear. These will be helpful in many cases, but additional leaf collections from the same individual plant should be made for certainty. One should not expect to be able to identify incomplete or immature specimens of Salix any more readily than such specimens in other genera. A key to the species of, say, Potentilla or Solidago, would be unthinkable if based solely on leaves or solely on flowers, though a few species are distinctive enough to handle in this way. In a sense, therefore, Salix might be considered an easier genus than many, since the majority of specimens can usually be identified on the basis of leaves or flowers alone. But the best practice is to mark a plant and collect material from it at different seasons.

Identification of willows requires patience and good magnification of about 10x with adequate illumination. In several species, the presence of copper-colored hairs on young foliage is a very helpful characteristic; do not assume that these are absent until a careful search has been made. (In some species, such as S. fragilis and S. amygdaloides, for example, the presence or absence of such copper hairs is not significant.) Similarly, examine the petioles of a number of leaves before concluding that glands are absent. Look at several leaves to gain an impression of the nature of the margin. In short, do not base conclusions on a single examination of a single part! In a few species, the sequence of flowering in the ament is distinctive. This is a characteristic best seen in partly developed staminate aments; fully mature or exceedingly young aments will not demonstrate the sequence. The filaments of ~~older~~ stamens may shrivel and shorten, making them falsely appear younger, so be very cautious in using this characteristic. In S. discolor, S. humilis, S. glaucophylloides, and S. cordata the first well-developed stamens with ripe anthers appear at the apex of the ament, those at the base developing subsequently.

The keys presented here will be recognized as differing in many respects from traditional keys to Salix. They are based on original examination and measurement of approximately 2000 specimens of Salix from Michigan, aided by the annotations of C. R. Ball, the outstanding authority on willows, on almost every specimen. Although Dr. Ball's annotations, correspondence, suggestions, and published accounts have been of very considerable help, and his nomenclature and concept of the species largely followed, he is not to be held responsible for the details of the present treatment, which differs in a number of instances from his choice of distinguishing characteristics for species and in other regards.

GENERAL KEY TO MICHIGAN SALIX

1. Leaves green beneath (similar to upper surface, or $\pm$ yellow-green, glabrous or pubescent, but neither whitened nor glaucous nor with the surface hidden by dense white pubescence)
2. Leaves either $\pm$ entire or remotely spinulose-denticulate (the greatest distance between teeth on the sides of mature leaves mostly 3-6 mm), the blades mostly linear-oblong or narrowly lanceolate; stamens 2; capsules pubescent or glabrous
3. Leaves $\pm$ entire, revolute, the upper surface with impressed (sunken) veins; capsules (& often other parts) white-tomentose; filaments glabrous 12. S. candida
3. Leaves remotely denticulate, not revolute, the upper surface smooth or with the veins slightly raised; capsules and young growth glabrous to silky, but not tomentose; filaments $\pm$ densely pilose on basal half 1. S. interior
2. Leaves closely serrate (the teeth on sides of mature leaves less—usually much less—than 3 mm apart), the blades narrowly lanceolate to ovate or elliptic (except in No. 2, with 4-7 stamens); capsules glabrous
4. Leaves linear-lanceolate, acute to somewhat rounded at base, the blades at maturity mostly 4-10 times as long as wide; stamens 4-7, the filaments pilose basally; capsules 3-4 mm long, with styles less than 0.25 mm long (rarely slightly longer) . 2. S. nigra
4. Leaves lanceolate or broader, rounded to subcordate at base, the blades at maturity 1.5-6 times as long as wide; stamens 2 or if more the petioles glandular at the summit; capsules various
5. Petioles with 2 or more glands visible at or near junction with the blade; stamens 3 or more (usually 5); year-old branchlets glabrous and usually shiny

6. Blades of mature leaves about 1.5-3.5 times as long as wide, green or slightly whitened beneath, acute to short-acuminate; petioles and young foliage glabrous; stipules usually present (falling early) on young sprouts; leaves or leafy bracts on the short flowering branchlets (peduncles) usually entire or nearly so; scales, especially in staminate aments, sparsely pubescent to glabrous except at base; capsules smoothish and 4-6 mm long, dehiscing after July 1 (or sometimes as early as May in so. Mich.); introduced shrub or small tree rarely found as an escape 3. S. pentandra

6. Blades of mature leaves 2-6 times as long as wide, green to strongly glaucous beneath; leafy bracts of peduncles finely toothed, like the foliage leaves; common native shrubs, differing from no. 3 as described below (e. g., if leaves whitened beneath, then stipules always lacking, capsules larger, and scales pubescent to their tips; if green beneath, then tending to be long-acuminate on sprouts, often pubescent on petioles and when young, the capsules ripening early).

7. Leaves somewhat whitened to strongly glaucous beneath, acute or short-acuminate, estipulate; petioles and young leaves glabrous; scales of both staminate and pistillate aments usually $\pm$ pubescent to their tips; mature capsules (6.5) 7.5-10 (12) mm long, $\pm$ granular-roughened or wrinkled throughout, dehiscing after July 1 (occasionally June 15-July 1 in so. Mich. or early seasons) 4. S. serissima

7. Leaves dark to pale green, but not whitened, beneath, often stipulate on sprouts and long-acuminate at maturity; petioles and young foliage often sparsely to $\pm$ heavily pubescent with

copper-colored (sometimes whitish) hairs; scales usually with a prominent glabrate area on apical third or half of the back; mature capsules 4-6.5 (7.5) mm long, smooth (except usually in wrinkled beak), dehiscing before June 15 (or as late as July 1 in no. Mich. or late seasons) 5. S. lucida

5. Petioles without glands (though margin of blade may be glandular-toothed nearly to its base); stamens 2; year-old branchlets often pubescent or at least puberulent above the nodes

8. Unfolding young leaves at tips of branchlets usually very reddish, moderately to very sparsely pubescent; older leaves usually somewhat whitened beneath, glabrous or nearly so, the marginal teeth tending to be crenulate and with glands absent or very small and ± sunken; pedicels 1-2.5 mm long, usually about equalling or exceeding the scales; styles about 0.5 mm long or shorter; young aments flowering from base to apex; year-old branchlets densely to sparsely (and locally) puberulent—rarely somewhat villous

. 6. S. rigida

8. Unfolding leaves, even if (as occasionally) reddish, mostly covered with dense long silky hairs; older leaves densely hairy to glabrate, definitely green beneath (at least under the hairs), the margins usually sharply (sometimes even doubly) serrate, the teeth tipped with prominent enlarged glands; pedicels under 1 mm long, shorter than scales; styles usually 0.6-1.5 mm long; young staminate aments flowering from apex to base; branchlets ± villous-pubescent 7. S. cordata

