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*Note on Juncus alpinus, Vill.* By F. BUCHANAN WHITE,  
M.D., F.L.S., F.E.S.

(Read 9th February 1888.)

For some years past it has been suspected that *Juncus alpinus* was a member of the British Flora, on account of the existence of one or two herbarium specimens which probably (but *only* probably) belonged to that species. As one of these reputed examples came from Perthshire, the species had a special interest for me, and consequently I have been always keeping a lookout for it, and urging my friends to do the same. The search was all in vain, however, till one day in August last, when, wishing to see *Astragalus alpinus* growing in the Perthshire station where it was discovered by my friend Mr P. Neill Fraser, I came upon some rushes which, though immature, bore a suspicious resemblance to the long sought-for *Juncus alpinus*. Specimens of these I planted in the garden, where they ripened capsules, and proved my suspicions to be correct. (I may mention that I saw both the *Astragalus* and the *Oxytropis* in flower. The latter is *O. uralensis*, and not *O. campestris*,\* as suggested—from flowerless specimens—at a former meeting of the Society, but this has already been proved by Mr Brebner, who gave me specimens of each some years ago. It is very much to be hoped that the station for these rare plants will not become known to others than true botanists.)

\* *O. campestris* is not uncommon near Loch Loeh (7 or 8 miles distant from the *Astragalus alpinus* station), where it was discovered by Rev. J. Fergusson in 1887. In visiting its locality this season (1888) I found *Juncus alpinus* and *Kobresia caricina*.—F. B. W.

Shortly after finding these first specimens of *J. alpinus*, I got some rushes from my friend Mr J. Brebner, who was living in Glen Lochay, and with his usual kindness investigating the flora for me. Amongst these rushes were three stems of undoubted *J. alpinus*. Finally, on August 20, I found near Blair Athole a small bed of *J. alpinus* growing intermixed with *J. lamprocarpus*. Besides these three Perthshire stations, the plant was found—in September last—in a fourth locality, also near Blair Athole, by my friend the Rev. E. S. Marshall, whom I had told of the discovery. Mr Marshall, moreover, found the same species in Sutherlandshire, and it not improbably occurs, though perhaps locally, throughout the Scottish Highlands.

If thus, in one season, it has been found in comparatively so many places, how does it happen that *Juncus alpinus* has not been detected sooner? Probably because it requires a close examination to distinguish it from the nearly allied and very variable *J. lamprocarpus*.

This is pretty evident if, in the following record (from the *Report of the Botanical Record Club*, dated 1887, but just issued), the species is correctly determined: "87 Perth West. Croall. F. M. Webb. 'Moors near Gartur.' 'Near Ben Oss' (off Glen Falloch).—*Herb. Lees*; both sent as *lamprocarpus*, collected in 1875 and '79 respectively."

In the case of "critical" or obscure plants likely to occur in Britain, botanists would do well to familiarise themselves with the *facies* of the species to be looked for by the study of authentic foreign examples.

It is to be noted that this rush is not exclusively alpine, as the specific name would imply, but occurs also at low levels.

The specimens exhibited I have much pleasure in presenting to the Herbarium.

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*Poa palustris*, L., as a British Plant. By F. BUCHANAN  
WHITE, M.D., F.L.S.

(Read 14th November 1889.)

Though the occurrence of *Poa palustris* in Britain was recorded several years ago (*Botanical Exchange Club Report* for 1879), the finder, Mr G. Nicholson, of Kew Gardens, was of opinion that in the locality where it was found—the banks of the Thames at Kew and Mortlake—it was only naturalised. Mr Nicholson adds the opinion that “it does not seem improbable that it may occur in a wild state in Britain,” but does not give the reasons for supposing that it was naturalised only, and not native, on the banks of the Thames, nor does he indicate in what manner it may probably have been introduced.

In August last, my friend Mr William Barclay, who has set himself the task—a labour of love, however—of carefully exploring a portion of the banks of the Tay, found a grass which he could not at the moment identify. Within a day or two, however, we made it out to be *Poa palustris*, a determination which was confirmed by the eminent agrostologist, Professor Hackel.

On the banks of the Tay the grass is locally abundant, but so many aliens occur on these banks that the fact of its being abundant cannot in itself be accepted as a proof of the species being indigenous. On the other hand, the presence of the aliens in question is no proof that the *Poa* is also an alien, since many rare and local plants, whose nativity is undoubted, grow on the same parts of the banks of the Tay. The questions which presented themselves to us in discussing this point were these—“Supposing that the plant is an introduction, how could it have been introduced? and is there anything in its known distribution to militate against its nativity in Britain?” The aliens of the Tay banks are all species which have been in cultivation for their beauty or utility. *Poa palustris* is not, I believe, a fodder grass\* nor

\* In this, it seems, I am mistaken. Dr Aitken kindly tells me that it has been experimentally cultivated near Edinburgh, and promises to be a good fodder grass. I cannot find, however, that it has ever been cultivated in Perthshire. A careful search in the pasture fields in the neighbourhood of

would it be cultivated for its beauty. It is widely, but not universally, distributed in Europe—both north and south and east and west—and occurs also in North America. On the banks of the Tay it grows mixed with the local, but undoubtedly wild, *Carex aquatilis*. Looking, therefore, to all probabilities, we came to the conclusion that the species was indigenous.

Corroboration of this view was obtained soon afterwards by the discovery of another station. This was in a wild marsh near Crieff, sixteen miles distant, and with no possibility of transmission by water of seeds from one place to the other.

It seems not improbable that *Poa palustris* may be detected in other places. It is by no means unlike its allies, and might readily be passed over. Most of all it resembles *P. nemoralis*—with which it has been confounded—but the presence of a conspicuous ligule is a ready mark of distinction. It is more slender than either *P. pratensis* or *P. trivialis*, while the absence of stolons, as well as other characters, separates it from the former, and the almost nerveless spikelets from the latter.

Till somewhat recently the grass has been known as *Poa serotina*, Ehrh., the Linnean name *P. palustris* being supposed to be at least doubtful, if indeed it did not really belong—as Smith affirmed—to *Leersia oryzoides*. Nyman (*Conspectus*), however, catalogues the plant as *P. palustris* (L.), Rth., and says that it seems to be the same as the *palustris* of the *Systema*, 10th ed., and of *Species Plantarum*, 2nd ed.

the place where it grows in the marsh beside the Tay showed that it was not there, at any rate; and though it now occurs on the raised artificial bank of the river, its presence there is due to the fact that the bank had been mended with earth taken from the marsh. In cultivation in my garden the grass has become much more luxuriant. The wild specimens from near Crieff are much more slender than the Tay plant, and retain this characteristic under cultivation. This, I think, rather favours the view that *Poa palustris* is indigenous in Perthshire.—F. B. W.



*The History of Agropyrum (or Triticum) Donianum.*

By F. BUCHANAN WHITE, M.D., F.L.S.

(Read 12th December 1889.)

About the beginning of the century George Don found, on Ben Lawers, a grass of which he distributed specimens with (as regards a specimen now before me) this label—“*Triticum alpinum*. Nova species. Alpine wheat grass. Rocks on Ben Lawers.” Since Don’s time it seems not to have been gathered till Mr Cosmo Melvill rediscovered it on Ben Lawers in 1878, after which it remained undisturbed for ten years, when I found it again near the place where it had been collected by Mr Melvill.

In addition to, or perhaps on account of, its having escaped the observation of collectors, Don’s grass was almost generally ignored by botanical writers till Mr Mitten (*Hooker’s Journ. of Bot.*, vol. vii, p. 532) called attention to it as follows, referring it to *Triticum biflorum*, Brig.:—“The present is one of those plants gathered by the late Mr G. Don, which appears to have been overlooked by other botanists. His label in Mr Borrer’s herbarium runs thus: ‘*Triticum alpinum*. Nova spec. It differs from *caninum* by its short arista and upright spikes, and from *repens* by not running at the roots.’ No date is mentioned. It is thus clearly evident that he distinguished it as a new species. The only British species with which it can be confounded is *T. caninum*, from which it may be distinguished by its leaves, smooth on both sides, its usually two-flowered spikelets, and its want of the long awn; it also appears to be a more slender plant, with narrower leaves.”

In Hooker and Arnott’s *British Flora* (8th ed., 1860) it is given as var.  $\beta$  of *T. caninum*, with the synonym *T. biflorum*, Mitten (scarcely of Brignoli). In the *Student’s Flora* (1st ed., 1870) it is mentioned as *T. caninum*, var. *biflorum*, Mitten (*T. alpinum*, Don MSS.), and is said to be “only *T. repens*”—a statement qualified in the 3rd edition by the addition of “judging from the specimen.” Nyman (*Conspectus*) places it with a “?” under *T. violaceum*, Horn.

In the *Journal of Botany* (vol. xxv. p. 57, February 1887), Mr Cosmo Melvill writes on the subject under the heading "*Agropyrum (Triticum) violaceum*, Hornemann in Scotland." After mentioning that he had found a *Triticum* on Ben Lawers, he proceeds to say that when he came to examine the grass (some years after collecting it) he found it "to correspond exactly in every minutest particular with specimens of *Triticum violaceum*" from Norway and Lapland. He further adds that Mr A. Bennett had come to the same conclusion, with the addition that it was "identical with an original specimen of Don's *T. alpinum* in the Kew Herbarium." Mr Melvill also notices that "only a small piece of root was gathered with one of the specimens, but this, on a careful examination, would show that the plant was fibro-cæspitose, not creeping; and therefore, assuming this to be Don's original species, Sir J. D. Hooker's theory that *T. alpinum* is only a form of *repens* must fall to the ground. Indeed, it is nearer *caninum* than *repens*; but to my mind a true and very distinct species from any other: one of the chief characteristics by which it can in nearly every instance be told at a glance is the purple tinge of the spikelets, hence, doubtless, its trivial name."

Comparing one of Mr Melvill's specimens (which he kindly gave to me) with one of Don's (which Mr John Knox, of Forfar, had generously presented to the Perthshire Herbarium of the Perthshire Natural History Museum), I found that there was not the least doubt of their specific identity; and, moreover, that they were distinct from *A. repens*. Furthermore, I found that the plant which I gathered on Ben Lawers in 1888 was also the same. That the species was identical with *A. violaceum* seemed to me a little doubtful, but as I had no specimens of the latter with which to compare the Ben Lawers grass, I was content to accept Messrs Melvill and Bennett's determination. The plant I found on Ben Lawers grows on a rock ledge, where it forms a stout tuft. From it I took a small piece of the root, which has now made a good plant. In the course of its growth it developed a creeping stolon, and since N. J. Andersson describes (*Gramineæ Scandinaviæ*, p. 5) *T. violaceum* as altogether destitute of creeping stolons, I determined to compare for myself the Ben Lawers grass with *T. violaceum*. Andersson,

whose descriptions are always careful, describes the inner pales of *T. violaceum* as acute, and those of *T. repens* as bifid. The Ben Lawers grass had, I found when examining Don's and Melvill's examples, acute inner pales, but had, in addition, the ribs of the pale produced into short lateral awns lying on each side of the acute apex. Numerous examples of *T. repens* showed without exception inner pales constructed as described by Andersson, therefore it seemed probable that the character was a reliable one. A specimen of *T. violaceum* was then examined, and no trace of the lateral awns could be detected. Under these circumstances, and having occasion to mention the rediscovery of Don's grass, I provisionally named it (*Proceedings of the Perthshire Soc. of Nat. Science*, vol. i. p. xli.) *Agropyrum Donianum*. This name was adopted in preference to Don's manuscript name of *Triticum alpinum*, since that has been attended with much confusion, and because, moreover, it seemed desirable to associate Don's name with a flowering plant of the Scottish hills.

As, however, the species of the genus *Agropyrum* are so variable, it appeared advisable that the specialist on grasses, Professor Hackel, should be consulted. The opinion which he very kindly gave is briefly this:—If the characteristic of the lateral awns of the inner pales is constant, the specific separation of *A. Donianum* from *A. violaceum* would be justified; but if not constant, or at least not obvious (and from the specimens he has seen he is doubtful as to the constancy), it can serve only to separate *A. Donianum* as a variety.

This, then, is the history of *A. Donianum* up to the present time. It remains to be considered whether there are sufficient grounds for believing that the distinction of the lateral awns of the inner pale is to be relied on as a constant character.

In search of this character I have examined numerous pales in—(1) Don's plant; (2) Mr Melvill's specimen; and (3) many spikes from my cultivated Ben Lawers plant. In all of these I have never failed to find it. If, however, the pales are examined before the fruit has developed, the awns may easily be overlooked, since at that time they appear to be in a rudimentary condition only. As the fruit

matures the awns grow larger, till they become (as Professor Hackel remarks) "very obvious even for the naked eye." I am compelled, therefore, to think that this character is a constant one, and if constant, then *A. Donianum* is a good species.

Of the British species of *Agropyrum*, *A. Donianum* is most like *A. repens*. The leaves of *A. Donianum* are more rigid, and more scabrid on both surfaces; the spike (erect in both species) has comparatively shorter and broader glumes; the rachis is more strongly spinulose, not only on the edges, but on ribs within the edges; and the axes of the spikelets have longer internodes, which are hairy. The inner pale in *A. repens* is shortly bifid or emarginate at the apex.

From *A. violaceum* the chief distinction lies, as already mentioned, in the lateral awns of the inner pale, but there are other differences. The apex of the inner pale is more acute, and the spinulose pectination of the ribs is more dense, and not so long; the glumes and outer pale are proportionately longer and narrower; and the axis of the spikelet appears to be somewhat shorter and more longly spinulose. In colour the spike of *A. Donianum* is usually of a glaucous green, rarely slightly tinged here and there with violet, whilst *A. violaceum* derives its name from the violet colour of the spike. This colour character is probably, however, of comparatively little importance, since I have found both *A. repens* and *A. caninum* with violet-coloured spikes, and Swedish specimens of *A. caninum* with violet spikes have been distributed as *A. violaceum*. The spikelets of *A. Donianum* are three to four flowered.

Though *A. violaceum* is described as being altogether without stolons, this is, it seems, not quite the case, since Professor Hackel tells me that he has a specimen of the true *A. violaceum*, which shows short runners, but different from the long and scaly runners of *A. repens*. The stolon produced by my plant of *A. Donianum* is also short and scaleless.

As regards the specimen seen by Mr Mitten, and called by him *T. biflorum*, there is, judging from the description, some doubt, since our plant has not "leaves smooth on both sides," nor "usually two-flowered spikelets." *A. caninum* differs from *A. Donianum* by its often-nodding spike, softer

leaves, longer and flexuose awn of the outer pale, and structure of the inner pale, which is truncate or scarcely acute at the apex, into which the ribs converge and vanish.

Though *A. Donianum* has as yet been detected on Ben Lawers only, it probably occurs elsewhere, and possibly may have been confounded with forms of *A. violaceum* in Northern Europe. In *Alopecurus alpinus*, Sm., we have an example of a grass which was found first in Scotland, and afterwards in the Arctic regions and in Fuegia.

(1)

*Additional Notes on Willows in the University Herbarium.*

By F. BUCHANAN WHITE, M.D., F.L.S.

(Read 12th December 1889.)

In the notes on Willows in the University Herbarium, which I had the honour of submitting to the Society last session, I mentioned the existence of a specimen of *Salix Lapponum*, collected by Greville at Colinton near Edinburgh, which as it has ♀ catkins, dispelled the slight doubt, as to the species, suggested in the "Student's Flora." Since the notes in question were in type some additional specimens of willows have been found in the herbarium, and have been kindly submitted to me by Professor Bayley Balfour.

Amongst these are three more specimens of *Salix Lapponum* from the Edinburgh district, and three specimens of hybrids of that species. The collector's name is not mentioned, but the writing is, I think, that of the late Professor J. H. Balfour.

The examples of *S. Lapponum* include two from "near Craigerook, 1832," and one from "Dalkeith Woods, 19 May, 1838."

The hybrids are with *S. aurita* and with *S. cinerea*. Of the first there is a specimen with a ♀ catkin from Colinton, and another (which, though it has no flowers, is from the structure of the leaves scarcely doubtful) from Craigerook. The *S. cinerea* hybrid is labelled as from "Carlowrie, 1838."

We have thus proof that *Salix Lapponum* has been gathered in three localities near Edinburgh, namely, Colinton, Craigerook, and Dalkeith Woods, whilst the occurrence of a hybrid of it at Carlowrie suggests that it also grew there.

Considering that this species very rarely occurs as a wild plant below an altitude of 2000 feet above sea-level, I fear that there can be little doubt but that it is only an introduced plant in these localities. Whether it is still to be found the investigations of local botanists must decide.

But though the nativity of the species must be regarded with suspicion, there is no good reason why the hybrids should not be of spontaneous origin. *S. aurita* and *S. cinerea* are both common willows, and probably grow or grew

in all the localities. Indeed there are in the herbarium specimens of *S. aurita* from Colinton.

The hybrid *S. aurita-Lapponum*, Wimm. (*S. Læstadiana*, Hartm.  $\beta$  *opaca*, 2° *subaurita*, And.), has been found in both northern and central Europe. Its characters show a combination of those of its parents, but it much resembles the hybrid of *cinerea* with *Lapponum*, from which the rugosity, especially of the young leaves, best distinguishes it and indicates its affinity with *S. aurita*. Since its parents not unfrequently grow at no great distance from each other on many of the Highland hills, its occurrence in Scotland might be expected, but previous to these Edinburgh specimens I had seen one only which might possibly be it. This is a specimen of a willow—in Kew Herbarium—collected by Lightfoot, but without locality or date.

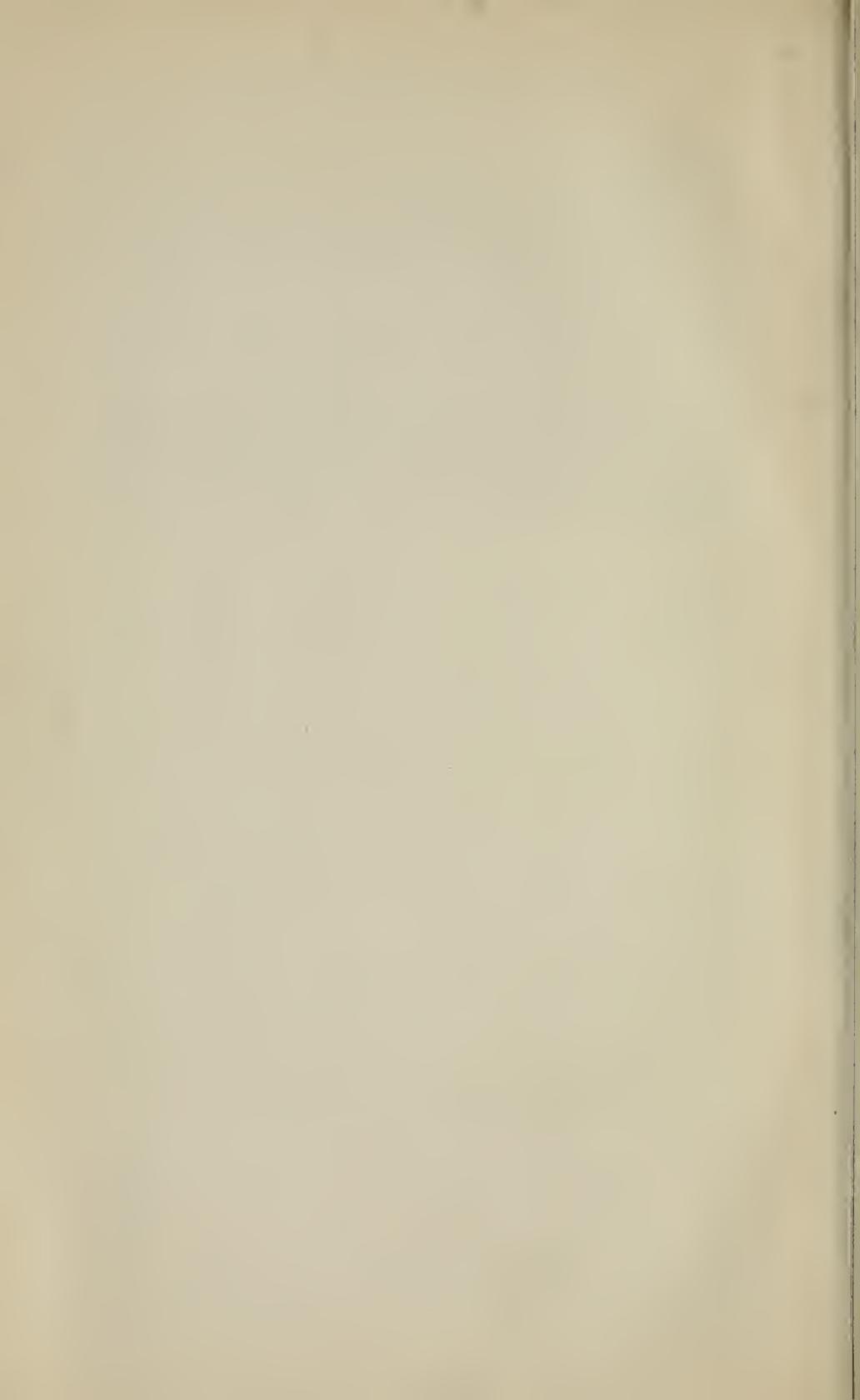
The hybrid with *S. cinerea*, *S. cinerea-limosa*, Læstad (*S. cinerea-Lapponum*, Wimm.; *S. Læstadiana*, Hartm.  $\beta$  *opaca*, 1° *subcinerea*, And.) is a much rarer form, and has been found in northern Europe only. The Carlowrie specimen, which I am inclined to refer to this, has numerous ♀ catkins, but the leaves are only quite young. It is very like *S. aurita-Lapponum*, but I think that from the densely black-pubescent twigs, the abundant rusty *cinerea*-like hairs on the under side of some of the leaves, and the absence of the rugosity of *S. aurita*, that the latter species has been replaced by *S. cinerea*. It is much to be wished that the plant could be rediscovered.

*S. latifolia*, Forbes.—Of this—which is a hybrid between *S. Caprea* and *S. nigricans*—there is a specimen labelled “S. W. corner of Duddingston Loch, a small tree 16 feet high,” but without date or collector’s name. This hybrid seems to be of rare occurrence. The majority of the few British specimens I have seen were collected in Perthshire.

*S. Sadleri*, Syme.—Having, during the past summer, found in Perthshire a hybrid between *S. lanata* and *S. reticulata* (or what seems almost certainly so), I have again made a study of *S. Sadleri*. *S. Sadleri* has been supposed to be a hybrid of *S. lanata* with *S. reticulata*, and for lack of a better explanation of its origin, I was content to temporarily accept it as such, though its affinity with *reticulata* is extremely obscure. I now think that it must be regarded as a variety of *S. lanata*, and not as a hybrid form. By a “variety” amongst willows I

mean forms which other botanists might perhaps call "sub-species."

*S. spuria*, Willd.—To this—which is *S. Lapponum* × *S. Arbuscula*—I referred in my previous notes a willow (on sheet 330) from Glen Dole, Clova, and mentioned that the Rev. E. F. Linton had found it in Clova more recently. I have lately seen a series of similar specimens collected in Clova by Rev. W. R. Linton, and now perceive that Mr Linton's specimens are hybrids of *Lapponum* with *herbacea* (= *S. sobrina*, B.W.) and not with *Arbuscula*. I suspect therefore that the specimen on sheet 330, which has leaves only, is the same. In the meantime, at any rate, it must be considered as doubtful.



A REVISION OF THE BRITISH WILLOWS.

By F. BUCHANAN WHITE, M.D., F.L.S.

[Read 6th June, 1889.]

(PLATES IX.—XI.)

I. INTRODUCTORY.

“HUNC locum sibi postulat Salicum familia, quæ si ulla in Botanicis obscura, hæc sane maxime,” wrote Linné in the ‘*Flora Lapponica*,’ and the unanimity with which all salicologists have echoed the sentiment is eminently suggestive. For the following attempt at a revision of the British *Salices* I would therefore bespeak a lenient criticism on the part of those interested in the subject.

Though the verdict, pronounced some years ago by one of the most eminent of our botanists\*, that the “definition and classification of Willows has long been a disgrace to systematic botany,” is still too true, it must not be forgotten that in the early post-Linnean days of botanical science much good work was done by British salicologists. “Full thirty years,” says Sir J. E. Smith, “have I laboured at this task” (of specific definition), “ten of them under the instructive auspices of my late friend Mr. Crowe, in whose garden every Willow that could be got was cultivated. . . . The plants were almost daily visited and watched by their possessor, whom no character or variation escaped; seedlings innumerable, springing up all over the ground, were never destroyed till their species were determined, and the immutability of each verified by our joint inspection. This was the more material, to set aside the gratuitous suppositions of the mixture of species, or the production of new or hybrid ones, of which, no more than of any change in established species, I have never met with an instance.” (*Eng. Fl.* iv. p. 164.)