1. Leaves whitened beneath, usually $\pm$ strongly glaucous and/or the lower surface completely hidden by dense white pubescence
9. Margins of foliage leaves (not always peduncular bracts) entire or sometimes (especially on sprouts) rather coarsely and irregularly or obscurely crenulate-serrate on apical half, often $\pm$ revolute; stamens 2 (or 1 in no. 9); capsules pubescent (except in nos. 8 & 21). [NOTE: All species included under this lead, except no. 8, are also in the supplementary keys to flowering specimens; these keys may be helpful to consult for material with aments not yet fully mature.]
10. Leaves completely glabrous (or hairy when first emerging from bud, the hairs rapidly deciduous)
11. Aments on long or short peduncles bearing green bracts or leaves; capsules glabrous, on pedicels 1.2-4 mm long; filaments glabrous; anthers yellow; axillary buds at most 5 mm long (no. 8) or 7 mm (no. 21); leaves strictly entire or obscurely toothed
12. Aments up to 3 cm long, terminating leafy peduncles or branchlets about 1-3 cm long; capsules strongly red-tinged (rarely bright green); style very short, not over 0.25 mm long; anthers about 0.5 (0.4-0.6) mm long; leaves strictly entire, slightly revolute, often $\pm$ rounded at apex; branchlets glabrous; stipules absent
 8. S. pedicellaris
12. Aments at maturity 3-9 cm long (or the staminate, and rarely pistillate, as short as 2 cm), on short green-bracted peduncles; capsules yellow-brown to greenish; styles usually 0.6-1.5 mm long; anthers 0.6-1.0 mm long; leaves $\pm$ acute at apex, with at least a few obscure teeth; branchlets, especially of current year, usually $\pm$ densely pubescent; stipules often present
 21. S. glaucophylloides

11. Aments essentially sessile, at most with tiny green or brown bracts at base; capsules pubescent, the pedicels various; filaments often pilose at base; anthers yellow to red or purplish; axillary buds up to 13 mm long on sprouts (though often under 5 mm, especially in no. 14); leaves ± obscurely toothed on about the apical third or half
13. Capsules less than 3 mm long; pedicels and styles essentially none; filaments (and sometimes anthers) united into a single stamen pilose at the base; anthers less than 0.5 mm long, dark brown or purplish; stipules none; leaves often tending to be subopposite, thickish, purplish, ± oblanceolate or narrowly oblong; escaped from cultivation 2. *S. purpurea*
13. Capsules (5) 6-10 mm long, on pedicels (1) 1.5-4.5 mm long; styles usually 0.5-1 mm long; filaments distinct, pilose or glabrous basally; anthers about 0.6-1.2 mm long, yellow or somewhat flushed with reddish; stipules often present; leaves alternate, thin, green (above), obovate (-oblanceolate) to elliptic; common native shrub 14. *S. discolor*
10. Leaves pubescent on one or both surfaces, at least until well-opened /± strongly and extensively
14. Branchlets/glaucous and glabrous; leaves rather densely covered with lustrous hairs beneath when mature (glabrous or nearly so above) 10. *S. pellita*
14. Branchlets not (or occasionally slightly) glaucous, pubescent or glabrous; leaves various
15. Pubescence of leaves consisting of straightish, silky, and appressed hairs

16. Leaf margins at most thickened, not revolute; capsules distinctly pedicelled, ~~pedicels~~ (pedicels 0.5-3.5 mm long); styles less than 0.5 mm long; widespread native shrubs 32
16. Leaf margins $\pm$ revolute; capsules sessile or nearly so; styles 0.5-1.5 mm long; escape from cultivation . 11. S. viminalis
15. Pubescence of leaves consisting of $\pm$ curled, tomentose, or woolly hairs (at most silky on youngest leaves just emerging from bud)
17. Under surface of leaf blade actually green, hidden by dense white- or gray-tomentose pubescence (rarely glaucous & with sparser white tomentum); leaves linear to lanceolate or narrowly oblong, (4) 5-12 (17) times as long as wide; ovary and capsules $\pm$ densely white-tomentose, on pedicels up to 1 mm long; young branchlets usually with flocculent tomentum
 12. S. candida
17. Under surface of blades $\pm$ whitened or glaucous, seldom completely hidden by the pubescence; leaves generally broader, usually less than 5 times as long as wide (rarely up to 6 times); ovary and capsules silky-pubescent, on pedicels 1-6 mm long; young branchlets glabrous or puberulent to villous (not flocculent-tomentose)
18. Aments on short leafy peduncles; pubescence (even on young reddish leaves) whitish, with no admixture of red or coppery hairs; leaves usually retaining at least sparse pubescence throughout above when fully developed, rugose, with veins and veinlets impressed above and prominent beneath; scales of aments rather narrow, whitish to pale brown, of uniform color or slightly darker at base or pink-tipped
 13. S. bebbiana

18. Aments on short peduncles or sessile but only rarely leaf-bracted (hybrids?); pubescence of unfolding leaves (especially above) in small or large part of copper-colored hairs; leaves becoming glabrous above when fully developed except often for whitish or coppery hairs on midrib, flat or (no. 16) slightly rugose (a few coppery hairs occasionally present at maturity); scales of aments typically rather broad, $\pm$ obovate, very dark brown to black except for pale base

19. Year-old branchlets glabrous . . . 14. S. discolor

19. Year-old branchlets pubescent or puberulent at least in small patches above the nodes. [NOTE: Sterile specimens not safely distinguished; see text. If old aments are present, the following choice may be helpful.]

20. Pistillate aments 3-12 cm long; anthers yellow or flushed with reddish, (0.6) 0.7-0.9 (1.2) mm long; leaves flat or the main veins slightly raised above . S. discolor

20. Pistillate aments 0.5-2.5 (rarely to 4) cm long; anthers red-purple to brown, 0.4-0.6 mm long (rarely larger); leaves often slightly rugose, the veinlets impressed above 16. S. humilis

9. Margins of leaves (at least mature foliage leaves) $\pm$ finely and distinctly serrate (the teeth rather distant in nos. 1 & 18) almost or quite to the base of the blade; stamens 2 to several; capsules pubescent or glabrous

21. Petiole with prominent (sometimes stalked) glands above at or near junction with the blade

22. Leaves broadly lanceolate to ovate-elliptic with acute or short-acuminate apex; capsules 4-10 (12) mm long, usually dehiscent after June 15; stamens usually 5 6
22. Leaves lanceolate to linear-lanceolate, attenuate at apex; capsules 3-6 mm long, usually dehiscent before mid-June; stamens 2-3
23. Leaves usually $\pm$ silky, at least beneath, at maturity, with 6-10 (13) teeth per cm on margin; capsules sessile or nearly so, 3-3.5 (4) mm long 17. S. alba
23. Leaves glabrous at maturity (silky when very young), with 4-6 teeth per cm on margin; capsules on short pedicels (ca. 0.7 mm long), 3.5-6 mm long 18. S. fragilis
21. Petioles without glands (or these occasionally obscure in no. 19)
24. Scales of aments yellowish, pilose at base and margins, glabrate on back, deciduous before ripening of capsules; flowers tending to be spaced in whorls, in rather slender, lax aments; capsules glabrous; stamens 2-7; native or introduced trees (when full-grown), with lanceolate, usually attenuate, leaves, these glabrous to somewhat silky at maturity
25. Leaves with vein islets coarse or obscure; stamens 2 (3); capsules 3-6 mm long, sessile or on very short pedicels 23
25. Leaves with a very fine network of veins, forming tiny islets (about 4 per ^{mm} ~~cm~~) clearly visible below; stamens 4-7; capsules 4.5-6 mm long, on pedicels (0.8) 1-2.5 mm long
26. Leaves, buds, and branchlets glabrous (or with scattered hairs on youngest unfolding leaves, a few rarely persistent on petioles above); petioles of mature leaves mostly 7-20 mm long 19. S. amygdaloides

26. Leaves retaining some pubescence, at least along midribs and petioles, above; young leaves & petioles and current year's branchlets thinly to rather densely pubescent; petioles of mature leaves about 3-6 mm long

. 20. S. caroliniana

24. Scales (except in otherwise distinctive nos. 1 & 21) brown to black (pale at base), frequently pilose throughout, persistent; flowers generally crowded into thickish aments; capsules glabrous or pubescent; stamens 2; native shrubs, with various leaves

27. Surface of leaves actually green beneath, covered with dense whitish pubescence

28. Margins of leaves closely serrate, the teeth tipped with enlarged glands; capsules glabrous; filaments glabrous or nearly so; young aments appearing with or slightly before the leaves;

scales dark-tipped, persistent 7. S. cordata

28. Margins of leaves rather remotely denticulate, the teeth often 3 mm or more apart, without enlarged glands; capsules often thinly silky; filaments ± densely pilose on basal half; aments developing after the leaves; scales yellowish, deciduous 1. S. interior

27. Surface of leaves whitened or glaucous beneath, glabrous or retaining pubescence. [NOTE: All six species below are included in the supplementary keys to flowering material (though only the last three normally have aments before the leaves); these keys may be helpful for use with specimens having young aments.]

[NOTE: If leaves are rather coarsely crenate-toothed and the specimen does not work well here, try couplet 18.]

29. Leaf blades ± rounded (occasionally acute) to cordate at base, often over 1.5 cm wide at maturity, glabrous or retaining a

little pubescence along the midrib; capsules glabrous;
stipules often present and conspicuous, especially on sprouts,
ovate to reniform; young unfolding leaves at tips of branchlets
usually reddish

30. Foliage with a definite "balsamic" (almost cosmetic or spicy)
odor, usually persistent even after long dried; mature leaves
completely glabrous; year-old branchlets red and shiny, smooth
and glabrous (the current year's branchlets glabrous to some-
what puberulent when very young); mature capsules on pedicels
2-4 mm long, subtended by rather uniformly light brown scales

. 21. S. pyrifolia

30. Foliage without balsamic odor; mature leaves often $\pm$ pubescent
on petioles and midribs; year-old branchlets usually puberulent
above the nodes if not more densely pubescent (current year's
branchlets frequently densely short-villous), not shiny and
seldom red; mature capsules on pedicels 1-3 (3.5) mm long,
subtended by dark brown to black scales pale at the base

31. Young unfolding leaf blades at tips of branchlets often
reddish, glabrous or usually with some copper-colored
hairs mixed with whitish; mature leaves thick, usually
very glaucous beneath; styles about 0.6-1.5 mm long; young staminate
aments flowering from apex to base . 22. S. glaucophylloides

31. Young unfolding leaves $\pm$ strongly red, but only with whitish
hairs (neither glabrous nor with coppery hairs); mature leaves
thinner, $\pm$ whitened to almost green beneath, not strongly
glaucous; styles about 0.5 mm long; young ^{/staminate}aments flowering
from base to apex 26. S. rigida

29. Leaf blades acute to (rarely) rounded at base, nearly always less than 1.5 (rarely to 2) cm wide at maturity, glabrous to silky; capsules at least thinly pubescent; stipules rarely present (at most tiny and narrow); young unfolding leaves not really red, though often with copper hairs and/or blackening in drying
32. Mature leaves glabrous or nearly so above (except for puberulent midrib), the under side $\pm$ silky, usually rather densely so, with the main lateral veins prominently rib-like; young leaves densely silky, without any coppery hairs, often blackening in drying; year-old branchlets puberulent (or sometimes glabrate), those of the current year usually densely so; capsules (2) 3.5-6.5 mm long, rather plump (ovoid) and rounded at tip

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- 23. S. sericea
32. Mature leaves $\pm$ pubescent above or essentially glabrous on both sides, the lateral veins not prominent below; young leaves nearly always with few to many copper-colored hairs mixed with whitish ones (or practically glabrous); year-old branchlets glabrous (sometimes slightly glaucous) to occasionally slightly puberulent; current year's branchlets puberulent to glabrate; capsules 4.5-8.5 mm long, $\pm$ lanceolate
33. Mature leaves $\pm$ glabrous on both sides, especially above; leaves sometimes tending to blacken in drying
- 24. S. petiolaris
33. Mature leaves retaining pubescence above; leaves not blackening in drying (or the youngest slightly so) . . .
- 25. S. subsericea

SUPPLEMENTARY KEYS TO FLOWERING MATERIAL IN WHICH AMENTS ARE WELL-DEVELOPED
BEFORE THE LEAVES

Do not try to use this key on specimens either with very immature aments or with foliage leaves developed, as the species may not be included or the measurements may differ from those given here. (Developing leafy bracts may, however, occur on the peduncles in several species keyed below.)

These keys are only guides to typical material; extremes of variation will cause difficulty. It is always best to collect leaves from the same plant later in the season. Be sure to measure the most mature examples of any part described, and several of them. Pedicels, in particular, may be shorter than the measurements given in the key if the flowers are not fully developed. Measurements of styles are of the undivided portion. Measurements are based primarily on dry specimens, and anthers, in particular, may be slightly larger when fresh. Although some unfortunate exceptions occur, these keys are offered for whatever help they may be.