In the work just cited 64 “species” of British Willows are described, a number which may be contrasted with the 30 of Babington’s ‘*Manual*’ (8th edition, 1881), and the 18 of Hooker’s ‘*Student’s Flora*’ (3rd edition, 1884); but since in the latter hybrid forms are not numbered, the comparison with the former is more just.

Smith’s species were not suppressed all at once. The salicologists who followed him were rightly so imbued with a consciousness of his great labours, that they were naturally averse

\* Professor Babington, in *Journ. Bot.* i. (1863) p. 167.

to differ from him without good reason, though some of them "could never satisfy" themselves as to the characters of some of the supposed species.

The accompanying Table (Plate IX.) will show, in a perspicuous manner, the very different views, as regards the number of British Willows which have been held at various times. The shaded columns show the quantity of numbered "species" at each period. The darkest portion indicates the number of true species included in each estimate; the medium the number of what are now (in this paper) recognized as hybrid forms; and the lightest the number of supposed species, but which are now considered to be forms only, or, if species, have no claim to be regarded as natives of Britain.

The periods are as follow:—

1762. Hudson, 'Flora Anglica.' 18 species (10 true, 1 hybrid).

Hudson's *S. reticulata* is a form of *S. herbacea*.

1804. Smith, 'Flora Britannica,' vol. iii. 45 species (16 true, 3 hybrids).

1828. Smith, 'English Flora,' 2nd ed., iv. 64 species (17 true, 6 hybrids).

1830. W. Withering, Jun., 'Arrangement,' 7th ed. 52 species (17 true, 6 hybrids).

1835. Lindley, 'Synopsis,' 2nd ed., and 1841, 3rd ed. 30 species (17 true, 5 hybrids).

1838. W. J. Hooker, 'British Flora,' 4th ed. 70 species (17 true, 18 hybrids).

1860. Hooker and Arnott, 'British Flora,' 8th ed. 38 species (17 true, 6 hybrids).

1873. Boswell, 'English Botany,' 3rd ed. 34 species (17 true, 10 hybrids).

1881. Babington, 'Manual,' 8th ed. 30 species (17 true, 7 hybrids).

1884. J. D. Hooker, 'Student's Flora,' 3rd ed. 18 species (16 true, 1 hybrid).—In this work supposed hybrids, though mentioned, are not numbered; and *S. cinerea* is treated as a subspecies.

1886. 'London Catalogue,' 8th ed. 31 species (17 true, 7 hybrids).

1890. As set forth in this paper, 58 forms (17 species, 41 hybrids).

From this statement it will be seen how great the range of opinion has been during the present century, the estimated number of "species" varying from 70 in 1838 to 18 in 1884!

But though since 1838 so many names have disappeared as the names of species, many of them are not only still retained in our lists as those of varieties, but have been added to; so that in the last edition of the 'London Catalogue' there are no less than 96 named willow-forms included under 31 species.

The object, therefore, of this Revision is in the first place to consider how many of these names deserve retention; and in the second to point out the occurrence in Britain of some hitherto unrecorded hybrids.

In endeavouring to carry out this intention it has happened that I have had occasionally to criticise the work—either the descriptions or the determinations of specimens—of some of the great salicologists; and I wish to state, though I daresay it is unnecessary, that such has been done in no carping spirit.

For the sake of brevity, I have not cited at length under each species the works chiefly consulted, but have referred to them simply by the names of the authors. The abbreviations thus used are as follow:—

Andersson. (N. J. Andersson, 'Monographia Salicum,' 1867.)—Of this great work, which, with Wimmer's 'Salices,' is of the utmost importance to the student of Willows, the first part only was published. The remaining species, as well as some rather later views of the author, are given in De Caudolle's 'Prodromus,' pt. xvi. section 2, 1868; and for all species after and inclusive of the *Viminales* the citation "Andersson" refers to the 'Prodromus.' Other works of the same author which have been consulted are the 'Salices Lapponiæ,' the genus *Salix* in Blytt's 'Norges Flora,' pt. ii. 1874; and the notes made on Leefe's 'Salicium Britannicum,' and communicated by H. C. Watson to the 'Botanical Gazette,' May 1851.

Babington. (Professor C. C. Babington, 'Manual of British Botany,' 8th ed., 1881.)

Boswell-Syme. (J. Boswell-Syme, 'English Botany,' 3rd ed., 1873.)

Forbes. (James Forbes, 'Salicium Woburnense,' 1829.)\*

\* For a large number of living specimens (from plants cultivated at Kew and probably originally derived from the Woburn collection), illustrating the species figured by Forbes, I am greatly indebted to Mr. George Nicholson.

J. D. Hooker. (Sir J. D. Hooker, 'Student's Flora,' 3rd ed., 1884.)

W. J. Hooker. (Sir W. J. Hooker, 'British Flora,' 4th ed., 1838. Borrer's opinion is frequently quoted in this work.)

Koch. (W. D. J. Koch, 'Synopsis Floræ Germanicæ,' 2nd ed., 1844.)

Smith. (Sir J. E. Smith, 'English Flora,' 2nd ed., 1828.)

Walker Arnott. (Hooker and Arnott's 'British Flora,' 8th ed., 1860, for which Dr. Walker Arnott was alone responsible.)

Wimmer. (F. Wimmer, 'Salices Europææ,' 1866.)

Any other works referred to (and many have been consulted) are cited at greater length.

In addition to consulting the descriptions, I have, when possible, compared our specimens with the examples published by several salicologists, and more especially by Wimmer. For an opportunity of doing so with great convenience, I am much indebted to the kindness of Mr. C. Bailey, who lent me his extensive collection of Willows, which includes, in addition to Wimmer's 'Collectio Salicum Europæarum,' many examples published by A. and J. Kerner, Reichenbach, &c.

Other specimens examined include Linné's own herbarium, belonging to the Linnean Society\*; Smith's, also in the possession of that Society; some specimens of Smith's attached, with notes, to the original drawings for 'English Botany,' preserved at the British Museum; the British Museum and Kew Herbariums; the British Willows of Edinburgh University Herbarium (kindly lent me by Professor Bailey Balfour); and several private herbariums, some of which contain, in addition to the specimens published by the Rev. J. E. Leefe, other examples received from that botanist. Mr. Leefe's specimens are valuable, not only as showing his own and Ward's opinion on many British Willows, but as illustrating the species of Smith and the views of Borrer.

Besides the specimens just mentioned, I have examined in a living condition several thousand examples, either collected by myself, or sent to me by friends and correspondents, to whose kind services I am much indebted, and whose names are mentioned under the species of which they have provided me with much-needed specimens, either living or dried.

\* For information regarding the labels of this collection I am greatly indebted to Mr. Daydon Jackson.

II. CLASSIFICATION.

Various arrangements of the Willows have been proposed; but perhaps the best is that of Andersson, though even that is not altogether satisfactory.

Andersson arranges the species in three tribes :—A. *Pleiandræ*, B. *Diandræ*, C. *Synandræ*.

The essential characteristics of the *Pleiandræ* lie in the pale unicolorous scales, which fall off before the fruit ripens; in the stamens being most usually not less than three in number; and in the nectary being commonly double.

The *Diandræ* are distinguished by having the scales, which are more or less darker-coloured in the upper part, persistent with the fruit; the stamens two in number and with free filaments; and the nectary very rarely double.

The *Synandræ* may be recognized by the filaments of the two stamens being more or less connate.

Now whilst these points are, in the main, characteristic of each tribe, they are not such decided distinctions as might be desired. In the *Pleiandræ*, for example, the stamens, though described as free, are not so in every species; since in some, as in *S. fragilis*, they are, or appear to be, connate at the very base when viewed from the back—from the front the adnate anterior nectary conceals the union; the nectary, though often double, is in one sex of some species single only; and the stamens in some species are almost constantly two in number. Moreover, the scales in some species of both the other tribes are unicolorous.

Andersson subdivides his three tribes into sections, and these again into groups. In the *Pleiandræ* there are two sections—the *Tropicæ*, with four groups, and the *Temperatæ* with three, namely, 5. *Amygdalinæ* or *Triandræ*, 6. *Lucidæ* or *Pentandræ*, and 7. *Fragiles* or *Albæ*. The *Diandræ* are divided into the *Microstylæ* (which includes 8. *Longifoliæ*, 9. *Cinerascentes* or *Caprææ*, 10. *Rosææ*, and 11. *Argentææ* or *Repentæ*); the *Podostylæ* (12. *Virescentes* or *Phylicifoliæ*, and 13. *Rigidæ*); and the *Macrostylæ* (14. *Pruinosæ*, 15. *Micantes* or *Viminalæ*, 16. *Nivææ*, and 17. *Nitidulæ*). The *Synandræ* have two groups only—18. *Incanæ*, and 19. *Purpureæ*.

Adopting Andersson's arrangement, but using in some cases his second name for the group as being more instructive, the British Willows may be classified as follows :—

## A. PLEIANDRÆ.

## 1. TRIANDRÆ.

1. *Salix triandra*, L.
- × *Salix decipiens*, Hoffm.
- × *Salix subdola*, B. White.
- × *Salix undulata*, Ehrh.

## 2. PENTANDRÆ.

2. *Salix pentandra*, L.
- × *Salix cuspidata*, Schultz.
- × *Salix hexandra*, Ehrh.

## 3. FRAGILES.

3. *Salix fragilis*, L.
- b. *britannica*, B. White.
4. *Salix alba*, L.
- b. *vitellina*, L.
- × *Salix viridis*, Fr.

## B. DIANDRÆ.

## 4. CAPRÆÆ.

5. *Salix cinerea*, L.
6. *Salix aurita*, L.
- × *Salix lutescens*, A. Kern.
7. *Salix Caprea*, L.
- × *Salix Reichardtii*, A. Kern.
- × *Salix capreola*, J. Kern.

## 5. REPENTES.

8. *Salix repens*, L.
- × *Salix ambigua*, Ehrh.
- × *Salix cinerea-repens*, Wimm.
- × *Salix Caprea-repens*, Lasch.
- × *Salix nigricans-repens*, Heidenr.

## 6. PHYLICIFOLIÆ.

9. *Salix phyllicifolia*, L.
- a. *S. phyllicifolia*, L., auct.
- b. *S. nigricans*, Sm.
- c. *S. phyllicifolia-nigricans*, Wimm.

- × *Salix laurina*, Sm.  
 × *Salix Wardiana* (Leefe, MS.), B. White.  
 × *Salix ludificans*, B. White.  
 × *Salix tephrocarpa*, Wimm.  
 × *Salix latifolia*, Forbes.  
 × *Salix strepida* (Schleich.), Forbes.  
 × *Salix coriacea* (Schleich.), Forbes.  
 10. *Salix Arbuscula*, L.  
 × *Salix Dicksoniana*, Sm.

## 7. VIMINALES.

11. *Salix viminalis*, L.  
 × *Salix Smithiana*, Willd.  
     a. *stipularis* (Sm.).  
     b. *sericans* (Tausch).  
     c. *velutina* (Schrad.).  
     d. *ferruginea* (G. And.).  
     e. *acuminata* (Sm.).

## 8. NIVEÆ.

12. *Salix lanata*, L.  
     b. *Sadleri* (Syme).  
 × *Salix superata*, B. White.  
 × *Salix Stephania*, B. White.  
 13. *Salix Lapponum*, L.  
     b. *helvetica* (Vill.).  
 × *Salix aurita-Lapponum*, Wimm.  
 × *Salix cinerea-limosa*, Læstad.  
 × *Salix spuria* (Schleich.), Willd.

## 9. NITIDULÆ.

14. *Salix Myrsinites*, L.  
 × *Salix Wahlenbergii*, And.  
 × *Salix saxetana*, B. White.  
 × *Salix sarta*, B. White.  
 15. *Salix herbacea*, L.  
 × *Salix Grahami* (Borr.), Baker.  
 × *Salix Moorei*, "Watson, L. C."  
 × *Salix simulatrix*, B. White.  
 × *Salix sobrina*, B. White.  
 × *Salix margarita*, B. White

16. *Salix reticulata*, L.  
 × *Salix semireticulata*, B. White.  
 × *Salix sibirica*, B. White.

### C. SYNANDRÆ.

#### 10. PURPUREÆ.

17. *Salix purpurea*, L.  
 × *Salix rubra*, Huds.  
 × *Salix sordida*, Kern.  
 × *Salix dichroa*, Döll.  
 × *Salix Doniana*, Sm.

It will be noticed that in this list one willow, generally included in British catalogues, has been omitted. This is *S. daphnoides*, Vill., which, though not unfrequently planted, can in no way be claimed as an indigenous plant.

It will also be noticed that in a very few cases only are varieties distinguished by name. "Varieties," "forms," and "modifications" of almost every species and hybrid have at one time or other been described; but since the forms so separated have, in the vast majority of cases, no constancy, but pass by imperceptible gradations the one into the other, their retention is a hindrance rather than a help. In the few instances where I have distinguished varieties, these have not all quite an equal rank; but their value will be indicated as each of them is specially discussed.

I may also state that I shall only occasionally allude to gynandrous forms, though in many cases names have been bestowed on them. A number of species have not very unfrequently a mixture of male and female flowers in the same catkin, whilst others have their floral organs quite monstrous. Such forms, though of considerable interest, ought not to be distinguished by name.

### III. HYBRIDIZATION.

In addition to the really great variability of the true species and consequent difficulty in attaining a satisfactory knowledge of them, the fact that Willows hybridize with the greatest facility adds immeasurably to the intricacies of the study. The earlier salicologists were mostly unwilling to recognize the pos-

sibility of hybridization, though such had been suggested; for Smith writes of "the gratuitous suppositions of the mixture of species, or the production of new or hybrid ones."

At a somewhat later period, however, the probability of the phenomenon was admitted; but it was left to Max Wichura\* to prove, by experiment, the truth of what had before been only—though on good grounds—suspected. Wichura found that not only did many binary hybrids occur naturally, but that ternary hybrids were also spontaneously produced. Binary hybrids are those produced by two species; ternary are those into whose composition three species have entered. In addition to this, he showed that by cross-fertilizing these hybrids, plants could be produced whose pedigree included no less than six species. (The accompanying diagram (Plate X.) shows graphically the pedigree of the compound hybrids.) Six species appeared to be the limit, as, from the imperfection of the pollen or of the seeds, the combination of species could not be carried further.

Theoretically, therefore, every species can form spontaneous hybrids with every other species; but practically hybrids are restricted by several causes. For hybrids to occur, not only must there be a certain degree of proximity of situation in the parents, but an identity in the period of flowering. Close proximity, though favourable for hybridization, is not absolutely necessary, since fertilization is accomplished by insect agency, and the attraction to insects of willow-flowers is very great. Identity of the usual time of flowering is an almost imperative necessity for the production of hybrids; but these also occur—though more rarely—between species which do not ordinarily flower at the same time, and must have been produced by some abnormality in the period of one of the parents. It must also be remembered that species, whose distribution is both lowland and alpine, have their time of flowering retarded in alpine situations, and are hence able to hybridize with the true mountain species.

A hybrid in its best condition is exactly intermediate in character between its two parents; but more frequently it shows a greater relationship with one rather than the other; and in those cases where it occurs in any abundance, a series of speci-

\* 'Die Bastardbefruchtung im Pflanzenreich erläutert an den Bastarden der Weiden,' 1865.

mens can usually be obtained exhibiting a more or less perfect gradation from one parent to the other. Some of these are probably due to the fact that they are really crosses of the hybrid with one of the parent species ; but this is not necessarily the case, since the influence of one parent may be stronger than that of the other ; and differences may also result from an alteration in the sex of the parents. Thus, if A and B represent two species, then  $A \sigma \times B \varphi$  may, it is supposed, produce a somewhat different-looking hybrid than  $A \varphi \times B \sigma$  does.

To recognize a hybrid, the student must, in many instances, have an intimate acquaintance with the characteristics of the true species, more especially in the case of closely allied ones. This is very essential, since the books usually describe the more distinct forms only, and frequently seem to ignore the insensible gradations which connect the hybrid with its parents: not that they really ignore them, but from the difficulty of expressing in words characters that the trained eye can more or less easily perceive.

The rank to be ascribed to hybrids and the system of nomenclature to be adopted are points on which it is desirable that more unanimity and uniformity should obtain amongst botanists. Taking Nyman's 'Conspectus' as a sample of a not uncommon method, it will be found that some hybrids (e. g. *S. rubra* and *S. Doniana*) are given full rank and numbered as species ; whilst others, of equal importance, have no such position. Some other authors merely indicate the occurrence of hybrids and do not describe them ; whilst among those who give hybrids a rank nearly or quite equal to species, some, as Andersson, place them in the groups to which they are most entitled to belong, but others, as Wimmer, keep all the hybrids together.

Then as regards the nomenclature, Andersson and many others adopt distinct names, which do not in any way indicate the real or supposed parentage ; but Wimmer, on the other hand, repudiates, as a rule, all such names, and uses for the hybrids a combination of the parental designations. In many respects there is much advantage in Wimmer's method ; but even he has not been able to employ it uniformly, and was obliged to use other names in certain cases where the parentage is doubtful ; and moreover in some instances the compound name that he has used is erroneous and misleading. Wimmer's plan also entails a breach of the law of priority. Under these circumstances, whilst

there is a decided advantage in employing a compound name—since it conveys distinct information—such can be used in those cases only where no earlier name exists, and *where there is no doubt about the parentage*.

*Regarding the Rank and Position of Hybrids.*—In the first place, they can scarcely be treated as mere varieties—much less ignored—if Willows are to be satisfactorily studied; on the other hand, neither can they be considered as equal to species. The title they should bear is that of “hybrid,” and their ordinal position should be near the species to which they are allied. As to whether they should or should not be numbered, that is a matter of convenience; but their names should always have the prefix  $\times$ , as indicating the hybrid origin.

Since, theoretically, every species of *Salix* can hybridize with every other species, the 18 British species (giving *S. nigricans* specific rank for this occasion) should produce about 144 binary hybrids. As a matter of fact, about 61 real or supposed hybrids of these 18 species are known; but somewhere about 20 of these have not yet been detected in Britain. The species with which each of the 18 hybridizes are as follow:—

*Triandra*, with *fragilis*, *alba*, *cinerea*, *aurita*, *Caprea*, and *viminalis*.

*Pentandra*, with *fragilis*, *alba*, *nigricans*, and *Arbuscula*.

*Fragilis*, with *triandra*, *pentandra*, and *alba*.

*Alba*, with *triandra*, *pentandra*, and *fragilis*.

*Cinerea*, with *triandra*, *aurita*, *Caprea*, *phylicifolia*, *nigricans*, *repens*, *viminalis*, *Lapponum*, and *purpurea*.

*Aurita*, with *triandra*, *cinerea*, *Caprea*, *phylicifolia*, *nigricans*, *repens*, *viminalis*, *Lapponum*, *Myrsinites*, *herbacea*, and *purpurea*.

*Caprea*, with *triandra*, *cinerea*, *aurita*, *phylicifolia*, *nigricans*, *repens*, *viminalis*, *Lapponum*, and *purpurea*.

*Repens*, with *cinerea*, *aurita*, *Caprea*, *phylicifolia*, *nigricans*, *viminalis*, *Lapponum*, and *purpurea*.

*Phylicifolia*, with *cinerea*, *aurita*, *Caprea*, *nigricans*, *Arbuscula*, *repens*, *viminalis*, *Myrsinites*, and *herbacea*.

*Nigricans*, with *pentandra*, *cinerea*, *aurita*, *Caprea*, *phylicifolia*, *repens*, *Lapponum*, *Myrsinites*, *herbacea*, *reticulata*, and *purpurea*.

*Arbuscula*, with *pentandra*, *phylicifolia*, *Lapponum*, *Myrsinites*, *herbacea*, *reticulata*, and *purpurea*.

*Viminalis*, with *triandra*, *cinerea*, *aurita*, *Caprea*, *repens*, *phyllicifolia*, and *purpurea*.

*Lanata*, with *herbacea* and *reticulata*.

*Lapponum*, with *cinerea*, *aurita*, *Caprea*, *nigricans*, *Arbuscula*, *repens*, *Myrsinites*, and *herbacea*.

*Myrsinites*, with *aurita*, *phyllicifolia*, *nigricans*, *Arbuscula*, *Lapponum*, and *herbacea*.

*Herbacea*, with *aurita*, *phyllicifolia*, *nigricans*, *Arbuscula*, *lanata*, *Lapponum*, *Myrsinites*, and *reticulata*.

*Reticulata*, with *nigricans*, *Arbuscula*, *lanata*, and *herbacea*.

*Purpurea*, with *cinerea*, *aurita*, *Caprea*, *nigricans*, *Arbuscula*, *repens*, and *viminalis*.

Whilst the foregoing list will serve to show the student what hybrids may be expected to occur, the accompanying diagram (Plate XI.) demonstrates the relation of both sections and species as regards hybridization. The larger circles indicate the sections, the smaller circles the species, and the lines connecting the latter show that these hybridize. As regards Britain, both the *Pleiandræ* and the *Syndandræ* are lowland (*i. e.* not ascending above 1000 feet) in their altitudinal distribution; but the *Diandræ* include both lowland and alpine species; and the groups thus formed are indicated by dividing the circle by dotted lines and numbering the segments. I. includes *S. viminalis* only, which is strictly lowland. II. forms a group of which the species, though most common in the lowlands, ascend into the region of III., the strictly alpine species, rarely, if ever, descending to 1000 feet. IV., including *S. Lapponum* and *S. Arbuscula*, ought not perhaps to be separated from III., since these are very rarely otherwise than alpine in their distribution.

Though nine or more ternary hybrids occur spontaneously in Europe, none have been detected with *absolute* certainty in Britain, perhaps from the great difficulty attending their recognition.

#### IV. COLLECTING.

Since Willows produce their flowers either before the leaves or when the leaves are only young, and since mature leaves are necessary for the proper determination of the species, leaf-specimens and flower-specimens cannot be obtained at the same time; hence, unless great care be taken, there is a real danger that the flowers of one bush and the leaves of another may be taken to represent one specimen.

In collecting, therefore, it is essential to guard against any intermixture of specimens. To do so, not only must the trees be marked, but the specimens taken from them be ticketed in such a manner as to prevent the possibility of mistakes. The method which experience has shown me to be a good one is as follows:— Provide a number of slips of paper 5 or 6 inches long by 4 inches wide, each with a long slit in it. On selecting a bush from which to take flower- or leaf-specimens, cut on the bark a number in Roman numerals\*, put the same number on one of the slips of paper, and add a description of the situation of the bush; then having taken the specimens required, pass their ends through the slit and transfer to the vasculum. On returning home, enter in the “locality note-book” the number and other particulars of the bush, and prefix in Arabic numerals the note-book or permanent number. Write the latter on small bits of paper and fix one to every specimen before it is put in the press to dry. In this way all risk of confusion of specimens will be avoided.

Whilst the note-book numbers must run continuously, the bush-numbers can, for the sake of convenience, be repeated when the localities from which the specimens are obtained are sufficiently distinct.

Before pressing the specimens it is desirable to enter in the note-book such particulars of the plant as can be better seen in the living than in the dried condition. The importance of these will vary according to the species or group. In the *Synandra*, for example, the extent of connation of the filaments and colour of the anthers (at different ages) are points to be noted in the living plant. The colours of the different parts, structure of the style, stigmas, and nectary, venation of the leaves (whether raised or impressed), surfaces (smooth or wrinkled), the margin (flat or incurved) are included in the characters which should be recorded in the note-book.

In drying, pressure sufficient, both in weight and continuance, to keep the leaves flat, without crushing the catkins too much, should be given. Some of the leaves, at various parts of the specimen, should be arranged so as to show the under surface. In selecting leaf-specimens side branches as well as terminal

\* Herr Hauptmann Schambach, of Northheim, Hanover, has kindly suggested another method of preserving the identity of the bushes. He uses narrow strips of lead (stamped with a number) which can be twisted round a branch.

shoots should be taken. The latter alone are not sufficient, as they often have leaves somewhat different from the normal condition; on the other hand, they are useful for illustrating the stipules. Leaf-specimens should not be taken till the leaves are mature (since the young leaves are deceptive), and, if possible, not earlier than the middle of August. Male catkins should exhibit both unopened and opened anthers. Female catkins should be neither too young nor too old, but be just about the age of fertilization. Specimens in young fruit are also useful.