PISTILLATE SPECIMENS

1. Ovaries completely glabrous

2. Year-old branchlets (but not necessarily new branchlets or peduncles) completely glabrous, reddish, shining; bracts on peduncle with conspicuous glandular margins; plants with a balsamic odor persisting in dry specimens; styles scarcely 0.5 mm long . 21. S. pyrifolia

2. Year-old branchlets ± densely puberulent or pubescent, at least in a small region above each node, scarcely ever both reddish and shining throughout (if smooth, the bracts not conspicuously glandular); flowers sweet-smelling, perhaps, but without persistent balsamic odor

3. Longest styles about 0.5 mm long; pedicels 1-1.5 (rarely 2.5) mm long, about equalling to slightly exceeding the body (not the hairs) of the subtending scales 6. S. rigida
3. Longest styles (0.5) 0.7-1.5 mm long; pedicels various
4. Pedicels very short, inconspicuous, scarcely 0.5 mm long (rarely to 1 mm), shorter than subtending scales
 7. S. cordata
4. Pedicels 1-3 mm long, about equalling or exceeding scales . . .
 22. S. glaucophylloides

1. Ovaries pubescent

5. Ovaries sessile or nearly so, even the most mature pedicels not exceeding 1 mm, shorter than subtending scales (except often in no. 12)

6. Styles obsolete or very short (to 0.4 mm)

7. Ovaries up to 3 mm long; leaves (leaf scars) often tending to be opposite; growth of current year not at all begun or essentially glabrous 9. S. purpurea
7. Ovaries up to 5.5 mm long; leaves always alternate; youngest branchlets and growth of current year (including bracts on peduncle) just beginning at flowering time, finely silky-pubescent
 23. S. sericea (and a few other immature specimens; cf. couplet 13)

6. Styles distinct, 0.5-1.5 (2) mm long

8. Pubescence of ovaries (and, usually, bud scales and young branchlets) definitely tomentose or woolly . . . 12. S. candida
8. Pubescence silky or velvety, of $\pm$ straight hairs
9. Branchlets puberulent; escape from cultivation reported in so. Mich. 11. S. viminalis
9. Branchlets glabrous, glaucous; native shrub of no. Mich.
 10. S. pellita

5. Ovaries on pedicels 1-5 mm long (except in very immature aments), in some plants exceeding the subtending scales

10. Styles 0.5-1 mm long 14. S. discolor

10. Styles obsolete to 0.5 mm long

11. Scales subtending pedicels straw-colored to pale brown, $\pm$ elongate, uniformly colored or pinkish at apex or slightly darker at base; stigmas often completely sessile; leafy bracts developing on peduncles; aments 1-6 cm long; year-old branchlets usually pubescent (at least finely puberulent), sometimes glabrous

. 13. S. bebbiana

11. Scales pale to dark brown or black, usually rather broadly elliptic or obovate and paler at base; stigmas usually on short styles; peduncles, aments, and branchlets various

12. Leafy green bracts usually developing on peduncles; aments 1-3 (3.5) cm long [NOTE: mature leaves generally necessary for accurate identification]

13. Year-old branchlets nearly always glabrous ^{/and shining,} frequently a little glaucous; ovaries usually 2.5-7 mm long, lanceolate (the sides straight to concave, $\pm$ tapered to apex) 24. S. petiolaris (and some specimens of S. subsericea)

13. Year-old branchlets generally finely puberulent, at least in patches (sometimes completely glabrous); ovaries various, tending [S. sericea] to be shorter (often under 3 mm), blunt, and ovoid (convex-sided) 23. S. sericea (and some specimens of S. subsericea)

12. Leafy bracts not developing on peduncles (at least not until foliage leaves are also present; rarely [hybrids?] earlier); aments 0.5-12 cm long

14. Year-old branchlets glabrous 14. S. discolor
14. Year-old branchlets pubescent; at least in patches above
the nodes
15. Aments 3-12 cm long; mature stigmas often elongate (up to
5-8 times as long as thick and 1 mm long)
. 14. S. discolor
15. Aments 0.5-2.5 (very rarely to 4) cm long; stigmas shorter
and relatively stouter 16. S. humilis

STAMINATE SPECIMENS

1. Filaments (and sometimes anthers) united, forming a single stamen pilose at
the base; leaves (leaf scars) often tending to be opposite
. 2. S. purpurea
1. Filaments 2, distinct (or rarely fused at base only), pilose or glabrous;
leaves alternate
2. Peduncles developing at most small brown bracts
3. Anthers 0.6-1.2 mm long, averaging 0.7-0.8 or more; year-old branchlets
often (not always) completely glabrous
4. Aments flowering from base to apex; rare escape from cultivation
. 15. S. caprea
4. Aments flowering from apex to base; common native shrub
. 14. S. discolor
3. Anthers 0.3-0.7 mm long, averaging at most 0.6 mm (usually about 0.4-
0.6); year-old branchlets densely pubescent throughout to puberulent
above the nodes only (or occasionally in yellow-anthered plants com-
pletely glabrous)

5. Anthers very dark, red-violet (or pale brown in age, but scales often strongly tinged with red-violet, placing such plants here)
6. Pubescence of branchlets largely or entirely flocculent-tomentose, white; pubescence of scales often $\pm$ wavy or curled
 12. S. candida
6. Pubescence gray or sordid, villous to puberulent; hairs of scales $\pm$ straight 16. S. humilis
5. Anthers predominantly yellow (rarely yellow-brown) 8
2. Peduncles developing small to conspicuous leafy green (sometimes densely silky) bracts
7. Anthers dark red-violet, 0.3-0.5 mm long; pubescence of branchlets, bracts, etc., mostly or entirely flocculent-tomentose, white
 12. S. candida
7. Anthers predominantly yellow (to yellow-brown), 0.1-1.1 mm long; pubescence of branchlets not flocculent-tomentose—usually rather gray or sordid, villous to puberulent, or absent
8. Anthers 0.6-1.1 mm long, averaging about 0.7 mm or more
9. Mature scales whitish to pale brown, of uniform color or slightly darker at base or pink-tipped; year-old branchlets pubescent to glabrate 13. S. bebbiana
9. Mature scales brown to black, usually paler at base (occasionally $\pm$ uniform medium brown or reddish); year-old branchlets pubescent or glabrous
10. Aments (when in full flower) ovoid, half or more as thick as long, flowering from base to apex; rare escape from cultivation 15. S. caprea
10. Aments more elongate (less than half as ~~long~~ ~~xx~~ thick/as long), in most (not all) species flowering from apex to base; native shrubs

11. Year-old branchlets completely glabrous 16
11. Year-old branchlets densely pubescent to finely puberulent,
at least in patches above the nodes
12. Bracts of peduncles densely silky-pubescent beneath,
the margins with prominent enlarged $\pm$ spherical glands
(sometimes hidden by the hairs); aments flowering from
apex to base 7. S. cordata
12. Bracts thinly silky or glabrous except at base, the
margins with glands absent or scarcely enlarged and appearing
merely as tips of low teeth; aments flowering variously
13. Filaments pilose toward base; bracts rather small and
inconspicuous 25. S. subsericea
13. Filaments glabrous; bracts small or, often, well-developed
and conspicuous
14. Scales with rather wavy or curled hairs; bracts of
peduncle not glandular-margined; aments flowering from
base to apex 6. S. rigida
14. Scales with $\pm$ straight hairs; bracts often with small
glandular-tipped teeth; aments flowering from apex to
base 22. S. glaucophylloides
8. Anthers 0.4-0.7 mm long, averaging at most 0.5-0.6
15. Year-old branchlets completely glabrous
16. Branchlets rather strongly glaucous . . 10. S. pallida
16. Branchlets not glaucous (or slightly so in no. 24)
17. Branchlets reddish and shiny; margins of bracts prominently
glandular-toothed; aments flowering from base to apex; plants
with persistent balsamic odor . . . 21. S. pyrifolia

17. Branchlets greenish, yellowish, or dark, but seldom red and shiny; margins of bracts not glandular, or if obscurely so the aments flowering from apex to base); flowers sweet-smelling at most, not with persistent balsamic odor
18. Anthers 0.6-1.0 mm long; aments flowering from apex to base 22. S. glaucophylloides
18. Anthers 0.4-0.7 mm long; aments flowering from base to apex or from middle toward both ends
 24. S. petiolaris (and some specimens of S. subsericea and S. sericea, which usually have puberulent branchlets)
15. Year-old branchlets densely pubescent throughout to puberulent at least in small patches above the nodes
19. Bracts densely silky-pubescent beneath, the margins with prominent enlarged ± spherical glands (sometimes hidden by the hairs); aments flowering from apex to base
 7. S. cordata
19. Bracts thinly silky or glabrous except at base, the margins without glands; aments flowering from base to apex or middle to both ends 23. S. sericea and 25. S. subsericea (also puberulent-branched specimens of S. petiolaris; in addition, small-anthered specimens of S. rigida will run here, as will S. viminalis, a rare escape from cultivation)

1. S. interior Rowlee. SANDBAR WILLOW. One of our most distinctive species in its remotely toothed leaves. The leaves are ± densely silky and tend to be broader in f. wheeleri (Rowlee) Rouleau; this form usually occurs on dunes and other sandy sites.

2. S. nigra Marsh. BLACK WILLOW. The very fine reticulation of veinlets visible on the under sides of the leaves indicates the affinity of this species with S. amygdaloides and S. caroliniana, which differ in having the leaves glaucous beneath and normally somewhat broader. The hybrid of S. nigra and S. amygdaloides, S. ×glatfelteri Schneid., is known from Michigan and should be expected wherever the two species are found.

3. S. pentandra L. BAY-LEAVED WILLOW; LAUREL W. Known as an escape from cultivation, apparently established in . . .
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 Cultivated elsewhere in the state. Sometimes difficult to distinguish from the next two species (see full descriptions in the key), but with leaves typically paler beneath than in S. lucida and not long-acuminate, but not so glaucous as in S. serissima. (The measurements given in the key for mature capsules are based on cultivated and escaped Michigan specimens, and are in accord with manuals; several European specimens examined have capsules as long as 8 mm and granular-roughened as in S. serissima.)

4. S. serissima (Bailey) Fern. AUTUMN WILLOW. Frequently distinguished from the next species by shorter aments. Although this is a helpful tendency, it is not a sufficiently consistent characteristic to use in the key. Mature pistillate aments of Michigan specimens of S. serissima range from 2 to 5 cm in length; those of S. lucida, from 1.5 to 5 cm. Staminate aments range from about 2.5 to 3.5 ⁱⁿ ~~cm~~ S. serissima and from 1.5 to 6 cm in S. lucida.

5. S. lucida Muhl. SHINING WILLOW. The young branchlets and under surfaces of mature leaves are pubescent in var. intonsa Fern. Plants with leaves narrower than usual have been described as var. angustifolia Anderss. See also comments under S. pentandra and S. serissima.

6. S. rigida Muhl. This willow, once widely known as S. cordata Muhl. (whence the name HEART-LEAVED WILLOW), is by some botanists, especially foresters, not considered distinct from the western S. eriocephala Michx.

Narrow-leaved extremes [var. angustata (Pursh) Fern.], with the blades $\pm$ acute at both ends, superficially resemble S. petiolaris, but may usually be distinguished by the large, conspicuous stipules, especially on sprouts, and absence of any copper-colored hairs in the pubescence of young leaves (which are generally red in this species but not in S. petiolaris).

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7. S. cordata Michx. SAND-DUNE WILLOW; FURRY W. Most Michigan plants have been segregated under the name S. syrticola Fern. (or were called in the past S. adenophylla Hook.), but the differences do not seem sufficiently consistent to warrant recognition of more than the single species. Normally rather densely silky, even on mature leaves, although occasional specimens occur with the foliage almost completely glabrous (var. abrassa Fern.).

S. myrtillifolia Anderss. This species, which ranges from Labrador to Alaska, has not been thought to occur as far south as the United States. A single specimen from the Au Sable dunes west of Grand Marais (Alger Co.) was determined as this species by Ball. Its leaves, however, have some hairs on both surfaces, the styles are 0.8-1 mm long, and the pedicels under 1 mm. Since S. myrtillifolia is supposed to have glabrous leaves, styles 0.5-0.8 (1) mm long, and pedicels 1-1.5 mm long, it seems best tentatively to consider this specimen as glabrate S. cordata.

8. S. pedicellaris Pursh. BOG WILLOW. A species very distinct in its complete lack of pubescence, strictly entire leaves, long-peduncled aments, and bog habitat. Plants reported from Michigan with the leaves green rather than glaucous beneath have doubtless lost the glaucousness in drying, though they occur farther east. Our plants, with the leaves glaucous beneath, are var. hypoglaucia Fern.

9. S. purpurea L. BASKET WILLOW; PURPLE-OSIER W. A European willow originally grown in this country for basket-making, locally established as an escape from cultivation. The leaves tend to be opposite or nearly so, except toward the tips of young branchlets. Herbarium specimens are sometimes confused with S. pedicellaris; in addition to the usual habitat distinction (S. purpurea would not be expected in bogs) and the position of the leaves, S. purpurea has a distinctive purplish color to the foliage, the leaf margins are obscurely toothed toward the apex, and the axillary buds are (3) 5-13 mm long on sprouts.