In studying Willows "a practised eye is," as Mr. Leefe says, "more to be relied on than the characters found in books;" since, as Fries remarks, "*Characteres non specierum sunt criteria, sed ad species dignoscendas adminicula. Ex his modo species agnoscuntur, ex vegetationis cognoscuntur. . . . Hinc Linnæus in speciebus discernendis non characteres sed oculorum judicii que aciem laudat.*"

Whilst all parts of the plant are variable, some characters, on which a good deal of reliance has been placed, are so inconstant that they may, in many cases at least, be almost or quite ignored, though in other instances they are really of importance. Familiarity with the species can alone teach the student what are the points on which he can depend. In many species the presence or absence of stipules, and the shape of these organs, are of no great value for the discrimination of the plant; in others it is the very reverse. The presence or absence or the amount of pubescence is a character of similar value, as is the presence or absence of glaucosity.

#### V. DISTRIBUTION.

Though it is probable that the records of distribution in Britain of the true species are, on the whole, correct, the range of the hybrids has yet to be worked out; and for the sake of accuracy it is perhaps expedient that a new census of the distribution of all the British Willows should be taken.

Perthshire is as rich as—probably richer than—any other county. All the seventeen true species and thirty-one of the hybrids occur in it; and since the neighbouring county of Forfar is probably nearly as productive, and has several hybrids which have not yet been detected in Perthshire, Central Scotland appears to be the metropolis of Willows in Britain.

## VI. REVISION OF THE SPECIES.

## A. PLEIANDRÆ.

## Group I. TRIANDRÆ.

## 1. SALIX TRIANDRA, L.

Smith and his school of salicologists considered that the willow which is now known as *S. triandra*, included three, if not four, distinct species, viz. *S. triandra*, L., *S. amygdalina*, L., *S. Hoffmanniana*, Sm., and perhaps *S. contorta*, Crowe,—distinguished by the shape, size, and colour of the leaves, and nature of the shoots. Continental botanists, on the other hand, while not usually recognizing all these, separated from *S. triandra* several other forms. At the present day none of these forms are recognized as species, though most of them are retained as varieties, at least by the British school. Thus, in the last edition of the 'London Catalogue' four varieties of *S. triandra* are given, namely, a. *amygdalina* (L.), b. *Hoffmanniana* (Sm.), c. *Trevirani* (Spreng), and d. *contorta* (Crowe).

The majority of continental salicologists, as Koch, Grenier, and Andersson, make the more important varietal characters lie in the colour of the leaves, while Wimmer considers the shape to be of more value.

Andersson's leaf-varieties are  $\alpha$ . *discolor*, Koch (underside of leaves intensely glaucous), and  $\beta$ . *concolor*, Koch (paler but not glaucous). Of each of these there are the forms 1. *latifolia*, 2. *angustifolia*, and 3. *microphylla*. He also gives two catkin varieties,  $\gamma$ . *tenuijulis* and  $\delta$ . *crassijulis*.

Wimmer's varieties are  $\alpha$ . *vulgaris*,  $\beta$ . *angustifolia*, and  $\gamma$ . *Vilarsiana*, each with modifications according as the underside of the leaves is green or glaucous.

On the whole, Andersson's division into *discolor* and *concolor* seems to be the arrangement most worthy of retention; since an examination of any large series will show that the variations dependent upon shape, whether of the leaves or of the catkins, are all connected by intermediates and glide the one into the other. But the presence or absence of glaucosity is not a sufficiently stable character, either, upon which to found varieties; for, as Wimmer remarks, not only may glaucous and green leaves be found on the same plant, but even the same leaf may be partly green and partly glaucous below. It seems better, therefore, to place little importance on any of the so-called varieties—either British or continental—of *S. triandra*.

In Britain, judging from the specimens I have seen, *Salix triandra* exhibits fewer extreme forms of variation (though variable enough both in leaves and catkins) than it does in continental Europe. The 'London Catalogue' var. a. *amygdalina* seems to be equivalent to Andersson's  $\alpha$ . *discolor*, which he says is *S. amygdalina*, auctorum (*S. amygdalina*, L., if not altogether dubious, is only a synonym of *S. triandra*); b. *Hoffmanniana* is  $\beta$ . *concolor*, l. *latifolia* of Andersson; and c. *Trevirani* is a hybrid of *S. triandra* and *S. viminalis*, and will be considered hereafter. Specimens named by Leefe *S. contorta*, Crowe, do not altogether agree with Smith's description of that plant, which he says has leaves half the size of those of *S. triandra*. Leefe's *contorta* has long leaves, which in several ways suggest a cross of *triandra* with *fragilis*; but the catkins ( $\varnothing$ ) are in all essential particulars those of *triandra*, of which species it seems to be only a leaf-form.

Andersson is of opinion that his *discolor* is in Western Europe a more truly wild form than *concolor*, which is the more frequently cultivated one. In Britain *concolor* seems to be the commoner, and is more usually broad-leaved than narrow-leaved.

In Linné's herbarium there are not any specimens named *S. triandra*; but a plant labelled by Linné "hastata" (and by Smith "triandra?") appears to be *S. triandra*, with leaves glaucous below; and another example, labelled by Linné "Salix pentandra" (to which Smith has put a "?"), and with, in another hand, a stuck-down label with "Salix pentandra, Flor. Lap. 370. Foliis subtus cinereis. No. 8," seems also most probably *S. triandra*, with leaves narrowed at each end and glaucous below.

× SALIX DECIPIENS, Hoffm. (*S. triandra* × *S. fragilis*.)

In his 'Historia Salicum' (vol. ii. fasc. i. p. 9, t. 31, 1791), Hoffmann describes and figures a willow, which he named *S. decipiens*, from the resemblance of the leaves to those of *S. bigemmis* (= *S. daphnoides*), and which, he says, is one of several species that go by the name of *S. fragilis*. Smith, amplifying the description, adopted Hoffmann's species, and was followed for a considerable time by British botanists. The more recent British authors have, however, placed *S. decipiens* as a variety of *S. fragilis*, and have omitted more or less to notice important points of its characteristics.

The continental salicologists, on the other hand, very soon began to consider *S. decipiens* as either a synonym (*e. g.* Willdenow, as also Lindley amongst British botanists) or as a mere variety

(*e. g.* Koch) of *Salix fragilis*. Wimmer, while citing the name as a synonym, adds, in his notes, that the plant he has described is the same as Hoffmann has figured, and that, though no adult leaves are depicted, yet it is evidently a broad-leaved form, which he considers to be the type of the species (*i. e.* of *S. fragilis*).

Andersson dismisses *S. decipiens* as only a slight modification of *S. fragilis*, analogous to the var. *vitellina* of *S. alba*, and produced, like that, by the annual lopping of the tree. The short description he gives is similar to that given by Koch.

A careful study of the figures and descriptions will, I think, suggest that the plant attributed by Andersson &c. to *S. decipiens* is not Hoffmann's species, but a modification only of *S. fragilis*, produced, as Andersson says, by annual cutting-over, and distinguished by the bark of the twigs being testaceous in colour, and the lower leaves more or less obtuse. No allusion is made, it will be noticed, to the remarkable "polish" of the twigs, nor to the inflorescence.

In Britain, however, the plant described and figured by Smith as *S. decipiens* (and which is beyond doubt Hoffmann's species) has been continuously known under that name, though the more recent writers have, in reducing it to the rank of a variety, omitted to notice some of its essential peculiarities, and have in fact apparently not observed them.

As a matter of fact, Hoffmann's *decipiens* seems to be little known and scarcely understood by continental salicologists. Andersson saw in H. C. Watson's herbarium\* specimens published by Leefe†, and made no remark upon them, except that there were at Upsala two trees, planted by Linné, altogether like Leefe's plant, and that the form was very rare in Sweden. On this note Leefe and Ward make the following comment (*Journ. of Bot.* viii. p. 305): "certainly *decipiens*, E. B." Possibly the specimen (which, though in bad condition, seems to be quite the same as the British *decipiens*) in the British-Museum Herbarium, labelled "*Salix fragilis*, var. *decipiens*, Koch; Upsala; E. Fries (*Herb. Norm.*)," may be from one of these trees. Another specimen

\* I have a Willow from Surrey, labelled by Watson "*Salix undulata*, *vide* Andersson," which, though it is a leaf-specimen only, I have no doubt is *S. decipiens*.

† No. 50 of original fasciculus. Leefe says, "buds black in spring"; but his specimens have pale buds. He also says, "In specimens received from Professor Koch the scales of the ♀ are round and very hairy; the leaves of the ♂ are broader and less glaucous and reticulated beneath than in my specimens; those of the ♀ agree exactly." So apparently Koch knew the plant.

(♂), in Kew Herbarium, collected by Fries at Upsala, and labelled *Salix decipiens*, Koch, seems to be also the same as our *decipiens*, but with leaves more in the direction of *fragilis*.

As corroborating the belief that our *decipiens* is not known, under that name, to Continental botanists, it may be mentioned that specimens quite the same as it were collected at Königsberg, and published as *S. fragilis* var. *porcellanea* by Baenitz. These Königsberg examples again bear a resemblance so sufficiently close as to suggest identity of species with a willow gathered near Hanover by Beckmann, and named *S. fragilis* × *triandra*, f. *androgyna*\*.

From the study of a large number of specimens, living and dried, I have come to the conclusion that *S. decipiens* is a form distinct from *S. fragilis*, and suspect that it is a hybrid between *S. triandra* and *S. fragilis*.

Like all hybrid forms (and indeed all willows) its characters are more or less unstable; but usually it is so well marked that it is not difficult to recognize, though some leaf-specimens may be confounded with *S. fragilis* and others with *S. triandra*. In fact examples of what seems certainly to be *decipiens* were sometimes named *triandra* by the older botanists, as Forster, Borrer, &c.; and I have seen bushes and specimens which, so far as the leaves go, could not at first sight be readily distinguished from that species.

Comparing typical examples with *S. fragilis* (since it is with that species that it has been confounded), it will be found that, whereas *fragilis* attains the stature of a big tree, *decipiens* does not grow to more than a large bush or small tree—I refer, of course, to plants which have never been cut over. The bark of the trunk and older branches seems rougher and more broken than in *fragilis*, and, though not deciduous, as in *triandra*, appears inclined to split up. The branches are more upright in their direction than in *fragilis* (i. e. they form a more acute angle with the stem), and while somewhat brittle at their points of insertion, are less so than in *fragilis*. The year-old twigs are, as described by Smith, &c., highly polished, shining “like porcelain, as if varnished” (had Baenitz this description in view when he named his specimens var. *porcellanea*?), and most usually of a yellowish-white or clay-colour. The polish of the twigs has always been regarded as an important feature; and Smith tells Sowerby, in a note on the original sketch of his plate, to show the varnishing well, as it is the chief character. The shoots of the year are

\* Some other Continental examples are simply named *S. fragilis*.

often, but by no means invariably, of a fine crimson colour (frequently on the exposed side only), but not much, if at all, polished, and, sometimes at least, longitudinally furrowed.

The leaves are constantly smaller than those of *Salix fragilis*, and while in the same specimen a good deal of variety of form may be found, they are, as a rule, more oblong, more parallel-sided (*i. e.* of nearly equal width for a greater part of their length), usually less narrowed, and often indeed rounded at the base, and more abruptly and less longly acuminate at the apex. On the whole, the leaves are broader in proportion to their length than in *fragilis*. In colour and texture there is a distinct difference, but one more readily seen than described. The upper surface is less shining and of a duller green, and the underside is pale dull green, closely reticulated all over, from the veins, even the smallest, being dark green. The secondary veins (those springing from the midrib) in the larger and broader leaves seem to form with the midrib an angle more acute than in *triandra*, and less acute than in *fragilis*. The serration is also more irregular than in *fragilis*. In the ordinary form the leaves are always glabrous (except perhaps at the very first), nor are they glaucous below; but in the forms nearer *fragilis* there are exceptions to this.

Comparing the ♂ catkins with those of *fragilis*, they will be found to be quite unlike those of the common British form, inasmuch as they are denser-flowered and have the filaments much longer than the scales. They are much more like those of the European form, but are constantly smaller, and not so thick in proportion to their length. The catkins seem to be always fewer in number on a twig than in *fragilis*, and much fewer than in *triandra*; and, so far as my observations go, the flowers are most usually diandrous, but sometimes, though more rarely, triandrous. I am not sure that any important characters lie in the peduncular leaves, which are variable and usually entire.

The ♀ plant seems to be scarcer than the ♂; and, indeed, Boswell Syme says that the ♂ only is now known in Britain, which is not, however, the case. Hoffmann describes the ovary as attenuate from an ovate base, stalked, with the style scarcely distinct; and the capsule as oblong acuminate from an ovate base. Smith says the ovary is lanceolate on a shortish stalk, and tapering into a stout style one third its own length, and that the stigmas are half as long as the style. Smith does not figure the ovary; and from Hoffmann's figure there might be said to be either no style, or else one one-third the length of the ovary so

much is it a matter of opinion where the ovary ends and the style begins. In the specimens which I have seen I cannot say that the style is so long as one-third of the ovary, while it is not very markedly different in length from the stigmas, being sometimes a little longer and sometimes a little shorter than these. In typical specimens the ovary, which is smaller than in *Salix fragilis*, with shorter style and stigmas, is ovate, tapering, but rather blunt (*i. e.* as it ripens, contracted into the style), with a rather stout style (often bifid) and rather broad spreading or recurved cloven stigmas. The pedicel is about twice the length of the inner nectary, the outer nectary being very small and obscure. In both sexes the scales are variable, but are perhaps, on the whole, less hairy than in *fragilis*, and more hairy than in *triandra*.

Though for the above comparative description typical (*i. e.* intermediate) specimens have been selected, it must be kept in mind that many examples diverge either in the direction of *fragilis* or of *triandra*, the variation being chiefly noticeable in the leaves. Thus the leaves may be distinctly glaucous below, more distinctly and persistently silky when young, and more *fragilis*-like in shape; the bark, especially of the flowering twigs, may be darker in colour than usual; and the pedicel of the ovary may be three or four times as long as the nectary.

Compared with *S. triandra*, the more polished bark of the year-old twigs, the narrower more acute stipules (when these are present), the diandrous flowers, and the usually shorter pedicel and more distinct style will generally distinguish the plant; but, from the leaves alone, I would sometimes hesitate before affirming positively whether certain specimens belonged to *decipiens* or to *triandra*.

I have described the British *decipiens* at this great length because it has, almost unanimously, been referred to *S. fragilis*, and considered not, or scarcely, worthy of the rank even of a variety. That it might really be of hybrid origin seems not to have occurred to any botanist\*, though several supposed hybrids

\* Mr. M. S. Bebb, the American salicologist, remarks in a letter to me:—"I have always believed that it [*i. e.* *S. decipiens*] was a hybrid; but this was as far as I got! With the living plant of *triandra* I am not acquainted. It will not stand the hot sun of our midsummer months, and can barely be coaxed into a sickly bush, a few feet in height, crowded with dead twigs. *S. fragilis*, on the other hand, in all its forms, fairly luxuriates in our pseudo-Asiatic climate. Now *decipiens*, sent to me by my dear old friend the Rev. J. E. Leefe as the direct descendant of the plant of Smith, exhibited, as I now remember (though the fact had for me no significance at the time), a compromise, as it were, between the vigour of *fragilis* and the arrest of growth in midsummer so marked in the case of *triandra*."

between *Salix triandra* and *S. fragilis* have been described. Kerner, for example, distinguished three forms—*S. subtriandra*, *S. alopecuroides*, and *S. Kovatsii*; but of these I have seen authentic specimens of *S. alopecuroides* only, and the descriptions of none of them fit *S. decipiens* exactly. If, therefore, it is, as I suppose, a hybrid between *fragilis* and *triandra*, it would seem to be one additional to these, which, with yet another, named *pro tempore* by Andersson *S. gracilescens*, should all be united under the oldest name, viz. *S. decipiens*\*.

There is reason to believe that one of the other forms just mentioned—*S. alopecuroides*, Tausch—is also British. The Rev. E. F. Linton distributed some years ago, under the name of "*Salix undulata*: Summer-flowering," a triandrous willow found near St. Neots, Hunts. The specimens I have seen are certainly, in many ways, very like *S. undulata*; but at the same time they agree so well—making a little allowance for the abnormal flowering—with Wimmer's specimens (Coll. 19, Herb. 77) of *S. speciosa*, Host (*S. alopecuroides*, Tausch), that I have little hesitation in referring them to that species. It is desirable, however, that a larger series of normal specimens should be obtained. In the locality where Mr. Linton gathered his specimens there is no sign of willow-cultivation, though some species, chiefly *S. fragilis*, grow there.

In Britain *S. decipiens* is a widely-spread, but not very abundant, plant. Some botanists think that it is perhaps always planted; but Smith was of opinion that it was truly wild, though not unfrequently cultivated. In my experience it appears to be as wild as its allies *S. triandra* and *S. fragilis*, with which it often, but not invariably, grows. Bushes of it occur which have certainly never been planted, whatever their origin may have been.

Of British illustrations of *S. decipiens*, Eng. Bot. t. 1937, and Sal. Wob. xxix., represent the ♂ fairly well; but the foliaceous glands (usually absent) at the apex of the petiole seem rather exaggerated. Smith's plate was drawn from a specimen from "Mr. Crowe's garden, May 24, 1808." Another of the original drawings is marked "*Salix decipiens*, I think—J. E. S.;" but the plant looks to me like *fragilis* var. b, from the catkins, the adult leaves not being shown †.

\* Since this was written, I have received (through the kindness of Mr. Arthur Bennett) specimens of *S. fragilis-triandra* (Wimmer's name for *S. alopecuroides*, Tausch), cultivated in Sweden. Whilst the catkins (♂) of these are nearer *S. triandra*, the leaves &c. are quite those of *S. decipiens*.

† A botanist who does not know *decipiens* might, however, easily assume these plates to be illustrations of *S. fragilis*.

I have seen specimens of *Salix decipiens* from the following "Watsonian counties":—

3, South Devon (*Archer Briggs*); 6, Somerset (*Painter*); 12, Hants; 17, Surrey (*H. C. Watson*); 19, North Essex (*Leefe*); 23, Oxford (*Druce*); 32, Northampton (*Druce*); 36, Hereford (*A. Ley*); 38, Warwick (*T. Kirk*); 39, Stafford (*Fraser*); 64, M.W. York (*J. G. Baker*); 65, N.W. York (*Ward*); 80, Roxburgh (*Brotherston*); 81, Berwick (*Brotherston*); 85, Fife (*W. Martin*); 88, Mid Perth!; 89, East Perth!

× *SALIX SUBDOLA*, n. hybr. (*S. triandra* × *S. alba*.)

This is an equivalent of *S. decipiens*, with the *fragilis* element replaced by *alba*. In many ways it much resembles *S. decipiens*; and leaf-specimens might readily be passed over as a form of that hybrid.

I have as yet seen the ♀ plant only with catkins, but hope that some bushes may prove to be ♂.

The ♀ forms a rather low bush with upright branches. Bark of the older twigs pale grey-brown, rather dull, that of the shoots shining yellowish, but becoming more or less brown when dried; the very youngest shoots occasionally pubescent. Buds lanceolate, yellowish, with reddish tips when alive. Leaves narrow oblong-lanceolate, tapering at the base, obliquely acuminate at the apex; margin finely and rather closely glandular-serrate, the glands blackish in colour; upper surface shining pale green, with minute white dots, the veins very slightly impressed; under surface dull, pale green or more or less glaucous; chief veins slightly raised. Leaves mostly quite glabrous, but the very youngest silky, and the petioles of the older ones and occasionally the underside of the midrib and of the lamina towards the base sometimes pubescent. Catkins about 1 inch long, narrow, cylindrical, dense-flowered, erect or erect-spreading on leafy peduncles about half their own length; rachis thick, pubescent; scales pale greenish white, oblong spatulate, apex truncate-rounded, pubescent at the base, subglabrous on the back, inner side concave glabrous, long and densely ciliate on the margin; capsule small, ovate-conic, with a pedicel a little longer than, to twice as long as, the small thick yellow inner nectary (no outer nectary); style almost none, thick, subbifid; stigmas short, half bifid, recurved-spreading, segments broad, finally brown.

The facies of this hybrid is, as mentioned above, much like that of *S. decipiens*, from which the less shining and greyer bark of the older twigs, the more slender branches, the smaller, narrower, and more finely serrate leaves, the smaller catkins, and small

capsules with much shorter pedicels—all of which indicate a connection with *Salix alba* rather than with *S. fragilis*—serve to distinguish it. Its relation to *S. triandra* is closer than to the other parent; but the structure of the scales and capsules, as well as the pubescence of the leaves, when that is present, separate it from that species.

The name *S. triandra-alba*, which might have been applied to this hybrid—if its parentage was beyond doubt,—has already been used by Wimmer for the plant generally known as *S. undulata*. The latter hybrid is, however, now usually admitted to be a hybrid of *triandra* with *viminalis*, and not with *alba*\*.

I have as yet found *S. subdola* only on the west bank of the Tay below Perth.

× *SALIX UNDULATA*, Ehrh. (*S. triandra* × *S. viminalis*.)

Though for some time I believed that Wimmer, in thinking that *S. alba* and not *S. viminalis* was one of the parents of *S. undulata*, Ehrh. (= *S. lanceolata*, Sm.), was more correct than Andersson and the majority of salicologists, who hold the *viminalis* theory, I am now persuaded that Andersson's view is the right one. Wimmer, indeed, at one time considered *viminalis* to be a more probable parent than *alba*; but latterly he altered his opinion, though unfortunately he does not, in the 'Salices' at least, give his reasons for doing so.

But whilst Andersson treats *undulata* as a distinct hybrid between *triandra* and *viminalis*, he curiously gives an equally independent position to another hybrid (for which he uses Döll's name of *multiformis*) of the same two species, placing *undulata* in the *Triandrae*, and *multiformis* in the *Viminalis*. Döll more correctly brings all the *triandra-viminalis* hybrids under one name; and his example I follow, using, however, the oldest name, *undulata*, instead of the latest, *multiformis*.

The forms—which have all been described as distinct species—thus brought together are *S. undulata*, Ehrh., *S. lanceolata*, Sm., *S. Trevirani*, Spr., *S. hippophaifolia*, Thuill., and *S. mollissima*, Ehrh.

Though Andersson and others adopt the view that *S. undulata*, Ehrh., and *S. lanceolata*, Sm., are identical, there is really some doubt as to what Ehrhart's species truly is. Smith says that

\* Whilst the dwarf stature and general facies of the bushes incline me still to think that *S. triandra* and *S. alba* have both something to do with the parentage of this plant, more recently obtained leaves (from young shoots) strongly recall *S. fragilis*. It may be, therefore, possibly a form of *S. viridis*, though that seems to me improbable; or, perhaps, *S. decipiens* × *S. alba* (i. e. *S. fragilis* × *S. triandra* × *S. alba*).

though it is described as having a pubescent ovary, the original specimens seen by him have glabrous ovaries; and he suggests that the hairs of the scales have been mistaken for ovarian pubescence.

Wimmer thinks that under "*undulata*" several forms have been mixed up; whilst, to add to the confusion, Andersson himself, though citing under *Salix undulata*, *S. Trevirani*, Spreng. and the Sal. Wob. t. 13, repeats these citations under *S. multiformis*, to which—in the sense in which he uses that name—they really belong.

As generally understood, however, *undulata*, Ehrh., differs from *lanceolata*, Sm., only in having pubescent instead of glabrous ovaries, and is said to be extremely rare. From this extreme rarity and from the doubt as to whether the reputed pubescent form was really otherwise identical with *lanceolata*, Sm., I was inclined to consider the latter a hybrid, as Wimmer declares it to be, of *triandra* and *alba*, very similar indeed to the *triandra-viminalis* hybrids (*multiformis*, Döll, Anderss.), but distinguished from these by the more distinct and stronger serration of the leaves, which in veneration are revolute and not convolute. Against Wimmer's theory the only point that militated was the fact of the style of *lanceolata* being more distinct than in either *triandra* or *alba*.

My doubts on the subject have, however, been removed by the examination of a willow found in Miller's Dale, Derbyshire, by Messrs. Bailey and Painter. This has abnormal catkins, produced at the end of short branches in August. Whether the ovaries are similar to those of the spring flowers is yet uncertain\*; but they differ from those of ordinary *lanceolata* only in that some of them are more or less pubescent. On the same catkin occur ovaries almost or quite glabrous, some with a little pubescence towards the top only, and others more generally pubescent, and with the pedicel also pubescent. Whilst the occurrence of these pubescent ovaries, taken in conjunction with the structure of the style, seems to afford tolerably conclusive proof that *undulata* is a hybrid of *triandra* with *viminalis*, it must yet be kept in mind that, judging from what may be seen in other Salices, too much reliance should not be put on the absence or presence of pubescence.