10. S. pellita Anderss. SATINY WILLOW. Known in Michigan only from a few locations in the Upper Peninsula [and near Alpena?], where it is reported as locally abundant. The leaves have a distinctive lustrous and velvety appearance beneath; the hairs ranging from rather straight and silky to somewhat tomentose. Staminate material of this species has never been collected, and no pistillate specimens have been made in Michigan.

11. S. viminalis L. COMMON OSIER. SILKY O. Another species originally introduced from Europe for basket-making. Known in Michigan as a possible escape from cultivation only near Lansing [. . .], and early reported from a few other places.

12. S. candida Fluegge. SAGE WILLOW. HOARY W. One of the more easily recognized species, distinctive in its narrow leaves and usually abundant tomentose pubescence. It hybridizes with many other species, the influence of this parent generally readily recognized by presence of the characteristic tomentum. Plants with the leaves glabrous or nearly so (sometimes glaucous rather than green on under surface) are known as f. demodata (Anderss.) Rouleau, and occur sparingly throughout the state. Dr. F. C. Gates collected specimens illustrating both this form and the typical form from the same plant in Cheboygan Co., the branches coming from portions of the shrub in flowing and quiet water, respectively. This suggests that the difference may in part, at least, be a result of ecological factors.

13. S. bebbiana Sarg. BEAKED WILLOW; BEBB'S W. One of our most common and variable species, evidently hybridizing with several others. The narrow pale scales of the aments and long pedicels (up to 6 mm at maturity) are helpful characteristics in identification, in conjunction with the complete absence of any copper-colored hairs (though these are sometimes a little brownish). The filaments are often pilose at the base, as in a number of other species.

14. S. discolor Muhl. PUSSY WILLOW. Another of our commonest but most variable species, often hybridizing. Plants with mature branchlets and foliage glabrous or nearly so (typical var. discolor) are fairly readily recognized. Pubescent plants (var. latifolia Anderss.) are almost equally abundant throughout the state; they sometimes closely resemble S. humilis (and might even be a result of hybridization with that species). Fortunately, the mature aments in var. latifolia tend to be even longer than in typical var. discolor, in contrast to the short aments of S. humilis. Sterile leafy material is more of a problem to identify, the differences in leaf shape being rather subtle. The leaves of S. discolor have

more of a tendency to be elliptic; those of S. humilis run more consistently to an oblanceolate or narrowly obovate shape. The normally dry upland habitat of S. humilis is a helpful contrast with the moist habitat of S. discolor.

S. discolor var. overi Ball, differing in its relatively short and very broad leaves, is known from Isle Royale, . . .

See also comments under the next two species.

15. S. caprea L. GOAT WILLOW. FLORISTS' W. This species has been collected as an established escape from cultivation in St. Clair (in 1905) and Keweenaw (in 1888) counties. A native of Europe, it has been introduced as the Pussy Willow of florists. It will run to S. discolor in the general and supplementary pistillate keys, although staminate flowering material is readily distinguished by the very large, thick aments which flower from the base to the apex. In the absence of the distinctive fat aments, mature foliage specimens may be identified by their very broad (sometimes almost suborbicular) leaves, densely tomentose beneath. (The St. Clair Co. specimen is pistillate; the Keweenaw one, staminate.)

16. S. humilis Marsh. UPLAND WILLOW. PRAIRIE W. See also remarks under S. discolor. In southern Michigan, plants smaller in every way (especially in the small, almost rotund aments) are var. microphylla (Anderss.) Fern.—recognized in some works as a distinct species, S. tristis Ait. Plants with very broadly obovate, densely pubescent leaves have been called var. keweenawensis Farw. and are found primarily in the Upper Peninsula. A narrow-leaved and glabrate extreme, var. rigidiuscula (Anderss.) Robins. & Fern., has occasionally been collected. It is rarely completely glabrous or with slight pubescence only on the base of the midrib and the petiole. In the key, such plants will probably run to S. discolor, from which they differ in their narrow shape and, usually, dense pubescence of at least the youngest branchlets.

17. S. alba L. WHITE WILLOW. A tree introduced from Europe and locally naturalized. It hybridizes with the next species [forming S. xrubens Schrank], the hybrid including most of what has been called var. vitellina (L.) Stokes, the GOLDEN WILLOW (from the conspicuous yellow first-year twigs). The hybrids are intermediate in the characteristics enumerated in the key, or show some of each species (e. g., combining the serration of one with the pubescence or capsules of the other).

17. S. fragilis L. CRACK WILLOW. BRITTLE W. The leaves or bracts on the short flowering branchlets (peduncles) of this species and the preceding are usually $\pm$ entire; and glands are generally conspicuous at the summit of the petioles of mature leaves, but usually not on younger ones. The branchlets of S. fragilis are very brittle (whence the name) at the base, breaking off in windstorms. Twigs broken in this way root at the edges of streams and rivers by which they have been dispersed—an excellent example of natural vegetative propagation.

S. babylonica L. WEEPING WILLOW. This familiar tree is widely planted but is not known to be established in the state. It would run to S. alba or S. fragilis in the key, but is distinctive, first of all, in the pendulous branchlets—which are the source of the name "Weeping Willow." It has very short capsules (about 2-3 mm long), short aments (2-4 cm long), leaves with the serrations often rather distant or obsolete, glabrous or retaining a little silky pubescence, petiolar glands obscure or absent on mature leaves. The scientific name, based on Psalm 137, is hardly appropriate. The "weeping" tree is a horticultural strain introduced from Europe of a species originally Chinese and not weeping. The "willow" of Babylon is thought to have been Populus euphratica Oliv., which is a native of that region.

19. S. amygdaloides Anderss. PEACH-LEAVED WILLOW. See comments under S. nigra. Specimens have been collected near Grand Rapids (many years ago) in which the same aments include staminate and pistillate flowers.

20. S. caroliniana Michx. WARD'S WILLOW. COASTAL PLAIN W. This is a species found on the Coastal Plain from Florida to Texas, north along rivers in the Potomac and Mississippi valleys to southern Indiana and southern Illinois. Its occurrence in southeastern Michigan (specimens determined by Ball in 1957, originally identified as S. interior and S. alba by the collectors), near Grand Rapids (Kent Co.) and Vicksburg (Kalamazoo Co.) is remarkable. Other coastal plain species in Michigan, in similar parts of the state, are small herbaceous plants. Our one fruiting specimen has the pedicels about 0.8-1 mm long (shorter than usual for this species).

21. S. pyrifolia Anderss. BALSAM WILLOW. The rather spicy balsamic fragrance of this plant, lasting as long as 75 years or more in herbarium specimens, is remarkable.

22. S. glaucophylloides Fern. BLUELEAF WILLOW. One may refer plants with small thick leaves (in part, at least, an ecological response) to var. brevifolia (Bebb) Ball ex E. G. Voss, those with densely pubescent twigs and the leaves retaining some pubescence to var. albovestita (Ball) Fern., and normal glabrous plants to var. glaucophylla (Bebb.) Schneid. In view of the lack of clear distinctions between these tendencies, however, it would seem preferable merely to recognize plants with the branchlets, especially of the current year, ± white-villous as f. lasioclada Fern. This is the usual form in the state, strictly glabrous plants being relatively rare. Sterile specimens with mature leaves are often difficult

to distinguish from S. rigida, especially until one is sufficiently familiar with both species to evaluate the comparative characteristics of thick leaf texture and more heavily glaucous surface of S. glaucophylloides.

23. S. sericea Marsh. SILKY WILLOW. Many published records for this species, especially from the northern part of the state, are based on specimens of S. subsericea (which see).

24. S. petiolaris Sm. SLENDER WILLOW. MEADOW W. See comments under S. rigida (var. angustata) and the next species.

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25. S. subsericea (Anderss.) Schneid. This plant is often considered to be a hybrid between S. sericea and S. petiolaris, and indeed it is intermediate in several characteristics, especially of the fruit. However, it is maintained here as a good species (following Ball) in view of the presence of pubescence on the upper surfaces of the leaves (which neither ~~parent~~ supposed parent has) and the failure of the leaves to blacken in drying (as they do regularly in S. sericea and often in S. petiolaris). Also, we do not find S. sericea north of Saginaw Bay in the state, while S. subsericea is rather common throughout. Ordinarily, it resembles S. petiolaris closely, of which it might justifiably be treated as var. subsericea Anderss., differing chiefly in the pubescence and in a tendency for the capsules to be shorter and plumper (approaching those of S. sericea).

UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN, U. S. A.

February 23, 1957

MICHIGAN FLORA PROJECT
MUSEUMS ANNEX

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

Dear Dr. Ball:

Having just heard from F. J. Hermann that you have recently determined some willows for him, I am emboldened to write again regarding Michigan Salix. Perhaps my previous correspondence has been lost before it reached you--or on what I can imagine must be a very busy desk; or maybe a reply never reached me. Or perhaps my proposition was more than you desired to undertake. I would appreciate hearing from you, however, so as to know how to proceed.

The University of Michigan has agreed to support for five years the preparation of a state flora, complete with keys and distribution maps. Naturally, I am desirous that the maps be based on as accurate determinations as possible, and am hoping in certain critical groups to enlist the aid of specialists in checking determinations (not in the labor of writing text!).

Many of the willows in the herbaria in Michigan have already been seen by you. I am wondering whether you would be willing to look at those which do not already bear your annotations? I have borrowed the material from all of the other herbaria in Michigan (except Michigan State, which would send their material separately) and it could all be sent to you in a single shipment, without your having to keep track of many individual origins.

Repairs on some of the mounted specimens in the University of Michigan Herbarium might take another week or two, but I would be prepared to send the lot at any time toward the end of March or later which would be convenient to you. I know you have said before that you are always happy to look at Salix, but as this is a somewhat larger task than the submission of casual collections from a season or two, I want to be sure in advance that you would not consider this an imposition.

I shall look forward to hearing from you!

Sincerely yours,

Edward G. Voss

Edward G. Voss

Dr. Edward G. Voss,
Museum Annex (Botany),
University of Michigan,
Ann Arbor, Michigan.

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

25 February, 1957.

Dear DR. Voss:

I owe you 1,006 apologies if, as seems certain, your previous letter (s?) regarding determination of *Salix* in Michigan herbariums have gone unanswered. Yours of 23 Febry. just received.

Without stopping to look for such letter now, I rush this reply to assure you that I will gladly do the job as promptly as possible after the material is received. You can wait and send all in one shipment or send now such collections as are ready.

I am still under appointed from the U.S. Dept. of Agriculture as Collaborator, which enables me to use the frank in writing and in returning shipments of material. When specimens are sent for determination, and to be retained by me for my own herbarium, I do not use the frank.

I have forgotten if there is a weight limit on franked cartons but will inquire at the Dept. shortly. If there is, I might have to split any large shipments received from you.

As to text for such a flora, it is certain that all species, of both native and introduced, which will be found in Michigan, are included in the last edition of the Illustrated Flora. It would seem rather easy to omit those not occurring in Mich. and condense the keys accordingly.

Please address me at my home address, instead of the Dept. of Agr. because I will get the letters and packets where I do my work, and thus save time and labor of transferral.

Cordially yours,

Carleton R. Ball

(over)

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN, U. S. A.

February 10, 1958

MICHIGAN FLORA PROJECT
MUSEUMS ANNEX

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

Dear Dr. Ball:

Here comes your student of Salix with a rather formidable "final exam" to present! Herewith is a draft of my treatment of the willows, and I shall be grateful for any comments you may wish to make. Feel free to annotate the carbon copy in any way—or keep it if you care to. The last section, in particular, listing the species with remarks, is very tentative. It will be polished up considerably with more precision on distribution, specific data on habitat, unusual or aberrant specimens, etc., after the data from the labels on specimens are transcribed to standard record forms. You will note that following the current Code of Nomenclature, and as treated in Gleason's Illustrated Flora, I use the binomial to include all varieties of a species; the nomenclaturally typical variety is designated by repetition of the specific epithet in varietal rank. For the purposes of the Michigan Flora, I am not going into much detail on the matter of varieties and forms.

It is the keys themselves which have taken much of my time since mid-October. I have gone very carefully over all of the specimens which you so kindly annotated during the summer, including those returned directly to Michigan State University in East Lansing, over 200 in the University Herbarium here which you had previously annotated, and many in the herbarium of Cranbrook Institute of Science which you had annotated a couple of years ago.

From the specimens as annotated by you I feel I have been able to get a good idea of each species concept, and it is on the basis of 95% of these specimens that the keys are based. The measurements, etc., are all based on these specimens, not on statements in literature. About 5% of the total number of specimens, however (a very small fraction!) I felt I would prefer to discuss with you further. Since the distance is great, I have compromised with a personal discussion on willows and prepared these specimens to be returned. They constitute bundles numbered I, II, III, and IV on the top of this carton. With each sheet is a small slip on which I have suggested my reasons for wondering why the specimen might not represent a different species. In some cases, especially in the sericea-subsericea-petiolaris complex, these involve annotations made by you about 1931, and quite possibly your ideas on these have changed since then. In other cases, it appears that in your annotation you brought the nomenclature of the original label up to date, but the specimen appears to have been misidentified originally. In still other cases, more than one species is apparently mounted on a sheet to which you have given one name. When a collector has not specifically indicated by numbers or statements that later collections are from the same plant as

flowering collections, I think we dare not assume this. In some sheets, it is pretty obvious that such collections represent more than one species, and you have thus annotated them; in those of this type returned herewith, I suspect the name applied to the more mature specimens—perhaps the juvenile material is impossible to name, but in these returned specimens I do question that it is the same as the mature leaves. And there are other cases, perhaps, in which by a thorough combing of the specimen with the microscope I have noted some character which might have been less evident as you annotated them. Well, regardless of the reasons involved—and in many cases it is doubtless a matter simply of judgment on a complex problem—these are specimens which I would greatly appreciate your re-checking in the light of the comments which I have placed on the slips accompanying them. Doubtless in many cases I am dead wrong, and I shall be grateful for your straightening me out.