Taking, now, the forms which Andersson combines under *multiformis*, Döll, and Wimmer under *S. triandra-viminalis*, Wimm.,

\* The Rev. W. Hunt Painter has, since this was written, kindly sent me spring flowering specimens from "this old and large tree." These have glabrous ovaries. It is desirable to see if the second flowering always shows pubescent capsules.

namely *a. Salix Trevirani*, Spreng., *b. S. hippophæifolia*, Thuill., and *c. S. mollissima*, Ehrh., it will be found that they differ from each other chiefly in the amount of pubescence of the various parts, and in the structure of the catkins and capsules, *a* and *b* being nearer *triandra*, and *c* nearer *viminalis*. (Here it may be remarked that Andersson's and Wimmer's descriptions are not in exact agreement in every particular, nor Wimmer's with his published specimens.)

Through the kindness of the Rev. Augustin Ley and Dr. Fraser, I have seen a series of a willow found by them in Herefordshire and Staffordshire respectively, distributed under the name of "*Salix hippophæifolia*, Thuill.," and doubtless the plant meant by the "*S. triandra c. Trevirani* (Spreng.)," of the 'London Catalogue.'\*

Whilst Dr. Fraser has found, near Wolverhampton, one ♂ bush only, Mr. Ley reports that the willow found by him is tolerably common on the lower course of the Wye in Herefordshire, where it is almost uniformly androgynous, though purely male plants do occur. The specimens of the latter which he has sent to me are practically identical with Dr. Fraser's examples, except that perhaps these are a little more pubescent. Comparing them with Wimmer's specimens, I think that, although they do not quite exactly agree, yet they belong rather to *a. Trevirani* than to *b. hippophæifolia*.

Mr. Ley's androgynous examples are much more difficult to place; for though, as regards the leaves, they are perhaps nearest *Trevirani*, in catkin structure they vary a good deal, some being near *Trevirani*, and others near *mollissima*, but none of them agreeing with *hippophæifolia* as defined by Wimmer. They seem, in fact, to connect *Trevirani* and *mollissima* without touching on *hippophæifolia*, and show that *triandra-viminalis* includes more forms than those described by Wimmer or by Andersson (under *multiformis*).

In addition to the specimens mentioned above, I have seen examples of a willow collected by Mr. A. Brotherston at Carham, in Northumberland, which fits *b. hippophæifolia*. Considering that both *S. triandra* and *S. viminalis* are common British species, it seems not impossible that hybrids between them may be of more common occurrence than is at present supposed,

\* It may be mentioned that both Andersson and Wimmer use "*hippophæifolia*," and some other botanists "*hippophæifolia*," to denote Thuillier's plant [Fl. Par. ed. ii. 514], and that the name *hippophæifolia* has been employed for both *a* and *b*.

though restricted by the difference in the period of flowering of the species. Leaf-specimens of the form *Trevirani* bear an evident resemblance to those of *Salix rubra*; but it is, as mentioned above, with those of the forms *undulata* and *lanceolata* that they are more likely to be confounded. Besides the difference in the serration of the leaves, as already stated, distinctions in the female inflorescence are also described; but these are not all to be relied on. The catkins are sometimes, but by no means always, smaller and slenderer, nor are the scales always darker-coloured. When the capsule is pubescent, that affords a ready mark of distinction from *lanceolata*; but Wimmer says that it is more usually glabrous though "*punctulato-scabra*;" the pedicel is shorter, and the style often longer and more slender. In the ♂ the stamens vary from 2 to 3.

The form *b. hippophæefolia* has much similarity to *a. Trevirani*; but makes a smaller bush, with smaller and narrower leaves, smaller and more slender catkins, and smaller pubescent capsules. The leaves of *Trevirani* are described by Wimmer as glabrous, and those of *hippophæefolia* as pubescent when young; but in his examples of *Trevirani* the young leaves, at least, show pubescence.

The form *c. mollissima* is, in its typical condition, a very different-looking plant from either *a* or *b*, and might readily be passed over as a form of *S. Smithiana* (with which, indeed, Smith at first confounded it), from the resemblance of the leaves to some states of that plant, and from the aspect of the catkins. It is, I suppose, on account of this form that Andersson has placed "*multiformis*" amongst the *Vinimales*, and not amongst the *Triandrae*. From its Continental distribution the form *mollissima* might be expected to occur in Britain, but it has apparently not yet been detected.

Though I have, in a measure, indicated the distinctions between the various recognized forms of the *triandra-viminalis* hybrid, I do not think that in it, more than in other hybrids, should varietal names be retained. Whilst the named forms, as described, seem to have a certain amount of stability, many specimens (including even those published by Wimmer himself) cannot well be placed in any of them, and though there has not yet been found such a complete series—connecting the two parents—as other hybrids afford, this is probably only on account of the rarity of the plant. Of all the forms, *lanceolata* is both the commonest and the least liable to variation; but it is doubtful whether it occurs anywhere in a

truly wild condition, especially since the ♀ only is known. Of it I have seen specimens from the following counties, in addition to those recorded in 'Top. Bot.' ed. 2:—

57, Derby (*C. Bailey*); 77, Lanark (*R. McKay*); 88, Mid Perth !; 89, East Perth !; 92, South Aberdeen (*Trail*).

## Group 2. PENTANDRÆ.

### 2. SALIX PENTANDRA, L.

Of *S. pentandra*, Andersson distinguishes three leaf-forms:—*latifolia*, with leaves whose length is two or three times the breadth; *angustifolia*, with leaves three to five times as long as broad and narrower at the base; and *microphylla*, with thin leaves scarcely more than one inch long. He remarks that *latifolia* is more usually shrubby, and *angustifolia* generally arborescent, and thinks that as the latter is the prevalent North-Lapland form, it indicates that the home of the species is in the north (*Sal. Lap.* p. 15).

Walker-Arnott's experience (and also mine) is that, in a wild state in Britain, *S. pentandra* is a bushy shrub; but that when cultivated it becomes a tree, with broader and larger leaves than those of the wild plant, in specimens of which from the same marsh they vary much in size and shape.

Besides the leaf-forms there is also considerable variation in the size of the catkins; but in neither case are these characters of sufficient importance to deserve varietal rank.

In Britain both the modifications *latifolia* and *angustifolia* occur, though many specimens cannot well be referred to one more than the other; but comparing British examples with Continental—of both of which I have seen a rather large series—it would seem that in Britain there is a greater tendency for the plant to be broader-leaved than in Continental Europe. Indeed, many specimens from the latter would scarcely, so far as the leaves go, be recognized, at the first glance, as *pentandra* by a British botanist.

In the Linnean Herbarium there are two sheets devoted to *S. pentandra*. On one, labelled by Linné "3. *pentandra*," the ♂ example is, without doubt, *pentandra*; but the ♀ seems a little doubtful. The other sheet bears, in Linné's writing, "*Salix pentandra*," to which Smith has put a "?," and has also a label, in a now unknown hand, "*Salix pentandra*, Flor. Lap. 370. Foliis subtus cinereis." The specimen is ♀, and seems more like *S. triandra* than anything else.

Lastly, it must be noted that Andersson describes the rachis of

the catkin of *Salix pentandra* as glabrous; whereas other authors more correctly allude to it as hairy. It is, of course, possible that Andersson has met with specimens such as he describes.

× *SALIX CUSPIDATA*, *Schultz.* (*S. pentandra* × *S. fragilis*.)

In Britain this hybrid has been either overlooked or is very rare, being confined to Shropshire.

So far as the leaves go, *S. cuspidata*, says Wimmer, can scarcely be distinguished from *S. pentandra*; and this is very evident in many Continental examples, in which, from the leaves alone, it would be impossible to say to what plant they should be referred.

The most important distinction between *S. cuspidata* and *S. pentandra* lies in the ♀ catkins. In the former these are more slender and more tapering, and bear narrower and more cylindrical capsules with longer pedicels. A majority of authors describe the pedicels as three or four times the length of the nectary (as compared with *S. pentandra*, in which it is at most nearly twice the length of the nectary); but Wimmer says of the pedicel of *cuspidata* "brevissimis," and of *pentandra* "brevis;" and his specimens show a shorter pedicel in the former than in the latter. I am therefore inclined to think that *S. cuspidata*, just like other hybrids, shows an instability even in what are generally supposed to be important and constant characters, and that too much dependence must not be placed on any one point.

Apart from the female flowers, distinctions (all variable) may be found in the leaves (more acuminate, thinner, paler-veined, and sometimes glaucous below, in *cuspidata*); in the male flowers (fewer-stamened and laxer); in the scales (more hairy); in the size of the tree (bigger); and in the time of flowering (earlier than *pentandra* and later than *fragilis*). The form of the stipules is sometimes said to afford an important character; but it is very doubtful if this is the case.

Through the kindness of Mr. W. Phillips, F.L.S., I have been able to examine living specimens of the Shropshire plant. Like the British *S. pentandra*, they have broader leaves than many of the Continental examples.

Though some recent British botanists think that *S. cuspidata* is doubtfully native in its English localities, *S. pentandra* is admitted to be native as far south as Worcestershire; and as both it and *S. fragilis* occur in Shropshire, there seems to be no valid reason, on that ground, why *S. cuspidata* should not be wild there.

In answer to my inquiries, Mr. Phillips has given me the fol-

lowing information about *Salix pentandra* and *S. cuspidata* in Shropshire. *S. pentandra* seems to be native, making usually a shrub from about 7–10 feet high, but occasionally a tree of about 20 feet. *S. cuspidata* (which also appears to be native) attains in its best form a height of 25 feet or more; but another form (more *pentandra*-like) is only a shrub-like bush. Of the latter I have seen only one plant (which belongs beyond doubt to *S. cuspidata*); but bushes reported to be similar in appearance grow at comparatively short intervals for twelve miles or more along the Rea Brook. Whether these are all *cuspidata* or whether, as is probable, some, or most of them, are *pentandra*, requires investigation.

Of the Shropshire plant I have seen the ♀ only; and apparently the ♂ has not yet been detected there.

× *SALIX HEXANDRA*, Ehrh. (*S. pentandra* × *S. alba*.)

To this rare hybrid I am inclined to refer the following specimens:—

1. A plant, in the Edinburgh University Herbarium, collected near Duddingston (Edinburgh) by J. Knapp in 1836, and referred at one time to *S. alba*, and at another to *S. fragilis*. This seems most probably a hybrid between *pentandra* and *alba*, both of which grow at Duddingston.

The leaves are too young, but, on the whole, are similar to those of authentic specimens of *S. hexandra*. They are at first clothed with silky pubescence, but become quite glabrous. In some cases the apex of the petiole is glandular, but not so glandular as in Wimmer's specimens. The catkins (♀), with long leafy peduncles, much resemble those of *S. pentandra*. The capsule is more slender than in that species; and the pedicel is longer than it is, as described, in *S. hexandra*; but in a hybrid the length would be subject to variation. The style, almost obsolete, and the short spreading-erect stigmas are like those of *S. pentandra*.

2. A bush found by me at Restenet, near Forfar, growing with *S. pentandra* and *S. alba*. Of this I have not yet seen flowers; but unless to *S. hexandra*, I do not know where to refer it.

Attention may here be called to another probable hybrid of *S. pentandra* which I have found near Restenet, where that species abounds. Of this supposed hybrid I have seen leaves only. It has somewhat the aspect of *S. decipiens*; but since *S. triandra* does not, so far as I know, occur in that neighbourhood, it has probably no connection with the latter species. The other parent may possibly be *S. phyllicifolia*.

## Group 3. FRAGILES.

So much confusion exists in the synonymy of *Salix fragilis* and its nearest ally, that before entering into a discussion of their forms, it will be first of all necessary to attempt to define clearly some of the essential characters of the three British plants of this group, and then to see what names they should bear. Two of these are usually admitted to be true species, and these I shall term in the mean time A and B. The third is an undoubted hybrid between them, and may be designated A × B.

A has the capsule elongate-attenuate from an ovate base, gradually produced into the style, and hence acute, distinctly pedicellate, with the pedicel 2-3 times as long as the nectary. Leaves more or less obliquely acuminate, and, though often at the very first somewhat silky, eventually quite glabrous, and shining above.

B has a smaller capsule, ovate-conic in shape, more or less obtuse at the apex, and not tapering into the very short style, scarcely pedicellate, with the pedicels at the very utmost not exceeding the nectary. Leaves usually narrower and smaller, straightly acuminate, more or less silky, rarely eventually subglabrous, and slightly shining above.

A × B, in its most intermediate condition, has a capsule larger than B, but smaller than A, conical in shape, more or less obtuse, very shortly styled, and pedicellate, with the pedicel about as long as the nectary. Leaves more or less straightly acuminate, at first somewhat silky, but eventually quite glabrous and shining above, more distinctly serrated than B, but less coarsely than A. But while this is what may be termed the typical state, innumerable forms, ranging from A to B and showing various combinations of their characteristics, occur. Some of these are with difficulty distinguished from A or from B, as the case may be.

Regarding the name that B should bear, there is no doubt, since all authors are agreed in considering it to be *S. alba*, L.; but with respect to A and A × B there is much difficulty. Delaying for a moment a consideration of Linné's description, an examination of other descriptions, figures, and authentic specimens will show that the views of salicologists regarding the names to be assigned to these two species have been widely different. The opinions of the more important writers are as follows. (The words of the author indicating which form he had in view are given within brackets and inverted commas.)

A has been called :—

*Russelliana*, Sm., by J. E. Smith in his *Fl. Brit.* 1045; *E. B.* t. 1808; and *Eng. Fl.* iv. 186. (*Engl. Fl.*, “germen tapering stalked.”)

*Russelliana*, Sm., by Willdenow, *Sp. Pl.* iv. 656, n. 7 (“germinibus pedicellatis subulatis”).

*Russelliana*, Sm., by W. J. Hooker in *Fl. Scot.* 279 (1821) (“germens pedicellate oblongo-subulate”), and in *Brit. Fl.* 4th ed., 358, n. 14 (“germens stalked lanceolato-acuminate”).

*Russelliana*, Sm., by Forbes, *Sal. Wob.* 55, t. 28 (“germen tapering stalked,” the plate showing a pedicel three times the length of the nectary).

*Fragilis*, L., by Koch, *Syn. Fl. Germ.* ed. 1 & 2 (ed. 2, 2. 740, n. 3) (“capsulis ex ovata basi lanceolatis pedicellatis, pedicello nectarium bis terve superante”).

*Fragilis*, L., by Lindley, *Syn. Brit. Fl.* ed. 3. 230, n. 3.

*Russelliana*, Sm., by Lindley, *l. c.* 230, n. 4. (Lindley follows “the arrangement of Koch;” and though he cites the *Eng. Bot.* plates for “*fragilis*” and “*Russelliana*” respectively, he makes the capsule the same in each, and distinguishes “*Russelliana*” by the young leaves being silky and the stipules more acute.)

*Fragilis*, L., by Wimmer, *Sal. Eur.* 19 (“germina in pedicello brevi aut brevissimo, conico-subulata.” In Wimmer’s specimen, Coll. no. 9, the pedicel is about twice the length of the nectary).

*Fragilis*, L., by N. J. Andersson, *Mon. Sal.* 41, n. 28 (“capsulis elongato-conicis, attenuatis, pedicello nectarium bis terve superante”).

*Fragilis*, L., by Grenier, *Fl. de France*, iii. 124 (“capsule ovoïde-conique atténuée au sommet, a pédicelle deux-trois fois plus long que les glandes”).

*Fragilis*, L., var.  $\beta$ , by Walker-Arnott, in Hooker & Arnott’s *Brit. Fl.* 8th ed., 401, n. 10 (“ovary lanceolate-acuminate.” *S. Russelliana*, Sm., is given as a synonym of the variety).

*Russelliana*, Sm., by C. C. Babington, *Man. Br. Bot.* ed. 1 (“germens stalked lanceolato-acuminate”).

*Fragilis*, L., var. *S. Russelliana*, Sm., by Babington, *l. c.* 6th, 7th, and 8th editions (with same description as in the 1st edition, and with, in the last edition, “*S viridis*, Fr.?” as a doubtful synonym).

*Viridis*, Fr., by Boswell Syme in *Eng. Bot.* 3rd ed. t. 1308, as regards the plate, which is a reproduction of Smith’s plate of *S. Russelliana*.

*Fragilis*, L., by Boswell Syme, *l. c.* viii. 205, n. 3, as regards the letterpress ("capsule conical subulate, on a stalk twice or thrice as long as the nectary").

*Fragilis*, L., by J. D. Hooker, *Student's Fl.*, 3rd ed. ("capsule pedicelled," which definition is rather too brief).

A × B, on the other hand, has been called :—

*Fragilis*, L., by Smith, *Fl. Brit.* 1051; *Eng. Bot.* t. 1807; and *Eng. Fl.* iv. 185 ("germen ovate abrupt, nearly sessile").

*Fragilis*, L., by Willdenow, *Sp. Pl.* iv. 669, n. 51 ("germinibus subsessilibus lanceolatis").

*Pendula*, Ser., by Seringe, '*Essai*,' 79.

*Fragilis*, L., by W. J. Hooker, *Fl. Scot.* 279 ("germens shortly pedicellate, oblongo-ovate"), and *Brit. Fl.* 4th ed. 358, n. 13 ("germens shortly pedicellate oblongo-ovate").

*Fragilis*, L., by Forbes, *Sal. Wob.* 53. t. 27 ("germen ovate, abrupt, nearly sessile").

*Montana*, Forbes, by Forbes, *l. c.* 37, t. 19 ("germens nearly sessile, ovate lanceolate").

*Alba*, L., *γ. viridis*, by Wahlenberg, *Fl. Suec.* ii. 635 ("tota glabra viridis." *S. viridis*, Fr., is quoted as a synonym).

*Fragilis*, L., var. *γ. Russelliana*, by Koch, *Syn. Fl. Germ.* 2nd ed. 741 (capsule not described; but, from the leaves, must come under A × B).

*Fragilis-alba*, Wimm., by Wimmer, *Sal. Europ.* 133 ("germina in pedicello brevissimo conico-cylindracea." *S. Russelliana*, Sm., *S. viridis*, Fr., and *S. pendula*, Ser., are given as synonyms).

*Viridis*, Fr., by N. J. Andersson, *Mon. Sal.* 43, n. 29 ("capsulis breve conicis obtusiusculis pedicellatis, pedicello nectarium subsuperante").

Fries's own description will be noticed presently.

*Fragilis*, L., var. *pendula*, Fr., by Grenier in *Fl. de France*, iii. 125. (From description of leaves &c., comes here. *S. Russelliana*, Sm., and *S. pendula*, Ser., are cited as synonyms.)

*Fragilis*, L., var. *α*, by Walker-Arnott in *Brit. Fl.* 8th ed. 401, n. 10 ("ovary oblong-ovate").

*Fragilis*, L., by C. C. Babington, *Man. Br. Bot.* 1st ed. ("germens stalked oblong-ovate").

*Fragilis*, var. *β*. *S. fragilis*, by Babington, *l. c.* 6th, 7th, and 8th eds. ("capsule oblong ovate").

*Fragilis*, L., by Boswell Syme, *E. B.* 3rd ed. t. 1306, as regards the plate, which is a reproduction of Smith's plate of *S. fragilis*.

*Viridis*, Fr., by Boswell Syme, *l. c.* viii. 207, n. 4, as regards the

letterpress ("capsule conical subulate, on a stalk slightly longer than the nectary." *Salix Russelliana*, Sm., is given as a synonym).

Other authors might be cited; but as I am unable to give the full synonymy from personal examination of the various books (so much confusion exists in the citations even of the best salicologists, that these cannot be used without having been verified), I abstain from giving more.

From the above it will be seen that A has been called:—

- S. Russelliana*, Sm.,
- S. fragilis*, L.,
- S. viridis*, Fr., and
- S. fragilis*, L., var. *Russelliana*.

And that A × B has been termed:—

- S. fragilis*, L.,
- S. pendula*, Ser.,
- S. montana*, Forbes,
- S. fragilis*, L., var. *Russelliana*,
- S. viridis*, Fr.,
- S. fragilis-alba*, Wimm.,
- S. fragilis*, L., var. *pendula*, Fr., and
- S. alba*, L., var. *viridis*.

Since thus both A and A × B have been supposed to be *S. fragilis*, L., Linné's own descriptions must be referred to.

In the 'Flora Lapponica' (1737), p. 282, No. 349,—which is described thus, "Salix foliis serratis glabris ovato-lanceolatis acuminatis,"—is often quoted as referring to *S. fragilis*; but Andersson says that *S. fragilis* does not grow in Lapland, and that Linné's figure (t. viii. fig. b), which represents a leaf only, must be referred to *S. pentandra*, which species it is certainly very like. (In Smith's edition, 1792, there is added, after the diagnosis, "*Salix fragilis*, Sp. Pl. 1443.") In the 'Flora Suecica' (2nd ed. 1755), p. 347, n. 883, the description runs:—"SALIX (*fragilis*) foliis serratis glabris ovato-lanceolatis acuminatis; petiolis dentato-glandulosus. Fl. lapp. 359, t. 8. fig. B. Fl. Suec. 795. Spec. plant. 1017," which is also the description in the 'Sp. Plant.' 2nd ed. 1443.

In these descriptions nothing is said about the ovary; and, so far as the leaves go, they might equally well refer to A, A × B, or to *S. pentandra*. In fact, the plant of the 'Flora Lapponica' seems, with little doubt, to be *S. pentandra*, since Linné says

in his notes that the Lapland plant, which is a lofty bush, differs from the *tree* which grows in Sweden, which he thus describes:—"Salix foliis serratis glabris lanceolatis acuminatis appendiculatis," and quotes more especially for it Ray's (Hist. 1420), "Salix folio longo splendente, fragilis." In the 'Flora Suecica' he seems to have thought, however, that they were after all the same, as he cites the 'Fl. Lap.' and describes the leaves as "ovato-lanceolatis" instead of simply "lanceolatis." It seems, therefore, uncertain whether Linné had in view, so far as his descriptions go, A, or A × B, or both of them. Nor does his Herbarium throw any light on the subject; for the only specimen labelled "*fragilis*" by Linné has "*alba?*" added to it by Smith, and seems to be *alba* ♂.

Hudson and Lightfoot, the immediate English followers of Linné, do not afford any information by which the question can be decided; but Hoffmann (as noticed under *S. decipiens*) states that "nomine *Sal. fragilis*, L., diversæ species occurrunt," which, though it does not indicate the exact nature of the Linnean species, is valuable as showing that the subject was in an unsettled state.

Not only because he was a Swede, but a botanist of the highest rank, the descriptions of Elias Fries deserve most careful attention. By Wimmer, Andersson, and, in fact, all modern botanists, A × B has been referred to Fries's *S. viridis*, with the citation "Nov. Fl. Suec., Mant. i. p. 43," and "Nov. Fl. Suec. ed. 2, p. 283." (As a matter of fact, the name was given earlier, as Fries quotes a prior part—the first edition of the 'Novitiæ;' and it is mentioned by Wahlenberg, 'Flora Suecica,' 1826, under *S. alba*, with the citation "*S. viridis*, Fr. Nov. p. 120," while the dates of the works mentioned above are 1832 and 1828 respectively.)

As the 'Mantissa' seems to be considered the most important citation, we will first of all examine it. The part relating to the Willows is entitled "Commentatio de Salicibus Sueciæ." Here the species and forms we are now discussing are mentioned as follows:—3. *S. fragilis*, with varieties β. *S. pendula* and γ. *S. vitellina*; 4. *S. viridis*; and 5. *S. alba*.

*S. fragilis* is described as having the later leaves "*subsericeis*," and the capsules "*subsessilibus ovato-conicis*." It is referred to the *S. fragilis* of Linné ("in Itin. Scan. p. 200 stabilita") and of Smith. The branches are stated to arise at right angles to the trunk.

47

The var.  $\beta$ . *Salix pendula* differs by its more elongate, slender, at length pendulous branches and smaller capsules. Linné's 'Flora Suecica,' first edition, No. 812, is cited under it, and also *S. Russelliana*, Sm. "ex spec." The leaves are said to be much narrower, the later ones often notably silky, and the capsules more evidently pedicellate. In both forms the catkins are described as making right angles with the branch, and the ripe ♀ catkins as pendulous.

*S. viridis* is said to have very glabrous leaves, and the capsules to be "*pedicellatis ovato-subulatis*." The catkins are afterwards described as erect, and the later leaves pilose below. Fries adds that it agrees well enough with *S. decipiens* among the Smithian species.