If you look over my keys first, it might give you some idea of the characteristics which, rightly or wrongly, I have emphasized. You will note that I think I have noted a couple of characteristics not widely used which appear to be helpful. These are the almost invariable presence of copper hairs in the pubescence of younger leaves of S. discolor and S. humilis and their absence from S. bebbiana; similarly, their presence in S. glaucophylloides and absence in S. rigida. Except for some of the specimens returned herewith, this character holds beautifully in the material at hand. Another character, of which I am a little less certain and on which I would especially appreciate your judgment, involves the sequence of flowering in the aments (at least the staminate ones). I note that Fernald distinguished S. discolor and S. caprea on this basis, and it seems to hold here. Trying to apply this to other species, I note that S. cordata Michx. and S. glaucophylloides apparently flower from the ~~lx~~ apex toward the base, while S. rigida, sometimes confused with these, flowers from the base to the apex. I have probably over-emphasized this in the keys, since it is so difficult to determine unless aments of exactly the right age are present.

It is, I know, quite presumptuous of me to challenge any of your determinations, and I would feel happier about it if the opportunity permitted a discussion at closer range. These are the specimens which I cannot make fit your keys or mine based as they are on the vast majority of the specimens you have annotated, so that I shall be happy to learn in just what respects I have gone wrong. I would therefore appreciate your returning my little slips with the specimens, so that I can check what I thought I saw against your observations.

In the remainder of the carton, are specimens which you have not previously annotated and on which your opinion will be welcome. In all cases, I have made tentative determinations, usually on little slips stuck under a twig. Immediately under the 4 bundles for re-checking is one of 14 specimens from the University of Michigan Biological Station Herbarium; these were sent to you in my previous shipment, but were returned without annotations—perhaps the bundle did not get unpacked. It happens that I see no cause for disagreement with the latest annotation in each case. The next ~~xxx~~ bundle~~s~~ down contains~~xxxxxx~~ 20 sheets from the University of Michigan Herbarium which have been mounted since we sent the

previous material. Below this are two bundles containing a total of 47 sheets from other herbaria, not yet seen by you. At the bottom is a bundle of my collections of the past season. These are in two folders, one marked as unicates which I would appreciate having returned (unless, of course, you wish to retain all or part of any specimen for further study), and the other marked for you to retain.

The 100 specimens returned for re-checking include 32 from the University Herbarium. These are listed in the first two columns on the enclosed loan forms. In the third column are listed the 20 being sent for initial checking. The 100 for re-checking are arranged in something of a logical order, the most simple ones on top of bundle I, and the more complicated ones at the end of bundle IV. Material which I suspect is the same species or species-group is together in order. The specimens of several herbaria are in one sequence in these four bundles, and only those from the University Herbarium (for which the loan form is a requirement) are listed, in the order in which they appear in this sequence--though many specimens of other herbaria may be interposed.

Incidentally, you will note in my keys some cross-references back (or forward) to other couplets. For instance, on page 10, the first lead in couplet 22 directs one back to couplet 6. Specimens of S. serissima and glaucous ones of S. pentandra would run here. Similarly, farther down on the page specimens of S. alba and S. fragilis without petiolar glands (usually lacking in young material, as near as I can tell) will run to the first lead of couplet 25, and thence back to couplet 23. Also, some species, such as S. rigida, are keyed under two major divisions of the key.

Now a few miscellaneous questions--if you are still with me:

I note several specimens of yours, made in June 1941, on the "estate of L. A. Ball" 5½ mi. E and 1½ mi. N of Mancelona. On the Antrim Co. map I find a "Ball School" near this location. Have you relatives in this part of Michigan?

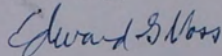
Both Fernald and, years ago, Schneider state that staminate material of S. pellita is unknown. I note that in Gleason you describe the filaments, and staminate aments are illustrated. I assume, therefore, that staminate material has been found.

In your letter of July 1 you commented on the occurrence of S. myrtillofolia in Michigan, as indicated by a specimen collected by Stanley Cain near Grand Marais. (I have trouble making this fit, and am returning it in the lot herewith; see also comment on p. 22 of my MS.) You mentioned also in this letter that "there was one other specimen looking like that, in your shipment or those from Mich. State University. I cannot recall final determination of it and am afraid that I carelessly repacked the bundle without completing the study. If you find an un-attested specimen with leaves pure green on both sides, just return it..." I have been carefully looking for such a specimen, and find none! There were no un-annotated specimens in the lot at Michigan State, and the only others lacking annotation are 14 from the Biological Station, re-

turned herewith. I would love to include this as another species in the state flora, but am not, frankly, convinced by the Cain specimen.

With this (I hope last) intrusion on your good nature, I shall hope to have gained sufficient experience with the willows to feel some degree of competence in handling our material myself from now on—except for the inevitable sticklers. I never expected to spend nearly four months working over the 2000-odd specimens at hand, but it has been an interesting and challenging task and I am happy to feel convinced that good species do exist in Salix and can be recognized! It was discouraging to find myself so often at odds with existing keys, which I either interpreted ambiguously, or found jumping from staminate to pistillate characters, or including measurements which just didn't fit our specimens as determined by you. The results are now in your hands, and I shall await with anticipation your patient attention to ~~my~~ amateurish efforts.

Sincerely,

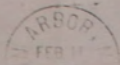


Edward G. Voss

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P. S.: The returned specimens may, of course, as before, be sent by express collect addressed to me, Michigan Flora Project, Museums Annex, U. of M., Ann Arbor. All are to be returned here (except the few unmounted ones for you to retain)—none are to be sent elsewhere this time.

EDWARD G. VOSS
120 MUSEUMS ANNEX
UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN



THIS SIDE OF CARD IS FOR ADDRESS

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

February 10, 1958

Dear Dr. Ball:

This card is simply to advise you that I am sending out by prepaid express tomorrow morning one carton containing willows for checking. Full details are in a four-page letter enclosed in the top of the carton, along with a 22-page manuscript on the genus *Salix* in Michigan.

Sincerely,

Edward G. Voss

Edward G. Voss