In the second edition of the 'Novitiæ' the capsules of *S. viridis* are described as "*subpedicellatis ovato-subulatis*" and as with "*pedicello brevissimo*;" and the angles made by the branches are alluded to, viz.  $90^\circ$  in *S. fragilis*,  $60^\circ$  in *S. viridis*, and  $35^\circ$  in *S. alba*. As, however, this work is four years earlier than the 'Mantissa,' the description in the latter must be considered as superseding that in the former work.

In a later work, 'Flora Scanica,' 1835, *S. fragilis* is distinguished by the later leaves being silky and catkins pendulous. *S. viridis* by very glabrous leaves and erect catkins.

So far, then, as Fries's descriptions go, his *S. fragilis*, since it has sessile and ovate-conic capsules, must belong to  $A \times B$ , and his *S. viridis*, from its pedicellate and ovate-subulate capsules, to  $A$ . The leaves also indicate the same conclusion; but the description of the direction of the branches suggests the reverse. Fries's published specimens (in his 'Herbarium Normale'), so far as I have seen them, belong—*S. fragilis* to  $A$ , and *S. viridis* to  $A \times B$ . From this confusion the chief deduction seems to be that Fries's views were not always the same; and that, as regards at least the essential part of the descriptions in the "Commentatio," his *S. fragilis* is the same as Smith's.

The result, therefore, which we appear to have arrived at is this:—

1st. That there is no certainty, but absolute uncertainty, regarding the species which Linné himself had in view.

2nd. That while Smith, Willdenow, &c. (and Fries in his descriptions) have considered  $A \times B$  to be *S. fragilis*, L., Koch, Wimmer, Andersson, &c. have taken  $A$  to be that species.

The question is, therefore, which of these two parties is right, —a question which, it seems to me, it is almost, if not quite, impossible to decide. I am inclined to think that it is not unlikely that  $A \times B$  (the Smithian *Salix fragilis*) has at least as much claim to be considered Linné's *S. fragilis* as *A* has. If this claim could be proved, then  $A$  would = *S. Russelliana*, Sm., and  $A \times B$  would = *S. fragilis*, L.; but as there is so much uncertainty, and as an adoption of Smith's views would entail great synonymic changes, it seems more expedient to follow Koch, &c., and to consider *A* as being the Linnean *S. fragilis*, in which case  $A \times B$  = *S. fragilis*  $\times$  *S. alba*.

### 3. SALIX FRAGILIS, L.

*S. fragilis*, as it has just been defined, namely, with *S. viridis* as well as *S. decipiens* eliminated from it, is not, as it occurs in Britain, a species subject to any great range of variation.

The points of distinction between it and *S. decipiens* have already been pointed out, and those between it and *S. viridis* may be better considered when treating of that plant. Though in Britain, as in Continental Europe, there is no great difficulty in distinguishing it from *S. alba*, yet it is so closely allied to the latter, that, as Andersson remarks, in some regions of Asia they are united by so many forms, that it is not easy to point out the difference between them. For this reason, he thinks that possibly it originated there, and has thence immigrated into Europe. If this be the case, it must have occurred at a very early period, if Saporta is right in his determination of certain plant-remains of the Pleistocene tufa of the Seine valley, not to mention Heer's discoveries in Swiss Miocene deposits. Be that as it may, *S. fragilis* is, at the present day, in Britain as native, to all appearance, as most other species of lowland willows.

As mentioned above, *S. fragilis* does not in Britain show any great range of variation; but an examination of any extensive series and a comparison with Continental specimens will show that there are two tolerably distinct forms which seem worthy to rank as varieties. These may be called  $\alpha$ . *genuina* and  $\beta$ . *britannica*; and the distinctions between them lie chiefly, if not entirely, in the flowers. In  $\alpha$  the  $\sigma$  catkins are rather dense-flowered, with the stamens conspicuously longer than the scales, whilst in  $\beta$  the catkins are lax-flowered, and the stamens are scarcely longer than the scales. Hence in  $\alpha$  the stamens and in  $\beta$  the scales form the conspicuous feature of the catkins. In the  $\text{♀}$  the differences

between  $\alpha$  and  $\beta$  are not so striking, but in good specimens are sufficiently evident. In  $\alpha$  the ovary is much wider at the base than in  $\beta$ ; and may be described as ovate-lanceolate, that of  $\beta$  being lanceolate-subulate. The scales, though variable, are perhaps more usually shorter in  $\alpha$  than in  $\beta$ ; the catkins, especially when young, rather denser-flowered and stouter; and the styles and stigmas rather thicker. The chief difference, however, is in the shape of the ovary.

The two varieties show no constant differences in leaf-characters, though I am inclined to suspect that  $\alpha$  is generally broader-leaved than  $\beta$ .

Whilst both forms occur in Britain— $\beta$ , however, being very much the more abundant one— $\alpha$ , so far as I have seen (from specimens and figures), is the only variety found in Continental Europe. In Britain  $\alpha$  seems to be decidedly rare. I have found one  $\sigma$  plant in Perthshire; Mr. A. Brotherston has gathered both sexes in Roxburghshire; and a  $\sigma$  collected by Mr. T. R. Archer Briggs in South Devon seems also referable to it.

Since the  $\text{♀}$  is Smith's *Salix Russelliana* (of which the  $\text{♀}$  only was known to him), perhaps  $\beta$  ought to retain that name as a varietal designation; but as the name "*Russelliana*" has been the subject of so much confusion, the propriety of keeping it up seems doubtful. Moreover, it is possible that Forbes's *S. monspeliensis* is the  $\sigma$  of  $\beta$ . Specimens received from Kew Gardens with the name *S. monspeliensis* belong to the var.  $\beta$ ; but Forbes's figure (*Sal. Wob.* t. 30) is doubtful, as, though the single flower shows the long scale of  $\beta$ , the rest of the figure is more like  $\alpha$ . The *E. B.* t. 1808, and *Sal. Wob.* t. 28, of *S. Russelliana* represent  $\beta$ ; but in both figures the ovary is a little too obtuse at the apex—in the original drawing for the *Eng. Bot.* figure it is not obtuse. The  $\sigma$  catkins figured in the plates of "*fragilis*" in *Eng. Bot.* t. 1807, and *Sal. Wob.* t. 27, suggest  $\beta$  rather than  $\alpha$ , as do the single  $\sigma$  flowers of the former, while in the latter they are like those of  $\alpha$ . It is possible, however, that in both cases they have been taken from *S. viridis*. With the original drawing of the  $\sigma$  for *Eng. Bot.* a single catkin is preserved, which, if not *viridis*, is the var.  $\alpha$  of *fragilis*.

Several leaf-varieties of *S. fragilis* have been described, founded on the breadth of the leaf, or on the colour of the underside; but they are not of sufficient distinctness or importance to be worthy of retention.

Finally, since in Britain *S. fragilis* has been so much confused

with *Salix viridis* and *S. decipiens*, and since it is possible that (as in several Continental localities) it may be in some places rarer than *S. viridis*, it will be necessary to work out afresh its distribution, though it probably occurs throughout. I have specimens from the following counties:—

3, S. Devon (*Archer Briggs*); 16, W. Kent (*E. Edwards*); 17, Surrey (*E. S. Marshall*); 19, N. Essex (*Leeffe*); 20, Herts (*B. Daydon Jackson*); 23, Oxford (*G. C. Druce*); 27 or 28, Norfolk; 32, Northampton (*Druce*); 34, W. Gloucester (*J. M. White*); 36, Hereford (*A. Ley*); 37, Worcester (*R. F. Towndrow*); 38, Warwick (*T. Kirk*); 40, Salop (*Leighton*); 47, Montgomery (*Eyre Parker*); 57, Derby (*C. Bailey*); 64, M.W. York (*J. G. Baker*); 65, N.W. York (*Ward*); 66, Durham (*Middleton*); 80, Roxburgh (*A. Brotherston*); 83, Edinburgh (*Maughan*); 85, Fife!; 87, W. Perth!; 88 Mid Perth!; 89, E. Perth!; 90, S. Aberdeen (*Trail*).

#### 4. SALIX ALBA, L.

Although Andersson describes eleven varieties or forms (the majority, however, not being natives of Europe), and Wimmer four principal forms, *S. alba* does not in Britain present any great range of variation, with the exception of the remarkable modification *S. vitellina*.

Most of the British specimens which I have seen are in the direction of *S. cærulea*, Sm., a form which in structural differences can be separated from typical *S. alba* only by its adult leaves being less pubescent. In other respects *S. cærulea*,—probably the "Huntingdon Willow" of arboriculturists, though Smith calls "*Russelliana*" the Bedford or Huntingdon Willow,—is said to differ from ordinary *S. alba* by its more rapid growth and the greater value of its timber, and hence would be selected for planting. Thus all our trees being probably self-sown escapes when not actually planted, would most naturally belong to this form.

There seems thus to be no good grounds for retaining *cærulea* as a variety. In its extreme form the adult leaves are nearly glabrous; but between this state and the very pubescent form *argentea*, Wimm. (*S. splendens*, Bray), all gradations occur. Of the extremely pubescent form, I have seen no British examples.

As regards leaf-form, there is some degree of variation in British specimens, but not so sufficiently marked as to deserve distinction. Leeffe has noticed (in Sal. Exs.) that the leaves of

the ♀ are generally broader; and, so far as I have seen, they are constantly broader in proportion to their length, and hence possibly belong to Wimmer's form *ovalis*.

*Salix vitellina*, L., is reduced by Koch, Wimmer, Andersson, &c. to the rank of a mere form of *S. alba*, distinguished only by the colour of its bark and its generally narrower leaves, and said to be often produced either by being cut over every year, or by a diseased condition of the plant. Whether it be a diseased condition or not, it certainly does not depend for its characters on annual lopping; and, in addition to the colour of the bark, has several important structural differences to separate it from ordinary *alba*.

The catkins are much more slender and proportionately, if not actually, longer, with usually more scattered flowers, and remarkably long and narrow scales. The leaves are smaller and usually of a paler or more yellow-green, and frequently less pubescent. Boswell Syme thinks that the ovaries are always abortive; but whilst I have not had sufficient opportunities of studying the plant to be positive, I am inclined to think that he is wrong on this point. On these grounds, I consider that *vitellina* is worthy of at least varietal rank.

Fries thought that "*S. vitellina*, L.," pertains to *S. fragilis*. In Linné's herbarium are two specimens labelled by Linné "*S. vitellina*." To the ♂ Smith has put a "?" and to the ♀ "*alba*?" The ♂ has the long scales of *vitellina*; the ♀ has short scales, but long narrow catkins; the bark in both is now purple-brown, while the leaves are too young to afford much information. On the whole, I think these specimens are nearer *vitellina* than typical *alba*.

Whether *S. alba* is native in Britain is perhaps doubtful, for, whilst usually planted, yet self-sown plants occur. The var. *vitellina* is said to occur chiefly in osier-grounds, but in Norfolk Crowe (Smith's 'Engl. Fl.') thought it was "truly wild."

× *SALIX VIRIDIS*, Fr. (*S. fragilis* × *S. alba*.)

*S. viridis*, Fr., may be taken as the central or typical form of a Willow which presents a regular series of gradations between *S. fragilis* on the one side and *S. alba* on the other. Consequently it is considered to be a hybrid between these two species; but if, as Andersson says (as has been already noticed under *S. fragilis*), these two species are so connected in some parts of Asia that it is difficult to separate the one from the other, it seems quite pos-

sible that the plants known as *Salix fragilis* and *S. alba* may be only extreme states of one species, and that *S. viridis* is the intermediate condition. In favour of this view may be cited Hartig's statement that in N.W. Germany, where *S. fragilis* is very rare, *S. viridis* is very abundant, and Kerner's that in Lower Austria it is scarcely less common than *S. fragilis* itself.

The question of the specific identity of *S. fragilis* and *S. alba* is one, however, that must be studied in the supposed metropolis of the species in Asia, where it can alone be determined whether the connecting forms mentioned by Andersson are intermediates or hybrids. In Western Europe, into which they have immigrated or been brought, they must, in the meantime, be treated as distinct species and *S. viridis* as a hybrid between them.

In its most intermediate or typical condition *S. viridis* (or at least the ♀ plant) is not difficult to recognize, but those states (especially of the ♂) which approach one or other of the parents are by no means easy of determination.

Compared with *S. fragilis*, typical *S. viridis* has leaves of a darker green\*, rather less shining, more finely serrated on the margin, and less oblique towards the apex; the ♂ catkins rather dense-flowered, narrower and longer; the ♀ catkins more (usually) erect and more slender; capsules smaller, paler when dried, conical-cylindrical, contracted into the style, and hence more or less obtuse at the apex (instead of lanceolate-subulate or ovate-lanceolate, attenuate into the style), and with a shorter pedicel not exceeding twice the length of the nectary (instead of 2-3 times as long †).

From *S. alba*, *S. viridis* differs by the broader and larger leaves, very soon quite glabrous, and more shining above; longer and less dense-flowered ♂ catkins; and larger, usually more distinctly pedicelled and distinctly styled capsules. The capsules hold an intermediate place in size between those of *fragilis* and of *alba*. Taking the average of *fragilis* capsules as 7 mm. in length, and of *alba* as 2 mm., those of *viridis* are about 5 mm.

The habit of the tree is also different from that of both its

\* In his directions to the artist, noted on the original drawing for *Eng. Bot.*, Smith says, regarding *Russelliana*, "green of every part lighter than in *S. fragilis* (i. e. his *fragilis*, which is *viridis*), and also "the midrib is much broader in this than in *fragilis*."

† The pedicel of *fragilis*, whilst usually 2-3 times the length of the nectary, is sometimes barely twice the length, but varies in the same catkin.

parents. In *Salix fragilis* the branches (or at least the main ones) make with the stem an angle of  $90^\circ$ , well shown in the lower branches of the figure of "Johnson's Willow" (referred to *S. Russelliana*, Sm.) in the frontispiece of *Salicium Woburnense*. In *alba* the angle is  $35^\circ$ , and in *viridis* it is said to be  $60^\circ$ . I rather think (from measurements I have made) that the angles made by the twigs show a somewhat similar difference—those of *fragilis* forming the widest and of *alba* the narrowest angles, *viridis* being more or less intermediate. Too much dependence, however, must not be placed on this character.

Now whilst the characteristics of the typical *viridis* are as mentioned above, the hybrid, as met with, more frequently shows a departure from these towards either *fragilis* or *alba*, till finally it is almost impossible to separate it from one or other of these species. It may also have one set of organs very similar to one of its parents, and another set resembling those of the other parent. Thus the leaves and twigs may be almost inseparable from those of *alba*, whilst the capsules may be almost identical with those of *fragilis*, or *vice versâ*. It is hence almost or quite impossible to frame a short description which will include all the characters of this variable plant. In practice, however, the trained eye of a salicologist will detect differences which cannot easily be expressed in words.

*S. viridis* is widely distributed in Britain, occurring from Cornwall and Surrey to Perth. How it has hitherto escaped recognition is rather surprising, but is probably due to the fact of the failure of salicologists (both British and Continental) to discover that the *fragilis* of Continental botanists and Smith's *fragilis* were different plants, and the consequent confusion regarding, and erroneous determinations of, Smith's *Russelliana*. Andersson, moreover, in some quite unaccountable way, not only failed to recognize British specimens of *viridis*, but actually named them "*fragilis*," and thus led British botanists (who would place a deserved confidence in the opinion of that great salicologist) to naturally believe that *viridis* did not occur in Britain. Not to specify other instances (*e. g.* several examples in Kew herbarium\*), the case of the specimens in Leefe's 'Salicium Britannicum Exs.' may be mentioned. "No. 52. *S. fragilis*, E. B. t. 1807," of which

\* One instance is very curious. The more mature ♀ example on a sheet of specimens from Upsala, collected and named "*fragilis*" by Andersson, must, according to his description in the 'Monographia,' belong, beyond doubt, to *viridis*.

Leefe says, "My plant agrees well with the figure of *E. Bot.*," was examined in Watson's herbarium by Andersson, who made this note regarding it (Watson in 'Botanical Gazette,' No. 29, 1851):—"Specimina foliifera ad *S. viridem*, Fr.—amentifera ad *S. fragilem*, L., pertinent."\* I have not seen the specimens in Watson's herbarium, but there seems no reason to suppose that they are different from other examples sent out under the same name and number by Leefe at the same time, and similar also to specimens published in his second fasciculus. These specimens are, beyond doubt, the *Salix fragilis* of Smith, and have an almost sessile, ovate-conic, obtuse, short-styled ovary. Andersson had not at that time written the 'Monographia;' but in it he cites, under *S. fragilis*, L., the figure in *Eng. Bot.* t. 1807, which, as is the case with Leefe's specimens, shows characters in direct opposition to his diagnosis of *fragilis*, but quite in accordance with the description of *viridis*. What adds to the unintelligibility of Andersson's note on Leefe's specimens is that the leaves of the latter do not belong to the most intermediate condition of *viridis*, but are somewhat in the direction of *fragilis*, and hence show a good knowledge of *viridis* on Andersson's part. An explanation of the mystery may be this, that, in the first place, there was time only for a hurried examination of these and the Kew specimens, and, in the second, a belief, adopted from others, and not verified by personal examination of his works, that Smith's *fragilis* was the same as the continental plant.

Both Wimmer and Andersson recognize the fact that *S. viridis* varies in the direction of one or other of its parents, but they do not describe so great a range of variation as actually exists. The modifications described by Andersson are *a. fragilior* (in the direction of *fragilis*), *β. excelsior* (the typical or most intermediate condition), and *γ. albescens* (near *S. alba*). Wimmer has also three forms—*a. viridis* (with leaves green below), *b. glabra* (leaves glaucous below), both being glabrous †; and *c. vestita*, which is the same as Andersson's *albescens*.

Nyman ('Conspetus') thinks that three varieties are of major value, viz. *S. Russelliana*, Sm., *S. excelsior*, Host, and *S. palustris*, Host. *Russelliana*, Sm., is, as has been shown, not rightly

\* Andersson (*Mon.*) cites Leefe's No. 50 (*decipiens*) under *fragilis*, but does not mention Nos. 51 and 52.

† He says also "gemmis glabris," yet the autumn buds of his exemplars of *glabra* are pubescent, but seem to become glabrous by spring.

placed here, even as a synonym; *excelsior* is, according to Wimmer, the same as his var. *glabra*, and *palustris* his var. *vestita*; but Andersson's determination of Host's species is different.

These varieties, whatever names be adopted for them, are marked by too indefinite and inconstant characters to be of much practical value. On the whole Andersson's varietal names *fragilior* and *albescens*, if taken in the sense that they indicate a departure from the central form in the direction of *fragilis* or of *alba*, are to be preferred; but, as mentioned above, the vegetative organs may show affinity with one, and the reproductive organs with the other, of the parents. If these names are used at all it should be with reference to leaf-structure only.

In Britain *Salix viridis* exhibits a considerable range of variety. It may be of some interest and utility to briefly notice some of the forms which I have seen.

From Worcestershire, Mr. R. F. Towndrow kindly sent me living specimens from seven trees. Two of these are so closely related to *S. alba* that if they had not formed part of the series received, I should have called them rather untypical *S. alba*. Two others are also on the *alba* side of the type or *excelsior*, which they connect with *albescens*—one being nearer the latter variety than is the other. Two others exhibit relationship to the other parent, one having leaves scarcely distinguishable from those of *S. fragilis*, and the other being much nearer the type. The remaining tree seems nearest of all to typical *S. viridis* and has leaves quite different from any of the others, and resembling those of t. 27 in Sal. Wob. and not unlike Eng. Bot. t. 1807. The catkins ( $\sigma$ ) have the filaments apparently shorter, in proportion to the length of the scales, than in Swedish examples of *S. viridis*, suggesting a derivation from the var. *britannica* of *S. fragilis*. The broad dark green leaves recall those of *S. alba* ♀.

Of the same leaf-form as the last is a ♀ plant collected in Oxfordshire by Mr. G. C. Druce. It has long and slender catkins, and capsules resembling those of *S. alba*, but shortly pedicelled.

Very different from these specimens are a series of examples collected by Mr. T. R. Archer Briggs in South Devon and East Cornwall. They are all ♂ and, unfortunately, most of them have no adult leaves. Hence their affinity is not so easy to determine, but out of eight trees seven seem to be related to *S. alba* rather than to *S. fragilis*. Three of them are remarkable for having more or less partially triandrous, and even tetrandrous flowers, a

condition which, though probably of rare, is not of unknown occurrence. Whilst in most of Mr. Briggs's specimens the twigs are rather slender and reddish in colour, the catkins vary both in size and direction. Some of the specimens are rather like No. 1955 of Billot's 'Exsiccata,' published as *Salix fragilis*, but which agrees with the description in Grenier and Godron's 'Flore de France' of *S. fragilis* var. *pendula* (*S. pendula*, Ser.), which Wimmer says is a form of his var. *vestita* of *S. viridis*.

In Roxburghshire, Mr. A. Brotherston has found a few trees which may be described as having the leaves of *S. alba*, and the capsules, except that the pedicel is short, of *S. fragilis*. He also finds what seems to be the ♂ of the same, and I have seen a similar plant from Brandon, Warwickshire (*T. Kirk*). These would be called var. *albescens*.

In Perthshire, *S. viridis* occurs in several places on the banks of the Tay, along with *S. fragilis* and *S. alba*. In one place the trees have evidently been planted, but have almost certainly been brought from some other and adjacent part of the banks. They are all ♀ and, whilst distinctly *S. viridis*, closely approach *S. fragilis* in character. In another locality a single tree grows. This is much older than those in the above-mentioned station, and is, in all probability, self-sown. It is in many ways like *S. alba*, from which, however, the more glabrous leaves and distinctly though shortly stalked capsules at once distinguish it. From some other stations I have as yet seen leaf-examples only.

From the erroneous conceptions of Smith's *Russelliana* by many salicologists, it is not to be wondered at that the citations of descriptions and figures, as regards both *S. viridis* and *S. fragilis*, are in many cases wrong. Andersson, for example, cites *Sal. Wob.* t. 27, and Wimmer both that and t. 29 and t. 30 under *S. fragilis*, L.; but t. 27 is *viridis*, t. 29 is *decepiens*, and t. 30 is *fragilis*. Under *S. fragilis-alba* (= *viridis*, Fr.) Wimmer refers to *Sal. Wob.* t. 28 (*Russelliana*), which represents *fragilis*, and to t. 19 (*montana*), which, from the description "germens nearly sessile," as well as from the figure, is *viridis*. The references to Smith's descriptions and figures, and to those writers who have followed Smith, are likewise all wrong, though, while giving "*Russelliana*, Sm.," as a synonym of the *fragilis-alba* hybrid, both Wimmer and Andersson confessed that in their opinion the identity of *Russelliana*, Sm., was altogether doubtful. It is evident, therefore, that the synonymy and citations—both British

and Continental—of *Salix fragilis* and *S. viridis* require careful revision, since many of the existing citations have not been, it would seem, verified by personal examination of the works cited.

Both Wimmer and Andersson appear to be of opinion that *viridis* rarely, if ever, occurs otherwise than as an introduced plant. Whether this be the case in Britain, further investigations are required to show, but it is probable that it occurs spontaneously (*i. e.* self-sown) and as wild, but not more so, as either of its parents. From the nature of some of the forms it is likely that they have arisen from variations in the mode of cross-fertilization, some having sprung from *fragilis* ♂ × *alba* ♀ or *vice versá*, and others from the crossing of *viridis* with one of its parents. Differences, too, have probably originated through one or other of the two varieties of *fragilis* being concerned in the parentage. Experiments like those conducted by Wichura are necessary to decide these questions.

*S. viridis* has been found in the following counties:—2, E. Cornwall (*Archer Briggs*); 3, S. Devon (*Archer Briggs*); 13, Surrey (*Winch, A. Bennett*); 19, N. Essex (*Leefe*); 23, Oxford (*G. C. Druce*); 29, Cambridge (*J. Holme*); 30, Bedford (*C. Abbot*); 37, Worcester (*R. F. Towndrow*); 38, Warwick (*T. Kirk*); 80, Roxburgh (*A. Brotherston*); 83, Edinburgh (*Boswell Syme*); 88, Mid Perth! Possibly also in Stafford and Derby.

## B. DIANDRÆ.

### Group 4. CAPRÆÆ.

This group consists of a number of very closely allied species, three of which have been found in Britain. These three—*S. cinerea*, L., *S. aurita*, L., and *S. Caprea*, L.—are the most widely distributed members of the group, occurring throughout Europe at least. Whether they are really distinct species is a disputed point, but salicologists on the whole are tolerably unanimous in retaining them as such, although it is not to be denied that, either by intermediate or hybrid forms, they are so closely connected that it is difficult to point out distinctions which will hold good in every case. Wimmer, however, is of opinion that when studied in a living state they may be separated without much trouble—an opinion for which there seems to be justification, but which does not apply to the determination of dried, and consequently

often imperfect specimens. Such examples it is often impossible to place.

Whilst the older British botanists, Smith and his followers, thought that there were in Britain five species—the three mentioned, with the addition of *Salix aquatica*, Sm., and *S. oleifolia*, Sm.—the author of the latest British Flora ('The Student's Flora') has, on account of some remarks of Andersson, reduced *S. cinerea* to the rank of a subspecies of *S. Caprea*, and suggests that *S. aurita* is probably only another form. But, though in continental Europe *S. cinerea* is not rarely, as Andersson says, to be distinguished without difficulty from some forms of *S. Caprea*, in Britain this does not seem to be usually the case, since our common form of *S. cinerea* is much more closely related to *S. aurita* than to *S. Caprea*.

From the intimate alliance between these three species, and as they flower much about the same time, they, as might be expected, readily cross with each other, and to identify the parentage of the three hybrids thus produced is often most difficult.

### 5. SALIX CINEREA, L.

If a series of Continental examples of *S. cinerea* be compared with a series of British specimens, it will be seen that, though, perhaps, some of the examples may be tolerably similar, there is, on the whole, an absence of exact identity between the series. Moreover, if the descriptions of the species by the Continental salicologists be studied, it will be found that they do not, in some particulars, quite fit the British plant. That this appears to be a matter of some importance may be assumed if we consider that several species, of more or less restricted distribution, have arisen either from *S. cinerea*, or from its possible progenitor *S. Caprea*, or from the same stock.

Thus, peculiar to alpine and subalpine (especially limestone) regions from France to Transylvania there is *S. grandifolia*, Ser., a species which has been confounded with *S. Caprea* and *S. cinerea*, and has even been supposed to be an alpine modification of the latter. North of the range of this species, and chiefly in alpine and mountainous districts of Silesia, occurs *S. silesiaca*, W., a species which has very great affinity and similitude to *S. cinerea*, *S. Caprea*, and *S. aurita*. Of this a subspecies is found in the Caucasus. In the Mediterranean region occurs *S. pedicellata*,

Desf., which is connected with *Salix silesiaca* by *S. grandifolia*, and has so much affinity with these that it might be considered to be a southern modification of one of them. *S. pedicellata* forms the connecting link with *S. canariensis*, C. Sm., a species very similar to it, restricted to some of the North-Atlantic islands. Besides these, certain subspecies of *S. cinerea* occur in Russia and in Persia.

From these instances it would seem that there is a tendency in *S. cinerea* and *S. Caprea* to develop local races, some of which are so sufficiently distinct as to be considered as species. Hence it would not be very surprising if in Britain an insular form should occur, and the differences between it and the Continental plant become greater by separation, since, on account of the absence of economic value in the species and its great abundance, living plants from the Continent would not likely be commonly, if at all, brought to this country.

In such closely allied Willows as the *Caprea* the characteristic distinctions are more easily seen than described. It is thus rather difficult to put in words the differences between the Continental and the British *cinerea*, though the facies is sufficiently noticeable.

In the first place, the European plant has, as the name implies, an ashy-grey appearance, which is, in great measure, absent from the British form. This ashy-grey colour is owing to the pubescence of the twigs ("veluti incani," *Wimmer*; "griseo-tomentosi" and "incani," *Andersson*; cano-tomentosi," *Koch*; "grisâtre-tomenteux," *Grenier*) and of the underside of the leaves ("grisea," "cinerea," "de couleur cendrée"), and sometimes of the upper surface also. The British plant is, as regards the great majority of specimens, much less pubescent. The pubescence of the twigs is, moreover, not of a hoary-grey colour (except, perhaps, in the youngest shoots), but inclining rather to fuscous black; and the pubescence of the underside of the leaves has most usually a more or less considerable admixture of shining, rust-coloured, short, crisped hairs, which, with scarcely an exception (one will be noted), none of the Continental specimens show nor do the Continental descriptions mention.

In the second place, the average size of the leaves seems to be less in the British than in the Continental plant.

From this difference in the nature of the pubescence and in the size of the leaves, it follows that the British *S. cinerea* is more remote from *S. Caprea* than the Continental form, and rather nearer to *S. aurita*.

One of the European examples of *Salix cinerea* makes a nearer approach to the British form than any of the others. This belongs to the modification which occurs in Portugal, and which has been described as a species under the name *S. atrocinerea*, Brot., which Andersson treats as a synonym of *cinerea*. In the only specimen of this form which I have examined, the pubescence of the leaves (which, though thinner, are not unlike those of the British plant) is scanty and has a mixture of ferruginous hairs, but the catkins ( $\delta$ ) are remarkably pubescent and unlike ours. If one can judge from this single specimen, *S. atrocinerea* is worthy of more consideration than Andersson has given it.

In the catkins I have not yet detected any constant difference between the British and Continental *S. cinerea*. Andersson quotes an observation of Lange that in *cinerea* the  $\delta$  catkins are centrifugal and in *Caprea* centripetal, and Hoffmann's illustrations of *cinerea* seem to show this. According, however, to my observations our *cinerea* has most usually centripetal inflorescence.

Without, however, a comparative study of living specimens of the Continental *cinerea*, I am unwilling to ascribe to the British form varietal or subspecific rank, though it may be that further investigations will show that it is worthy of such.

Wimmer describes one variety only ( $\beta$ . *spuria*, Wimm.) of *S. cinerea*. This differs solely by its narrow lanceolate leaves, and forms very like his specimens (Coll. No. 32) occur in Perthshire and elsewhere. Andersson notices three leaf-varieties— $\alpha$ . *latifolia*,  $\beta$ . *longifolia* (which includes *spuria*, Wimm.), and  $\gamma$ . *brevifolia*, with a subvariety *microphylla* resembling *S. aurita*. He has also a catkin-variety ( $\delta$ . *laxiflora*), flowering later and with a leafy peduncle to the catkin. These leaf-varieties are useful only as indicating a considerable range of variation in the shape of the leaves, since there are all degrees of gradation between them.

As has been mentioned above, British *cinerea* seems, on the whole, to be less pubescent than the Continental plant. In a not inconsiderable number of specimens the pubescence of the year-old twigs, usually stated to be an important characteristic of the species, is almost or quite absent. Whether these specimens are true *cinerea* or hybrids it is impossible to say, since in their other characters they do not depart from *cinerea*. Frequently, too, the adult leaves are nearly glabrous.

Smith described, as has been already said, two supposed species which more modern botanists have placed as varieties or synonyms

of *Salix cinerea*. Boswell-Syme and, following him, J. D. Hooker term them and *cinerea genuina* slight varieties, which so run into each other that it is often impossible to refer a specimen to one more than to another, the distinctions being that *oleifolia* has narrower leaves with (as in *cinerea genuina*) reddish-brown hairs beneath, and *aquatica* obovate thinner leaves with usually white hairs beneath. Andersson considers them as synonyms of *S. cinerea*, *aquatica* being most probably his var. *latifolia*. Wimmer makes *S. oleifolia* a synonym, but, on account of *Sal. Wob.* t. 127 and Döll's opinion of *Eng. Bot.* t. 1437, refers *aquatica* to the hybrid *S. Caprea-cinerea*, Wimm. Walker-Arnott cannot distinguish them as well-marked varieties, and points out the fallacy of characters derived from the stipules, in whose structure Smith placed reliance. W. J. Hooker retains them as species, but states Borrer's opinion that their characters are unsatisfactory. These quotations will be sufficient to show that the general opinion is that *S. aquatica* and *S. oleifolia* are scarcely distinct, as varieties even, from *S. cinerea*, an exception being Wimmer's idea (derived from figures only) that *S. aquatica* is a hybrid between *S. cinerea* and *S. Caprea*.

One or two points in Smith's descriptions are not alluded to by modern botanists. *S. cinerea* he describes as a tree 20-30 feet high if left to its natural growth. *S. oleifolia* is also a tree; but *S. aquatica* is generally bushy, rarely forming a tree. The catkins of *S. oleifolia* are as large as those of *S. Caprea*, those of *S. aquatica* being much smaller and more like those of *S. cinerea*. He also says that *S. aquatica* is "most related" to *aurita*, and places the species in this order—*S. cinerea*, *S. aurita*, *S. aquatica*, *S. oleifolia*.

In Smith's herbarium specimens of both *S. aquatica* and *S. oleifolia*, from "Mr. Crowe's garden," are preserved. These are instructive in several ways, and show some discrepancies with the descriptions. The specimen of *S. aquatica* much resembles *S. aurita* in twigs and catkins; the leaves are thin, not very hairy, a little rugose above, margins slightly undulate-crenate, and underside with reddish-brown hairs. It looks like a hybrid of *S. aurita* with either *S. cinerea* or *S. Caprea*, the pubescence of the young leaves suggesting the latter. The *S. oleifolia* specimen has rather slender *aurita*-like twigs which are not very pubescent; the leaves resemble those of *cinerea*, have slightly revolute and sub-entire margins, and the underside has reddish-brown hairs; the catkins (♂) are larger than those of the usual *aurita*, but small for *cinerea*, and their scales are suggestive of *aurita*. With the

drawing for *Eng. Bot.* t. 1402, *Salix oleifolia*, a leaf is preserved. This, while rusty on the veins beneath, is covered below with coarse white woolly pubescence, and has the upper surface coarsely hairy; margins crenate-serrate and slightly revolute.

The specimens published by Leefe are interesting, not only as illustrating the opinion of the British botanists who succeeded Smith, but also Andersson's earlier ideas; for at the time that he examined Leefe's examples the hybrid origin of many willows had not been recognized. Leefe's specimens of the first fasciculus, taking them in their order, are these:—

"No. 38. *S. cinerea*, L., var.  $\beta$ , Koch. *S. aquatica*, Sm." From Yorkshire. Andersson thought that, as regards the leaves at least, this tended towards *S. laurina*. It is rather a puzzling plant and suggests *aurita*  $\times$  *Caprea*.

"No. 39. *S. cinerea*, Sm.?" From Yorkshire. Andersson thought that this was near *S. Seringeana*, Gaud. (= *incana*  $\times$  *cinerea*). So far as the specimens go it seems to me *S. cinerea* only.

"No. 40. *S. cinerea*, L.,  $\beta$ , Koch. *S. aquatica*, Sm.?" From Essex. This seems to be *cinerea*  $\times$  *aurita*.

"No. 41. *S. aquatica*, Sm." From Essex. A form of *cinerea*, says Andersson. This also seems to be *cinerea*  $\times$  *aurita*.

"No. 42. *S. aquatica*, Sm.?" From Essex. Andersson calls it a subspecies of *S. cinerea*. To me it seems certainly a good form of *cinerea*  $\times$  *aurita*.

"No. 44. *S. oleifolia*, Sm.?" From Essex. A form of *cinerea*, according to Andersson. I should call it *cinerea*  $\times$  *aurita*.

In Fasciculus iv. "No. 84. *S. aquatica*, Sm.," seems to be *S. cinerea*, and "No. 103. *S. cinerea*, L., *S. aquatica*, Sm.;" *cinerea*  $\times$  *aurita*.

In addition to these specimens I have examined a number of others which have been distributed by various botanists and labelled *S. cinerea*, *S. aquatica*, and *S. oleifolia*, as the case may be. These, just as the above, tend to show that there exists in the minds of botanists a considerable vagueness as to how the Smithian names should be applied. As, therefore, there is now no certainty about them, it will be expedient to drop the names *aquatica*, Sm., and *oleifolia*, Sm.

## 6. SALIX AURITA, L.

Contrary to what is the case in the majority of British species

of *Salix*, the continental salicologists have described more forms of *S. aurita* than British botanists have done.

Thus Andersson specifies three, and Wimmer four, principal modifications ; but as these are so connected by other intermediate forms that it is often impossible to say to which a specimen should be referred, it seems unnecessary to mention them by name.

*S. aurita*, like its allies, is subject to a great range of variation. At the same time it can usually be recognized without much difficulty, not so much by any one characteristic as by a combination of them and its general appearance. Its closest affinity is with *S. cinerea*, and, so far as dried leaf-specimens go, it is sometimes not easy to determine to which species they belong, since certain features of the twigs and buds, described as characteristic of the species, will, in practice, be found not quite reliable. Thus the year-old twigs, which ought to be glabrous, are not unfrequently more or less slightly pubescent in *S. aurita*, and glabrous when they ought to be tomentose in *S. cinerea* ; and the buds are glabrous or pubescent, though described variously as one or the other.

From this close relationship it follows that the hybrids between *S. aurita* and *S. cinerea*, when not exactly intermediate but more related to one or other of the parents, can only be distinguished with great difficulty.

× *SALIX LUTESCENS*, *A. Kern.* (*S. cinerea* × *S. aurita*.)

Wimmer remarks that the hybrid forms—which he calls *S. aurita-cinerea*—between *S. cinerea* and *S. aurita* are most difficult to make out, since the differences between the species themselves are not easily expressed in written notes, but that, nevertheless, such hybrids seem to be commoner than has been thought. If the student, however, has familiarized himself with the two species in question, so as to understand, in some degree at least, the range of their variation, the difficulty of recognizing the hybrid forms is not insurmountable when they occupy a more or less intermediate position. When, however, the hybrid shows, as is very frequently the case in such plants, greater affinity with one parent than the other, absolute certainty becomes well-nigh impossible.

The points of distinction between *S. cinerea* and *S. aurita* to be chiefly kept in mind are as follows :—twigs, in *aurita* more slender

and glabrous, in *cinerea* stouter and pubescent; leaves, in *aurita* smaller, softer, and more rugose; catkins, in *aurita* much smaller and with more distinct leafy bracts at the base; scales, in *aurita* narrower, more ferruginous, and less black at the tips; capsules, in *aurita* smaller, whiter, more pubescent, less subulate and more cylindrical, with no style and with short stigmas.

Theoretically the hybrid should have characters altogether intermediate, but practically it will be found that in some points the *cinerea*-influence predominates, and in others the *aurita*. The twigs are usually more slender than in *cinerea* and either pubescent or glabrous: the leaves are very variable, and from them alone it is impossible to determine the hybrid; but compared with those of *cinerea*, they are usually smaller and show, especially in a living state, more rugosity, whilst their shape and general appearance suggest a mixture with *aurita*; the catkins are intermediate in size and shape; the scales, whilst retaining a resemblance to those of *aurita*, are blacker at the tips; the capsules show an evident relationship with *aurita* in their whiter colour and more cylindrical form, whilst, in being more evidently though very shortly styled, they betray affinity with *cinerea*. In the ♂ plant reliance can be placed only in the intermediate size of the catkins and nature of the scales, taken, of course, in combination with twig- and leaf-characters.

Whilst these points indicate generally what is to be expected in the hybrid, every specimen must be judged on its own merits, and due weight allowed to certain features indescribable, but yet easily recognized by the practiced eye.

In Britain I believe that *Salix lutescens* is not an uncommon plant. Though British authors seem to have overlooked the record, Wimmer, so far back as 1866, mentions that he had seen specimens from Coventry Park, Warwickshire, collected by T. Kirk and distributed as *S. cinerea* var. *oleifolia*, Sm. This record of Wimmer's is suggestive of what turns out to be really the case, that in British herbaria *S. lutescens* has often been named *S. cinerea* or *S. oleifolia*, or even *S. aquatica*. As has been mentioned under *S. cinerea*, several of Leefe's published specimens of this group must be referred to *S. lutescens*. Some of these were issued as *S. aquatica* or *S. oleifolia*; but I think that in Fasc. i. Nos. 40, 42, and 44 (all from Essex), and in Fasc. iv. No. 103 (from Northumberland), must be called more or less good *lutescens*, as is possibly also No. 41 (of Fasc. i.). As noted

also under *Salix cinerea*, Smith's own specimens of *S. oleifolia* are possibly hybrids of *aurita* and *cinerea*, but will have to be compared with authentic examples of *lutescens*.

In Perthshire, whilst, in several places, specimens of whose hybrid origin there is no doubt, and which show several gradations, occur, I have seen a number of others about which there is much uncertainty. In places where both *S. cinerea* and *S. aurita* grow, a number of intermediate forms can be obtained, but plants of what also appears to be *S. lutescens* occur along with *S. cinerea* only. These, however, grow on the banks of rivers, and it is probable that they have been brought thither by water. Along with them grow other plants which differ very slightly from true *cinerea* and which may be (though this requires proof) hybrids of *cinerea* with *lutescens*. In the meantime I prefer to consider them as untypical *cinerea*.

I have also seen specimens of *S. lutescens* from other parts of Britain, as, *e. g.*, from Primside Bog, Roxburgh (*A. Brotherston*), Thirsk, Yorkshire (*W. L. Notcutt*), Crabtree, Devon (*Archer Briggs*)—all labelled as *cinerea*; named *oleifolia*, Sm.—Thirsk, Yorkshire (*J. G. Baker*), *lutescens* on the *cinerea* side; Quintin Pool, Warwick (*T. Kirk*), very near *aurita*; named *aquativa*, Sm.—Falkenham, Norfolk (*W. L. Notcutt*); Hatton, Warwick (*R. Bromwich*); and Dorset (*Salter*). Other specimens, which I refer to *lutescens*, are from Caithness (*E. F. Linton*), Worcestershire (*R. F. Towndrow*), Kincardineshire (*Trail*), Clova, Forfarshire, and Derbyshire (*W. R. Linton*), and Surrey (*W. H. Beeby*).

It is probable, therefore, that *S. lutescens* is a species widely distributed in Britain. At the same time it may be somewhat local, since *S. cinerea* and *S. aurita*, though not unfrequently associated, seem to prefer habitats of a rather different nature—wet moorlands in the case of *aurita* and river-banks in that of *cinerea*. Wherever the two do grow in proximity (and such places occur in many districts) there *S. lutescens* should be looked for.

#### 7. SALIX CAPREA, L.

In the 'Monographia' Andersson described a number of forms of *S. Caprea*, most of which are not mentioned in the 'Prodromus,' nor does Wimmer name any varieties.

In Britain the species is, for a willow, so tolerably constant in its characters that it is not likely to be mistaken for any other.

At the same time it has a certain range of variation. The year-old twigs and the buds, which are normally glabrous, are not unfrequently slightly, and sometimes decidedly, pubescent; the leaves, while typically roundly-oval, vary both in size and shape, being sometimes oblong, and at others much attenuate at each end—this latter form being, perhaps, more frequently found in northern and mountainous districts; and the catkins, though usually sessile or subsessile, are not very rarely provided with a leafy peduncle. Of this latter form I have found some rather curious plants in Perthshire. These, in addition to having the rather smaller catkins (in both sexes) furnished with a conspicuously leafy peduncle, form dwarfer and more slender bushes than is usually the case with *Salix Caprea*, and are later in flowering. The leaves are, however, not dissimilar to the ordinary form of the plant, and hence are not referable to the modification or variety *S. sphacelata*, Sm.

*S. sphacelata*, Sm., is now considered to be a subalpine form of *S. Caprea*, though Wimmer, from the figure and description, thinks that it may be referable to *S. silesiaca*. As well as differences in the leaves, it is said to have smaller catkins than in *S. Caprea*; but, whilst for these reasons it seems to be a rather well-marked form, I have seen too few specimens to be able to come to an opinion about it. The examples in Smith's herbarium ("from Mr. E. Forster's garden") look to me somewhat like a hybrid between *S. Caprea* and *S. aurita*. So in some respects do specimens labelled "*Salix sphacelata*, Sm., Cult. Hort. Kew. J. G. Baker;" but these agree still better with Wimmer's specimens Coll. No. 185) of *S. Caprea-cinerea* (= *S. Reichardti*) and, at any rate, are not pure *S. Caprea*.

× *SALIX REICHARDTI*, A. Kern. (*S. Caprea* × *S. cinerea*.)

*S. Reichardti*, A. Kern. (*S. Caprea-cinerea*, Wimm.), is a hybrid between *S. Caprea* and *S. cinerea*, which, according to Wimmer, is—like other hybrids of this group—very difficult to recognize on account of the close affinity of its parents.

As in Britain both *S. Caprea* and *S. cinerea* are common species, the hybrid between them might be expected to occur not rarely; but such does not seem to be the case, perhaps because their habitats are not quite identical (*Caprea* being a chiefly woodland,

and *cinerea* a river-bank species), but more especially because their periods of flowering are not exactly synchronous.

At the same time I think that the hybrid does occur, since I have seen a few specimens which, if not to it, I know not where they belong.

In Perthshire I have found several plants which, though not good intermediate forms (some leaning to *Salix Caprea* and others to *S. cinerea*), I can refer only to *S. Reichardti*. Other specimens are from Fifeshire (in Edinburgh University Herbarium), Worcestershire (*R. F. Towndrow*), and Kent (*E. S. Marshall*). A plant from Kew Gardens, labelled *S. sphacelata*, Sm., seems also to belong here; and a leaf-specimen from the "towing-path near Kew, Surrey" (*E. De Crespigny*) has leaves which are quite intermediate between *S. Caprea* and *S. cinerea*.

As Wimmer indicates, it is very difficult to point out in words the characteristics of this hybrid; and unless the student knows well the essential features of *Caprea* and *cinerea*, he will scarcely succeed in recognizing it, but rather place it as belonging to one or other of its parents, between which, of course, the combinations may be various.

On account of the plate in *Sal. Wob.* (t. 127) and Döll's opinion regarding *Eng. Bot.* t. 1437, Wimmer thinks that *S. aquatica*, Sm., is a synonym of his *S. Caprea-cinerea*; but, as pointed out under *S. cinerea*, I am inclined to believe that *aquatica* is a hybrid of *aurita* with probably *S. Caprea*.

× *SALIX CAPREOLA*, *J. Kern.* (*S. Caprea* × *S. aurita*.)

What has been said regarding the difficulty of identifying the hybrids of *S. Caprea* with *S. cinerea*, applies with nearly equal force to the hybrids of *S. Caprea* and *S. aurita*. Like the former they, too, are not of common occurrence, since the periods of flowering of the species are not quite identical.

In a locality near Perth, where *S. Caprea*, *S. aurita*, and *S. cinerea*, as well as the hybrid between the two latter, occur together, I have found some plants which I believe are *S. capreola*, though of different forms and not quite like any of Wimmer's published specimens. One has slender branches resembling those of *S. aurita*; leaves thin, intermediate between *S. Caprea* and *S. aurita*, and not unlike the *Sal. Wob.* figure of *S. aquatica*; catkins (♀) large; capsules subulate from a broad base, with a short

style and very short erect stigmas. Though apparently a hybrid of *Salix Caprea* with *S. aurita*, it is just possible that it may be with *S. lutescens* (= *cinerea* × *aurita*)—which is common in the same locality—from certain points of resemblance which it has to *S. cinerea*. Another plant from the same place is a rather different form. The slender *aurita*-like twigs are more pubescent (in some of Wimmer's examples they are pubescent); leaves more obovate in shape, near *aurita*, but with some trace of *S. Caprea* in them; catkins (♀) near *aurita*, but with black-tipped scales; capsules distinctly styled, stigmas longer and not so constantly erect. In Worcestershire Mr. R. F. Towndrow has found, along with less well-marked forms, one bush which is a very pretty condition of *capreola*, and notable for the distinctness with which it exhibits its hybrid origin. The catkins (♀) are in facies like those of *aurita*, but the ovaries are more subulate, the style more evident though very short, and the stigmas longer; the twigs are those of *aurita*, but the leaves are nearly intermediate, leaning a little to the *Caprea* side. Still another form is presented by plants collected at Clevedon, N. Somerset, by Mr. J. W. White and labelled *S. aquatica*. Of the parentage of these there seems to be little doubt. The connection with *aurita* is shown by the slender twigs, the shape in some degree of the leaves, and very short stigmas; while from *Caprea* has been derived the larger catkins (♀), the short but distinct style, the pubescence, veining, and, to some extent, the shape of the leaves. In the ♂ plant the only catkin which I have seen (of these Somerset specimens) is nearer that of *aurita*. A willow (♀) from Trysall has narrower leaves than those just mentioned, but seems to be another form of *capreola*. In addition to these I have seen more or less satisfactory examples from Derbyshire (*W. R. Linton*), Surrey (*W. H. Beeby*), and Kent (*E. S. Marshall*).

A puzzling plant from Hurstpierpoint, Sussex (*F. A. Hanbury*), must also be referred to this hybrid. It has slender glabrous twigs, intermediate in character; leaves (rather young) also intermediate, but not distinctly recalling either *aurita* or *Caprea*; catkins (rather old) larger than *aurita*; scales of *aurita*; capsules small and shortly styled.

Still another form occurs on rocks on the west bank of the river Naver, Sutherland (*F. J. Hanbury*), which, though most probably *Salix capreola*, must, as it has no flowers, remain at present a little doubtful. The facies of the plant is that of a

small form of *Salix Caprea*; but the leaves are obovate, conspicuously stipuled, rather rugose, and not so pubescent as in *Caprea*.

Much resembling this last are specimens, also flowerless, from Glen Dole, Clova (*B. Daydon Jackson*). Their leaves are much like some of Wimmer's specimens, but in the absence of catkins it is impossible to say whether the plant is *S. capreola* or a variety of *S. Caprea*.

The probable identity of Smith's specimens of *S. aquatica* with *aurita* × *Caprea* has been already mentioned under *S. cinerea*, and I rather suspect that Leefe's No. 38 (Fasc. i. "*S. cinerea* var.  $\beta$ , Koch; *S. aquatica*, Sm."), from Yorkshire, is possibly another form. Andersson thought that in the leaves at least the relationship of this specimen was with *S. laurina* (= *Caprea* × *phylicifolia*), but from this opinion Ward (who collected the plant) strongly dissented. The plant is a very puzzling one, but, from the shape and veining of the leaves and the pubescence of the younger ones (the older being subglabrous), it may possibly be *Caprea* × *aurita*. The catkins ( $\sigma$ ) are large and not much is to be learned from them.

In continental Europe *S. capreola*, like *S. Reichardtii*, is not a common species. Wimmer, who describes five forms, attributes to it a wider range of variation than does Andersson, and from its hybrid origin this it should naturally present. Like other hybrids, its characters consist in a combination of those of its parents; and as these are more or less variable, so also will be the resulting combination. Each specimen, therefore, which is supposed to belong to *S. capreola* must be judged on its own merits.

## Group 5. REPENTES.

### 8. SALIX REPENS, L.

*S. repens* is one of the most variable, in all its parts, of European willows, and hence several species were made out of it by the earlier salicologists. These supposed species were soon reduced to the rank of varieties; but even as such they cannot be retained, since none of their characters are to be relied on. It is, of course, possible to find specimens which agree with the descriptions; but, on the other hand, many examples combine in themselves the characteristics of several forms, and cannot be satisfactorily referred to one more than to another.

As principal modifications Wimmer gives a. *argentea*, b. *fusca*,

*e. vulgaris*, and *d. rosmarinifolia*, Koch (*non* L.). Andersson, who started in the 'Monographia' with three chief forms (*repens*, *fusca*, and *arenaria*) and one subspecies (*Salix rosmarinifolia*, L.), maintains in the 'Prodromus' the latter only, and that as a variety, distinguished by its globose catkins and much longer linear leaves. It is doubtful, however, whether it deserves special mention, though in its extreme condition it is well marked. But be that as it may, the *S. rosmarinifolia* of British lists requires some notice. This made its first appearance in British books in Hudson's 'Flora Anglica,' 1762. Hudson quotes as a synonym "*Salix pumila Rhamni secundi Clusii folio*, *R. Syn.* 447," in citing which he is followed by Smith ('English Flora'), who, however, gives as the authority for that description "Dill. in Raii Syn. 447," and says of the plant, "Found by J. Sherard. Dill." Though Hudson gives no locality for his plant beyond "Habitat in montosis udibus," it seems probable that both Hudson's and Smith's records are founded upon Sherard's specimen in the Dillenian herbarium; but Smith says that it was also "sent by Mr. Dickson, probably from Scotland, to Mr. Crowe." Since Smith's time *S. rosmarinifolia* has continued to appear in our books, as, for example, in Hooker's 'British Flora,' ed. 4, 1838, and Hooker and Arnott's 'British Flora,' ed. 8, 1860—in both of which Sherard and Dickson are recorded as the only finders; Babington's 'Manual,' ed. 8, 1881, where "S. ?" is given as the distribution; and Hooker's 'Student's Flora,' ed. 3, 1884, in which it is placed as a form of *S. repens*, "said to have been found in the last century by Sherard in bogs in Scotland," "Sherard" being evidently a slip of the pen for "Dickson." In addition to the descriptions the plant has been figured in *Eng. Bot.* t. 1365 and *Sal. Wob.* t. 87; and *Eng. Bot.* t. 1366 and *Sal. Wob.* t. 86 have been supposed to represent a variety of it. Moreover, specimens have been published by Leefe, namely *Sal. Exs.* i. No. 19, "*Salix rosmarinifolia*, L., E. B. t. 1365," "Received from Mr. Borrer many years ago, but not as a British species," and No. 24, "*Salix rosmarinifolia*, L., *S. Arbuscula*, Forbes, *Sal. Wob.* t. 86."

Through the kindness of Mr. G. C. Druce, I have been able to examine the willows of the Dillenian Herbarium. In it the "*Salix pumila Rhamni secundi Clusii folio*," Ray Syn. 447. n. 2, "found amongst Mr. J. Sherard's plants, the place not named," is a very bad specimen with old ♀ catkins and young leaves.

Though the leaves are rather narrower and more crowded than is usually the case, there seems to be no doubt but that the specimen belongs to *Salix viminalis*. Mr. Druce thinks that another willow in the same herbarium—the "*Salix pumila angustifolia inferne lanuginosa*" (J. Bauhin) Ray Syn. 447. 2—was also referred by Smith to *S. rosmarinifolia*. In this case the plant is *S. repens*.

As to the *S. rosmarinifolia* of Linné, salicologists differ in opinion. Andersson considered that it was the above-mentioned narrow-leaved and globose-catkined form of *S. repens*, and I am inclined to agree with him. Wimmer, on the other hand, believed it to be the hybrid between *S. repens* and *S. viminalis* (*S. viminalis-repens*, Lasch, *S. Friesiana*, And.). Wimmer referred *E. B. t. 1365* (*S. rosmarinifolia*, "Linn.," Koch, Boswell-Syme) and *Sal. Wob. t. 87* (*S. rosmarinifolia*, Sm.) to *S. viminalis-repens*, and by the evidence afforded by Leefe's specimens (*Sal. Exs. i. No. 19*) mentioned above, Wimmer's identification seems to be correct. The other plates, *Eng. Bot. t. 1366* and *Sal. Wob. t. 86* (*S. Arbuscula*, Sm. not L.), appear to represent the form *rosmarinifolia* of *S. repens*, as do Leefe's specimens No. 24, for which he quotes *Sal. Wob. t. 86*. Boswell-Syme called *Eng. Bot. t. 1366* "*S. rosmarinifolia* var. *angustifolia*, Wulf.;" but Wulfen's *S. angustifolia* is merely a synonym of the *rosmarinifolia* form of *repens*. In Smith's herbarium the specimen labelled "*S. Arbuscula*, Fl. Brit., Mr. Crowe's Garden, 1804," seems to be the same thing. To which of the forms Dickson's plant "sent to Mr. Crowe" belonged it is now impossible to say; but I suspect that from what Forbes, W. J. Hooker, Borrer, and Walker-Arnott say regarding the close affinity of *rosmarinifolia*, Sm., and *Arbuscula*, Sm., it was probably a *repens* form.

I think that in the meantime neither *S. repens* f. *rosmarinifolia* nor *S. viminalis-repens* can be admitted to a place in the British Flora.

In Linné's herbarium an example, labelled "22 *incubacea*" by Linné himself, and, in an unknown hand, "*Salix latifolia* minor, C. B. 474," is a slender straight-branched *repens* with oblong straight-pointed leaves moderately pubescent below. Some authors have referred *S. incubacea*, L., to *S. repens* × *aurita*, and others to *S. repens* × *viminalis*.

It remains to be noticed that the specimens of Leefe's *Sal. Exs. i. No. 11*, "*S. fusca*, L., var. *parvifolia*, E. Bot. t. 1961 ?; *Salict. Wob. 81*," with the remark "This is remarkably devoid of the

silky pubescence characteristic of its tribe\*. Received from Mr. Darwell, to whom it was sent by the late Mr. Forbes," certainly belong to *Salix Arbuscula*, L. *Sal. Wob.* t. 81 is, as regards the ♂ plant, in agreement with Leefe's specimens; but the ♀ plant figured is doubtful, and is more like *S. repens*. *Sal. Wob.* t. 80 (*S. ascendens*, Sm.) is also probably *S. Arbuscula*, L. The *Eng. Bot.* figures, however, represent *S. repens*.

Under *S. repens* must be placed, in the meantime at least, a willow in Mr. F. J. Hanbury's "Boswell herbarium" labelled "*Salix fusca*, Mullaghmore, Co. Sligo, J. B. Syme, 1840." The specimens are old and not in first-rate condition. The leaves are elliptic in shape, and hence not dissimilar to some forms of *repens*, but of a rather paler green and, almost from the first, glabrous both above and below, though some of the young leaves are densely silky and all are more or less ciliate on the entire margin. The catkins (♀) have leafy peduncles (whose leaves have buds in their axils) from  $\frac{1}{2}$  to 1 inch in length; the capsules are moderately hairy, pedicellate, acute, with (compared with ordinary *repens*) remarkably long and slender styles. The specimens much resemble Wimmer's specimens (*Coll.* No. 254) of *S. repens-myrtilloides*, Wimm. (*S. Aurora*, Læstad., *S. finmarchica*, Willd.), though not identical with them. Koch makes *S. finmarchica*, Willd., a variety (*ε. finmarchica*) of *S. repens*, with glabrous leaves, the young ones silky, and glabrous capsules. It is much to be desired that this plant could be rediscovered, as it deserves further study.

× *SALIX AMBIGUA*, Ehrh. (*S. repens* × *S. aurita*.)

*S. ambigua*, beyond doubt a hybrid of *S. repens* with *S. aurita*, is, according to Wimmer, the most frequent of all the hybrid willows.

In *Eng. Bot.* (3rd ed.) four varieties are enumerated, viz. :—*a. genuina*, *β. major*, *γ. spathulata* (Willd.), and *δ. undulata*. Wimmer mentions two forms (in addition to the more typical state), *β. microphylla* and *γ. longifolia*; and Andersson gives two modifications, 1. *S. spathulata*, Willd. (more related to *S. aurita*), and 2. *S. plicata*, Fr. (nearer *S. repens*). By Wimmer *S. spathulata*, Willd., is considered to be a synonym of *S. aurita*.

\* Although, perhaps, most usually pubescent, *S. repens* is not invariably so. I have found plants quite destitute of pubescence, but which, under cultivation, became more or less hairy.

Just as in other hybrids a number of specimens will not fit the varieties defined by botanists, but present intermediate characters, so in *Salix ambigua* there is a continuous series of forms stretching from *S. aurita* to *S. repens*, and showing various degrees of combination of the characters of the two species. Hence, as it is impossible to say of all examples to which variety they should be placed, the expediency of retaining any varietal names seems doubtful.

In Britain the distribution of *S. ambigua* is not well worked out, nor does the plant seem to be thoroughly understood. Though possibly not abundant, it probably occurs wherever *S. aurita* and *S. repens* grow at all commonly together, and as these species have been found almost throughout Britain, are very frequently associated, and flower at the same time, it is likely that *S. ambigua* has a wide distribution. It can often be recognized by the leaves alone, but most easily when these are intermediate. In less intermediate forms the greater silkiness of the pubescence serves to distinguish it from *S. aurita*, and the greater rugosity of the surfaces and less silky pubescence from *S. repens*.

× SALIX CINEREA-REPENS, *Wimm.* (*S. repens* × *S. cinerea*.)

A willow found by Mr. F. J. Hanbury on sea-cliffs near Melvich, in Sutherlandshire, July 1886, has such a strong resemblance to *S. repens* that it might well be passed over as a curious variety of that species. The pubescence of the leaves is, however, different, being less silky and more crisped; the leaves are more uniformly larger, as, perhaps, are also the catkins, and thus it appears to be a hybrid of *S. repens* with one of the *Capreæ*. The smoothness of the leaves indicates that *S. aurita* is not one of the parents, and their resemblance to one specimen in Wimmer's examples (*Coll.* No. 245) of *S. cinerea-repens* suggests the probable parentage. These Melvich specimens are, however, nearer *S. repens* than most of Wimmer's. If more adult specimens as regards the leaves, and less mature as regards the catkins (♀) could be obtained, they might very probably show greater differences from *S. repens*. At the same time the plant appears to be, with little doubt, *S. cinerea-repens*, *Wimm.*

A specimen (in Mr. A. Bennett's herbarium) from Holme Fen, Hunts (where *cinerea* and *repens* are the "most frequent willows"), probably also belongs here, though nearer *repens*. Though

I have little doubt regarding it, yet the specimen is too poor for absolute certainty, and is mentioned merely to call attention to the probable occurrence of the hybrid.

A leaf-specimen of a willow from Clova (*W. R. Linton*) is also perhaps an example of this hybrid.

× *SALIX CAPREA-REPENS*, *Lasch.* (*S. repens* × *S. Caprea.*)

Very closely related to the last (and with it to *S. ambigua*, of which, indeed, Andersson is inclined to think they are both forms) is the hybrid between *S. repens* and *S. Caprea*. To it I think belong two plants found by the Messrs. Linton on the cliffs at Armadale, Sutherlandshire. Unfortunately there are no flowers on either of the specimens, and till these are seen there must remain a little doubt\*. One of these specimens agrees with authentic specimens of *S. Caprea-repens* from Sweden, and is a fairly intermediate form. The other, whilst evidently belonging to the same hybrid, is, in the greater silkiness of the pubescence, rather nearer *repens*. Whilst these are undoubted hybrids of *repens*, the general facies and veining, pubescence, and colour of the leaves points to *Caprea* rather than *cinerea* or *aurita* being one of the parents, and therefore I give it a place in the list.

× *SALIX NIGRICANS-REPENS*, *Heidenr.* (*S. repens* × *S. nigricans.*)

Wimmer describes this hybrid from specimens sent to him by Heidenreich (who found two ♂ bushes near Tilsit, in Prussia), and compares it with *S. ambigua*. From that species it may be distinguished by the dull green of the leaves as contrasted with the grey colour of those of *S. ambigua*, which are moreover wrinkled.

Some willows found on the banks of the Tay above Dunkeld by Mr. C. M'Intosh, and on the banks of the Garry, near Blair Athole, by myself, though not very like the only specimen of Heidenreich's which I have seen, evidently belong to a hybrid between *S. repens* and *S. nigricans*.

The specimens before me include both ♂ and ♀, and show much the same characters. In all respects they are intermediate

\* Since this was written I have seen a ♀ catkin grown by the Rev. W. F. Linton on a cutting of the better-marked of the two plants. This, while it has a considerable proportion of *S. repens* in it, has also part of its characters from *S. Caprea*, and tends to confirm the opinion I had already formed.

between their parents, though the leaves are suggestive of *Salix nigricans* rather than of *S. repens*. The ♂ catkins are stouter than in *repens*, but smaller than in *nigricans*, the filaments slightly hairy at the base as in the latter, and the anthers with a tendency to become fuscous after the shedding of the pollen, as in the former. The ♀ catkins are rather slender and, like the ♂, furnished with leafy peduncles; the remarkably slender young ovaries are glabrous or slightly silky towards the top, which passes gradually into the rather short style; the stigmas are short and resemble those of *repens*. The leaves in shape are not unlike some of the forms of *repens*, and are uniformly small, oval in outline, closely and finely crenate-serrate on the margin, the short tips straight or twisted, the upper surface with adpressed hairs, and the underside—especially of the younger leaves—densely covered with a silvery silk-woolly pubescence. The branches are rather flexuous, but more divaricate than is usual in *repens*, at first pubescent, afterwards glabrous and shining, and reddish- or yellowish-brown in colour.

It is possible that a hybrid between *S. repens* and *S. phyllicifolia* (= *S. Schraderiana*, Willd., which is known only as a cultivated plant) also occurs in Britain; but more specimens must be seen before it can be recorded.

#### Group 6. PHYLICIFOLIE.

The British plants of this group are *S. phyllicifolia*, *S. nigricans*, *S. Arbuscula*, and several hybrids of these with other willows. In discussing the group, the first point to be considered is the very difficult question of the rank as species of *S. nigricans* and *S. phyllicifolia*.

All authors are agreed as to the intimate alliance of these two forms, but no recent botanist, with the exception of Bentham, has ventured to unite them, though some have expressed their doubts regarding the specific distinctness. On the contrary, they have laboured to discover points of distinction which would, at all times, serve for the determination of these willows. Unfortunately, however, for the student, these supposed distinctive characters are not always assigned to the same species, and,

moreover, they are occasionally not in accordance with the authors' own diagnoses.

In their extreme forms *Salix phylicifolia* and *S. nigricans* can be separated without any difficulty, but a by no means inconsiderable number of examples exhibit such a combination of the characteristics of each, that it is impossible to determine under which name they should be placed. It may be the case that these perplexing forms are, as some authors suppose, hybrids between two distinct species; but, in view of the polymorphic nature of both *S. phylicifolia* and *S. nigricans*, it seems more probable that they are only intermediates which connect the extremes of one most variable willow. Adopting this view, I combine them under the name of *S. phylicifolia*, L., which seems to have originally included both.

#### 9. SALIX PHYLICIFOLIA, L.

Whilst adopting the Linnean name for the series of European species which have been made out of *S. phylicifolia*, two subspecies or major varieties, namely  $\alpha$ . *S. phylicifolia*, L., Auct., and  $\beta$ . *S. nigricans*, Sm., should be distinguished.

The chief distinctions between *phylicifolia* and *nigricans* lie in the leaves and twigs. In *S. phylicifolia* the leaves are thicker and of a firmer texture, of a brighter and more shining green on the upper surface and often more glaucous below; whilst in *nigricans* they are thinner, less compact in substance, of a duller green and less shining above, and usually less brightly glaucous below—in both forms the underside may be green. *S. nigricans* has also a greater tendency to turn black in drying, but this is by no means invariable, and is of no real value as a characteristic, since some *nigricans* forms do not change colour and others appear to do so always.

The leaves of *S. phylicifolia* are not only less pubescent (sometimes, indeed, perfectly glabrous), with the pubescence quite or nearly disappearing at an earlier stage of their growth, but the hairs are usually—not always, perhaps—of a different character from those of *nigricans*. In *S. phylicifolia* the hairs are rather stouter, shorter, and straighter, somewhat shining, and, though mostly white in colour, have a mixture of bright red-brown ones. In *nigricans* the hairs, which are more numerous and sometimes

very abundant, are softer, duller-coloured, longer, more slender and less rigid, and (always?) unicolorously whitish.

As regards the twigs, the youngest—in both forms—are somewhat pubescent, but more constantly and decidedly in *Salix nigricans* than in *S. phylicifolia*; and whilst in the latter they are soon glabrous and shining, in the former they frequently remain downy and dull.

In the organs of fructification there seem to be no sufficiently constant differences.

But, as already mentioned, there are a considerable number of examples which show a greater or less combination of the characters just described. In some the affinity with *S. phylicifolia* is exhibited by the more slender, brighter-coloured, and glabrous twigs; in others it is these parts only which retain the resemblance to *S. nigricans*. In intermediate forms the twigs are usually more *phylicifolia*-like, the leaves thick and firm, shining above, but less brightly green than in *phylicifolia*, somewhat, but not very, pubescent below, and with the shining and coloured hairs of *phylicifolia* mingled with the duller and softer pubescence of *nigricans*.

Wimmer and others have considered these forms to be hybrids between *phylicifolia* and *nigricans*, and have distinguished them by the name of *S. phylicifolia-nigricans*, Wimm. It may be that Wimmer's views are correct, and that these are really hybrid forms. I am inclined, however, to think that they are only the intermediate conditions of one species; and if this is the case one name only—*S. phylicifolia*—must be retained, to the exclusion of *S. nigricans* and *S. phylicifolia-nigricans* even as varieties. But since the general concensus of opinion seems to be in favour of keeping *nigricans* as a form distinct from *phylicifolia*, it will be expedient, *in the meantime*, to distinguish by Wimmer's name, though not in his sense, the intermediate forms, and to use the designation *S. phylicifolia-nigricans* for those examples which show a combination of the characters of *phylicifolia* and *nigricans*.

Having thus indicated the characteristics of the three forms which I have united under *S. phylicifolia*, some of the British varieties which were ascribed to each when they were treated as distinct species must be noticed.

Of both *S. phylicifolia* and *S. nigricans* a considerable number of named forms—once supposed to be distinct species—are

retained in the British list. The characteristics of these consist in the shape of the leaves and in the amount of pubescence on the capsule and its stalk. An examination, however, of any considerable number of specimens will show that not only may the leaf-characters of one variety and the capsule-characters of another be present in one and the same specimen, but that both downy and glabrous capsules may occur in the same catkin. Leefe also has pointed out that under cultivation a smooth capsule may become pubescent.

Whilst there is probably no doubt that the plants on which the supposed species or varieties were originally founded showed considerable distinctness, their characters are those of individuals, and these almost all cultivated specimens. Moreover, quite different forms have not only been called by the same name by botanists who are supposed to have known the varieties, but have been figured and described. Since, then, these varieties do not exist in nature as constantly distinct entities, the varietal names can be no longer retained.

Of the varieties ascribed to *Salix phylicifolia*, one or two may be noticed more specially.

*S. tetrapla*, Walker, being, according to Wimmer, the same as his *S. phylicifolia-nigricans*, has been considered by some authors to be, if not a hybrid, a connecting-link between *phylicifolia* and *nigricans*. But, as Wimmer himself points out, his specimens (received from the Berlin Botanic Garden) do not agree with the English figures. Leefe's specimens (*Sal. Exs.* i. No. 8), "received from Mr. Borrer as the plant of Walker," differ from Wimmer's, and agree with *Sal. Wob.* t. 49, and appear, without doubt, to belong to  $\alpha$ . *S. phylicifolia*. Hence Wimmer's determination (and the theories founded on it) of *S. tetrapla*, Walker, must be considered as erroneous, though his specimens seem probably referable to *S. phylicifolia-nigricans*.

*S. Croweana*, Sm.—It is probable that under this name two plants are confounded—one an abnormal condition of *phylicifolia*, the other a hybrid of that species with *S. purpurea*. The essential characteristic is the combination of the filaments of the stamens for a greater or less part of their length, as in *S. rubra*. But the union of stamens may originate in two ways—one normally, by hybridization with the *Salices Synandræ*; the other abnormally, by cladostemmy. In the latter the branches of the filament are said to form an obtuse angle, in the former an acute

one. From Smith's specimens, and from the drawings, the combined filaments of *Salix Croweana* form acute angles, and hence are not strictly cladostemmic as that term is defined by Wimmer. From, however, the further abnormal development (as described and figured by Forbes, t. 52, and shown by specimens published by Leefe and Ward), when the stamens become changed into imperfect ovaries, it seems probable that, as Borrer thought, the connate filaments of Smith's *Croweana* were "but an accidental monstrosity." As such most of the specimens named *Croweana* must be considered, though some plants so called are *phyllicifolia* without any deformity. Besides these, however, I have seen specimens of two plants which have been referred to *Croweana*, but which apparently derive their connate filaments from the hybridization of *phyllicifolia* with *purpurea*. Since, however, these specimens are imperfect—having no mature leaves—and are, besides, not of certain British origin, it is unnecessary to say more about them on the present occasion.

*S. Dicksoniana*.—According to Leefe, the original *Dicksoniana*, the plant described by Smith, "must be regarded as at present unknown." Leefe refers his published specimens (*Sal. Exs.* i. No. 12) "received from Mr. Borrer as from Smith" to *S. Dicksoniana*, Forbes, t. 55, fig. 1, which they seem to be. Forbes himself had doubts as to his plant being the same as Smith's, but apparently was not satisfied that it was distinct. Forbes's figure has been sometimes referred to *S. nigricans*, to which it has some resemblance in the leaves; but Wimmer points out its likeness to plants intermediate between *S. nigricans* and *S. livida*. Andersson cites *Eng. Bot.* t. 1390 under *S. phyllicifolia*, but does not mention *Sal. Wob.* t. 55, except amongst the synonyms. All the specimens I have seen are cultivated ones, and probably from Borrer's plant. It is much to be desired that the form could be rediscovered in a wild state. In the meantime, judging from the cultivated examples, I strongly suspect that *S. Dicksoniana* is a hybrid between *S. phyllicifolia* and *S. Arbuscula*, since in its characters it is almost intermediate between the two.

Wimmer does not distinguish by name any varieties of *S. phyllicifolia*, but Andersson, in the 'Prodomus,' mentions two, which in the 'Monographia' are treated as subspecies. These are *S. Hegetschweileri*, Heer, supposed by Wimmer to be a hybrid of *S. phyllicifolia* and *S. hastata*, and *S. rhætica*, Kern., which is described as a form of *S. phyllicifolia* approaching *S. Arbuscula*.

It remains to be noticed that Wimmer, adopting the opinion that the Linnean *Salix phylicifolia* is doubtful, uses the name *Weigeliana*, Willd. The specimen in the Linnean Herbarium labelled by Linné "4. *phylicifolia*," though perhaps nearer the *phylicifolia* of modern authors than it is to *S. nigricans*, is, on the whole, rather doubtful.

We must now pass on to the varieties of  $\beta$ . *S. nigricans*, Sm., which is one of the, if not *the*, most polymorphic of all Willows. On its modifications upwards of one hundred supposed species have been founded, eight of which are still retained, though as varieties only, in British lists. For the reasons already given, it is impossible to maintain these, though it is just possible that one or two of the mountain forms may yet be shown to have some claims to distinctness (as varieties) by their greater constancy of characters.

Judging from the specimens published by Wimmer, Kerner, Billot, Reichenbach, &c., the Continental *S. nigricans* frequently differs less from *S. phylicifolia* than does the British plant. Many of these published examples have rather slender, glabrous or nearly glabrous, shining, chestnut-coloured twigs; and are distinguished from *phylicifolia* only by the thinner leaves, if even by that. It is not wonderful, therefore, that Andersson and others have spoken of the extreme difficulty with which the two "species" can be separated.

Andersson, following Fries, gives two chief modifications of *nigricans*:— $\alpha$ . *borealis* (*S. borealis*, Fr.) and  $\beta$ . *protea* (*S. campestris*, Fr.). *S. borealis* is a big bush or small tree, with stouter branches, more downy twigs, larger leaves, and larger catkins, with a leafy peduncle. *S. protea* is a smaller bush, with thinner leaves and subsessile catkins. I have not seen authentic specimens; but, judging from the descriptions, both forms, as well as intermediates, occur in Britain. In connection with this matter, that which has been said above with regard to the nature of the British *nigricans* as compared with the published Continental examples may be kept in mind.

Wimmer mentions two varieties— $\beta$ . *borealis*, Fr., and  $\gamma$ . *macrophylla*, Hartig (with large glabrous leaves)—and notices a number of special forms, which, however, can scarcely be identified without named examples.

$\gamma$ . *S. phylicifolia-nigricans*.—This name (afterwards altered to

*Salix nigricans-Weigelia*) is that under which Wimmer describes the plant he received as *S. tetrapla*, Walker, but which, as already mentioned, appears not to be the true *S. tetrapla*. Wimmer's plants, he thinks, were originally from Britain; and the only habitat he gives for the supposed hybrid is Scotland. Under this name I place all the specimens which cannot be referred positively to *phylicifolia* or to *nigricans*. Such examples, though less common than those which can be referred without doubt, are not rarely to be met with, and in a few places are more abundant than either *phylicifolia* or *nigricans*.

Andersson does not admit that there is any certain hybrid between *S. phylicifolia* and *S. nigricans*, and prefers to consider certain forms, which have been supposed to be hybrids, to be rather modifications of *phylicifolia* approaching *nigricans*, or of *nigricans* approaching *phylicifolia*.

#### *The Hybrids between the Phylicifoliæ and the Capreæ.*

Since in many parts of Britain species of the *Phylicifoliæ* and *Capreæ* groups frequently grow together, and their periods of flowering overlap, hybrid forms occasionally occur. It is not usually difficult to recognize these as hybrids, but it is not always easy to determine the exact parentage.

Having reduced *S. nigricans* and *S. phylicifolia* to the rank of subspecies or major varieties of one willow, the number of the hybrid forms ought perhaps to be likewise reduced; but since the *nigricans*, or the *phylicifolia*, element in the compound is often distinctly marked, it seems expedient to keep their hybrids separate.

In their most intermediate forms the hybrids of this group show such a combination of the characters of their parents that their compound origin is at once evident; but, as usual, there are other forms which are not so easily recognized and are still more difficult to describe. The most certain character perhaps is in the structure of the style and stigmas—smaller than in the *Phylicifoliæ*, and larger than in the *Capreæ*; but there are also usually other good characters in the catkins and in the leaves.

Whilst in most cases, though by no means in all, it is possible to decide whether it is *nigricans* or *phylicifolia* that is one of the parents, there is often a very considerable difficulty in determining which of the *Capreæ* is the other, and more especially in those forms where the latter element is the less predominant one.

Consequently the proper position of a number of specimens must remain doubtful.

That *Salix nigricans* hybridizes with *Caprea* and *cinerea* is admitted by all salicologists; but hybrids with *aurita* have been denied by some, though it seems certain that they exist. Since, then, *nigricans* crosses with these three *Capreae*, it seems but reasonable to suppose that *phylicifolia* should form analogous hybrids. Salicologists, however, allow only one such compound namely with *Caprea*. There occur in Britain, however, some willows which seem to show more or less distinctly the hybridization of *phylicifolia* with *cinerea* and *aurita*.

× SALIX LAURINA, Sm. (*S. phylicifolia* × *S. Caprea*.)

× SALIX WARDIANA (Leefe, MS.), n. hybr. (*S. phylicifolia* × *S. cinerea*.)

× SALIX LUDIFICANS, n. hybr. (*S. phylicifolia* × *S. aurita*.)

× SALIX TEPHROCARPA, Wimm. (*S. phylicifolia* × *S. cinerea* × *S. Caprea*.)

× *Salix laurina*.

Regarding the position and limits of *S. laurina*, there has been much disparity of opinion. Whilst Borrer and W. J. Hooker thought that it was very distinct, Walker-Arnett was inclined to believe that it connects *S. nigricans* and *S. phylicifolia*, and that *S. tenuior*, Borr., and *S. tenuifolia*, Sm., were synonyms and varieties of it. Leefe thought that it could not be satisfactorily distinguished from *S. phylicifolia*, of which species Babington considers it as a variety. Boswell-Syme gives it as intermediate, and J. D. Hooker as a hybrid between *S. phylicifolia* and *S. Caprea*.

Andersson and Wimmer, on the other hand, have no doubt that it is a hybrid between *phylicifolia* and *Caprea*; though Wimmer says that, on account of the uniformity of the specimens which he had seen from various parts of Continental Europe, it is a question whether it should not be considered to be a distinct species, and not a hybrid. This constancy of form, he thinks, is due, however, to the fact that probably all the specimens have been cultivated from an English stock. I have seen too few European examples to venture to endorse Wimmer's opinion; but the British plants which have been referred to *S. laurina* are by no means uniform in their characters; and to this is probably due the differences of opinion amongst British botanists. This

absence of uniformity, moreover, arises from the fact that two, if not three, different hybrids have been confounded under the name of *Salix laurina*, Sm.

Adopting Andersson's view that *S. laurina*, Sm., is a hybrid between *phylicifolia* and *Caprea*, the figure in *Eng. Bot.* t. 1806, the description in the third edition of that work, and the specimens published by Wimmer (*Coll.* no. 90) and Reichenbach (no. 2417) may be cited as illustrating the characters of the species\*. In most respects it very greatly resembles *S. phylicifolia* (with which, Andersson says, it has often been confounded), but shows its relationship to *S. Caprea*, not only in the structure of the ♀ catkins (the ♂ is unknown), but in the subarborescent growth, and in the size (and pubescence when it is present) of the leaves.

From the resemblance of the leaves, *S. laxiflora*, Borr., has been referred to *S. laurina* (as, *e. g.*, in the 'Student's Flora,' and, with some doubt, by Andersson); and it is possible that it may be a state much nearer *S. phylicifolia*, though from the structure of the flowers it is more probably a form only of that species.

#### × *Salix Wardiana*.

In addition to plants which agree with *S. laurina*, Sm., as indicated above, others have been published which, while evidently closely related to them, seem to show affinity with *S. cinerea* rather than with *S. Caprea*.

Amongst these are several published by Leefe, including that "received from Mr. Borrer many years ago as the plant of Smith" (*Fasc.* ii. No. 38), as well as the following:—

*Sal. Brit.* No. 43, found near Richmond, Yorkshire, by Ward, and labelled "I should refer it to *aquatica*. Borrer." Of this Andersson said "Mihi *S. laurina* forma;" and Leefe and Ward thought this a better verdict than Borrer's. The same plant was published in *Sal. Ews.* iii. No. 60, as *S. phylicifolia*, "*S. laurina*, Sm., proxima," with the remark that, though desiring to call it after the dis-

\* *Eng. Bot.* t. 1806 is cited by Smith under *S. bicolor*, Ehrh. (of which he makes *S. laurina* a synonym); but *S. bicolor*, Ehrh., is only *S. phylicifolia*. *S. bicolor*, Forbes, t. 38, though it has Smith's description of his *bicolor* (*laurina*) appended, seems to be a different plant; and Wimmer thinks that it represents *phylicifolia*, though the style is rather short.

coverer, Mr. Ward, he (Leefe) feared that it could not be satisfactorily distinguished from *Salix laurina*. Specimens seem also to have been afterwards distributed with the MS. name "*S. Wardiana*."

*Sal. Exs.* i. "No. 3. *S. laurina*, Sm.," "sent me under the name of *S. myricoides*."

*Sal. Exs.* iii. "No. 62. *S. phyllicifolia*." "*S. laurina*, Sm., proxima." "This connects No. 60 with *S. laurina*, Sm., No. 38, and *S. myricoides*, No. 3." \*

That these specimens have a similarity to each other may be gathered from Leefe's remark on the last (*Sal. Exs.* iii. No. 62), and that they also bear resemblance to *S. cinerea*, Borrer's note on No. 43 suggestively indicates; though how that acute salicologist could refer the catkins to that species is rather puzzling.

Leefe's specimens are all much nearer to *S. phyllicifolia* than to *S. cinerea*; but in Perthshire I have found several willows which complete the transition from one species to the other; and it is probable that a search in the localities whence Leefe's specimens came would reveal similar intermediate forms. The Perthshire specimens show much greater resemblance to *cinerea* than to *phyllicifolia*; but that they are hybrids of *cinerea* with one of the *Phyllicifoliæ* is demonstrated by the evident style, while the general glabrosity of the twigs, and to some extent of the leaves, indicates that *phyllicifolia* rather than *nigricans* is the parent.

Compared with the true *S. laurina*, this hybrid may be distinguished by its smaller catkins and smaller leaves, the general appearance and shape of which are suggestive of *cinerea*. The pubescence of the underside of the leaves shows a combination of the characters of the hairs of *phyllicifolia* and *cinerea* without the soft woolliness of that of *Caprea*. The capsules, which are somewhat variable, show no very great points of distinction, though usually smaller and without the yellowish whiteness frequently exhibited by the *Caprea* hybrid.

For the hybrid between *S. phyllicifolia* and *S. cinerea* I have adopted Leefe's MS. name, *S. Wardiana*, since it commemorates a botanist who was a diligent and sagacious student of British

\* Besides these, Leefe published another, *Sal. Brit. Exs.* "No. 73, *S. laurina*, Sm.," found at Richmond, Yorkshire, by Ward. Of this, Andersson says that it recedes somewhat from the true *S. laurina*, but is nevertheless near it. If it is *laurina* at all, it is very near *phyllicifolia*, and I would rather refer the specimens I have seen to that species.

Willows. The name *Salix Wardiana* is, of course, used in a wider sense than that in which it was employed by Leefe.

The ♂ has not been noticed, and though it probably occurs, it is very possibly difficult to recognize.

× *Salix ludificans*.

In addition to the Willows just noticed, I have seen specimens from a few bushes, which, whilst undoubtedly very close to *S. phyllicifolia*, cannot be satisfactorily referred to that species, on account of their short styles and other peculiarities, which seem to indicate that they are of hybrid origin. The *phyllicifolia* element in them is so predominating that it is difficult to determine the other parent, but after considerable study I think it must be *S. aurita*. Since *S. aurita* flowers a little later than the other *Capreæ*, it might be imagined that hybrids of it with the *Phyllicifoliæ* would be at least as frequent as those of the other *Capreæ*; but this is either not the case, or they have been overlooked.

For this hybrid I propose the name *S. ludificans*. As already indicated, all the specimens I have seen are very much nearer *phyllicifolia* than *aurita*, though, judging from other hybrids, it is probable that forms more remote from *phyllicifolia* occur.

The specimens and some of their distinguishing characteristics are as follows:—

A bush found by Mr. C. McIntosh on the banks of the Tay above Dunkeld has the catkins (♀) quite intermediate between *phyllicifolia* and *aurita*; but the leaves are very near those of the former species, exhibiting, however, in their shape a suggestion of *aurita*. The scanty pubescence, moreover (present on some of the leaves only), shows an affinity with *aurita*, since the hairs are finer and softer than in *phyllicifolia* and slightly crisped.

The other specimens I have seen were collected in Caithness by Mr. J. Grant and sent to me by Mr. A. Bennett. The examples are, unfortunately, not in the best condition and the material is scanty. They represent three bushes, of which one is ♂ and two ♀. One has the catkins (♀) rather different from the above-mentioned Perthshire plant, but, like it, intermediate between its supposed parents, and has the young leaves (I have not seen mature ones) apparently also intermediate. Another bears a striking resemblance to some forms of the hybrid between

*Salix aurita* and *S. nigricans*, but with the *nigricans* element replaced by *phylicifolia*, and, though a different looking plant from either of the above, shows its hybrid nature in all its parts.

The ♂, though, like the others, near *phylicifolia*, yet shows, in the small catkins and structure of the leaves, a relationship with *aurita*; but if it had not been for the ♀ examples it would probably have been referred to *phylicifolia*.

× *Salix tephrocarpa*.

In connection with the hybrids of *cinerea* and *phylicifolia*, mention must be made of the Willow described by Wimmer under the name *S. tephrocarpa*. Of this one bush only seems to be known, and, though it grows in the Berlin Botanic Garden, its origin is quite uncertain.

Both Wichura and Wimmer tried in vain to ascertain the parentage of this plant, and the latter finally came to the conclusion that it might be a hybrid between *laurina* and *cinerea*.

A Willow found by Mr. C. McIntosh on the banks of the Tay, above Dunkeld, agrees pretty well with the description of *S. tephrocarpa*; but I have been able to compare the leaves only, which I owe to the kindness of Herr Hennings, Director of the Berlin Botanic Garden.

The Berlin and Dunkeld leaf-examples, though not identical, have a fair resemblance to each other, and both show an undoubted relationship with *cinerea*. In other respects the Dunkeld plant has some affinity with *Caprea* and, to a slight degree, with *phylicifolia*. The catkins (♀) are large and very handsome, the white capsules contrasting strongly with the conspicuously black scales. The style is very short but present; and in this and some other points the affinity with *phylicifolia* is shown.

In the meantime I can find no place for this form but as a hybrid between *cinerea*, *Caprea*, and *phylicifolia*, and possibly arising from *cinerea* × *phylicifolia* crossing with *Caprea*.

× *SALIX LATIFOLIA*, Forbes. (*S. nigricans* × *S. Caprea*.)

Wimmer and, on his authority, Andersson consider that *S. latifolia*, Forbes, t. 118, is a hybrid between *S. nigricans* and *S. Caprea*. Leefe, on the other hand, has published (*Sal. Exs.* ii.

Nos. 52 & 53), under that name and with citation of the plate, a plant which he says is only a form of *Salix nigricans*.

Comparing Leefe's specimens with Forbes's plate and description, I find that they do not agree, and that whilst Leefe's *latifolia* is nothing more than what he thought it to be, i. e. *nigricans*, Forbes's plant is evidently a hybrid form.

From the affinity between *S. Caprea* and *S. cinerea*, their hybrids with *S. nigricans* frequently so much resemble each other that it is not easy to separate them. Wimmer relies on the yellowish-white much thicker capsules, thicker, shorter and broader catkins, the much broader, oval-subrotund young leaves, and the larger, broader, and more hairy old leaves, as characters by which to distinguish the best form of *latifolia* from hybrids of *cinerea* with *nigricans*, but remarks that some specimens show a departure from these points of distinction.

*S. latifolia* seems to have been found in a very few places in Lapland, Sweden, and Germany. The only undoubted specimens I have seen are all \* from Perthshire, where three bushes—in two widely separated localities—have been found by Mr. C. McIntosh and myself.

Of these, one is quite intermediate between *S. Caprea* and *S. nigricans*; another greatly resembles *Sal. Wob.* t. 118 and has more affinity with the *cinerea-nigricans* hybrid, but also seems to be, beyond doubt, *latifolia*; and the third, in its longer styles, inclines more to *nigricans*.

Of *S. latifolia* the ♀ only was known to Forbes and to Wimmer, but Andersson describes the ♂.

Wimmer refers *S. firma*, Forbes, t. 106, and *S. cotinifolia*, Sm., Forbes, t. 114, with some doubt, to *S. latifolia*; but Andersson thinks that they represent *nigricans* only. Of *S. firma* I have seen specimens from Kew Gardens which, though not quite identical with the plant figured by Forbes, are probably the same: they possibly represent another form of *latifolia*, but I think are rather *cinerea* × *nigricans*. The plant usually called in Britain *cotinifolia* does not appear to be the same as Forbes's, and is only *nigricans*.

\* Since this was written I have found in Edinb. Univ. Herbarium a specimen labelled "S.W. corner of Duddingston Loch," which must be referred to *S. latifolia* ♀.

× *SALIX STREPIDA* (*Schleich.*), *Forbes.* (*S. nigricans* × *S. cinerea.*)

Andersson uses the name *S. puberula*, Döll, for the hybrid formed by *S. cinerea* with *S. nigricans*, because he and Wimmer think that *S. vaudensis* (*Schleich.*), *Forbes*, is, though probably the same thing, somewhat doubtful. Wimmer is also of opinion that *S. strepida* (*Schleich.*), *Forbes*, t. 100, bears more resemblance to the same hybrid than to anything else, though Andersson refers it to *S. nigricans*.

Of *S. strepida* I have received specimens from Kew Gardens which are sufficiently like *Forbes's* figure, and which seem, without doubt, a hybrid between *cinerea* and *nigricans*. Consequently, since the name is earlier than either *vaudensis* or *puberula*, I have adopted it for this hybrid. *S. firma*, *Forbes*, t. 106 (which Wimmer thinks may be *S. Caprea-nigricans*), and *S. vaudensis*, *Forbes*, t. 117, are, judging from specimens cultivated at Kew, forms of the same hybrid.

Like other compound willows, *S. strepida* is subject to considerable variation, increased in this case by the variability of its parents. In addition to this, the intimate alliance, on the one hand, of *nigricans* to *phylicifolia*, and, on the other, of *Caprea* and *aurita* to *cinerea*, augments the difficulty of satisfactorily placing every specimen, and makes it impossible to draft such a description as will serve to identify the hybrid in every case. At the same time *S. strepida*, in many of its forms, has a facies of its own which, when once learned, should not fail to guide the student to a correct discrimination of the species.

Wimmer and, following him, Andersson describe three forms—*α. puberula* (Döll), *β. vaudensis* (*Forbes*), and *γ. nitida*, *Wimm.* From the examination of a number of specimens, I am unable to see any sufficient reason for maintaining these varietal names.

In its best forms, *strepida* combines the characters of its parents, but not unfrequently it exhibits more relationship with one than with the other. In some of its states the leaves so much resemble those of *nigricans*, that it is only by the shorter style and stigmas that any connection with *cinerea* can be suspected. In others the leaves, catkins, and capsules are so like those of *cinerea* that the relation with *nigricans* (or perchance with *phylicifolia*) is shown only by the rather long styles.

In Continental Europe *S. strepida* has been recorded from a

very few places only, perhaps because it has not been carefully looked for. In Britain it may not unreasonably be expected to occur in those parts of the north where its parents grow together, as they often do, since in Perthshire it is of wide, though not of abundant, occurrence on the banks of the Tay and some of its tributary streams. I have found both sexes, but have seen more ♀ than ♂ plants, probably because the former are more easily recognized. In the south-east of Scotland Mr. A. Brotherston has found plants which probably belong to *Salix strepida*, though the material I have seen is scarcely sufficient for absolute certainty.

× SALIX CORIACEA (*Schleich.*), *Forbes.* (*S. nigricans* × *S. aurita.*)

In his notes on *S. cinerea-nigricans* (*S. strepida*), Wimmer says that it is hardly to be doubted that hybrids between *S. nigricans* and *S. aurita* occur. As examples of such he cites *S. conformis*, *Schleich.*, in *Herb. Willdenow*, and thinks that *Forbes's* figure, t. 119, of *S. grisophylla* (*Schleich.*), *Forbes*, also represents such a hybrid.

*Andersson*, after quoting *Wimmer's* words, says that the *S. conformis* referred to is represented by three specimens, of which two belong to *S. aurita* and the third to *S. cinerea*, and that the specimens of *S. grisophylla*, published by *Schleicher*, which he has seen, are, as regards some, *S. nigricans*, and, as regards others, *S. cinerea*.

Under the name *S. aurita-nigricans*, *Heidenr.*, *Heidenreich* has distributed specimens of a Willow found near Tilsit in Prussia; but I am not aware that any description of it has been published.

Here and there, on the banks of the Tay between Dunkeld and Logierait, Mr. C. M'Intosh and I have found plants which appear to be certainly a hybrid between *S. nigricans* and *S. aurita*. As might be expected, these bear a very considerable resemblance to *S. strepida*, and some of them, indeed, might be nearly as well referred to that hybrid, except for a certain appearance suggestive of *aurita* rather than *cinerea*. Others, however, show a distinct combination of the characters of *aurita* and *nigricans*, and agree tolerably well with *Heidenreich's* examples.

Though *Wimmer* refers it to *S. nigricans*, I think that *Forbes's*

t. 112, *Salix coriacea*, represents this hybrid. From the plate alone no certain conclusion could be derived; but specimens received from Kew Gardens, and others published by Leefe (under *S. nigricans*), can scarcely be satisfactorily placed otherwise than here, though they do not exhibit the best form of the hybrid. In the plate both ♂ and ♀ flowers are shown, but I have seen the ♀ only. The flowers in the specimens show a more marked relationship with *aurita* than they do in the plate. If I am right in referring Forbes's plant, *S. coriacea* (Schleich.), Forbes, must be the name of the hybrid; otherwise it will have to be called *S. aurita-nigricans*, Heidenr.

Like its close ally *S. strepida*, *S. coriacea* shows considerable variation. From that species the form of the leaves, recalling *aurita* rather than *cinerea*, the usually smaller and narrower ♀ catkins, the shape and smaller size of the capsules, and frequently the colour of the scales are characteristic points which will serve to distinguish *coriacea*. So far, however, as our specimens go, it is more likely to be passed over as a form of *nigricans*, from which, however, careful examination will show its distinctness.

A plant found on the banks of the Tay above Dunkeld by Mr. C. McIntosh must be noticed here, since it seems to include *nigricans* and *aurita* amongst its parents. From certain points, however, in which it resembles the willow (from the same locality) already referred to as *S. tephrocarpa*, Wimm., I am inclined to suspect that it also includes *S. Caprea* and is a hybrid of that species with *S. coriacea*.

#### 10. SALIX ARBUSCULA, L.

There is a divergence of opinion amongst botanists as to the situation of *S. Arbuscula*. Many, including the British, think that it should be associated with *S. Myrsinites*, &c.; but Anderson, on account of the great similarity of the dwarfer forms of *S. phyllicifolia* and the larger sub-alpine states of *S. Arbuscula*, considers that its place is amongst the *Phyllicifoliæ*.

A number of varieties or modifications have been described, but various authors have treated these differently.

The varieties of the 'London Catalogue' are:—a. *carinata*, Sm., b. *fætida*, Schleich. (= *prunifolia*, Sm.), c. *venulosa*, Sm., and

d. *vaccinifolia*, Walker—all of which were at one time supposed to be distinct species.

Wimmer has:—*α. Waldsteiniana*, Willd., *β. formosa*, Willd., and *γ. fœtida*, Schleich. (to which he refers *venulosa* and *vaccinifolia*).

Andersson has also three chief modifications—*α. erecta* (with three leaf-forms which include *Waldsteiniana*, *formosa*, and *prunifolia*); *β. humilis* (with two leaf-forms which include *fœtida*, *venulosa*, and *vaccinifolia*); and *γ. thymelæoides*, Schleich. (about which Wimmer is doubtful, and which Andersson thinks may be a subpilose condition). Both Wimmer and Andersson place *Salix carinata*, Sm., as a synonym of *S. Arbuscula*.

If any varieties are to be retained, Andersson's arrangement seems to be the best. *S. erecta* is distinguished by its more upright and taller growth, its larger leaves, and less leafy catkins; *humilis* by its smaller size, more creeping habit, smaller leaves, and by the catkins which, when young, are subglobose and buried in leaves.

But whilst plants occur which agree well with the definition of one or other of these modifications, there are many which cannot be placed in one more than in the other. I therefore think that it is inexpedient to adopt any varietal names. As for the British forms, there seems to be little doubt but that Walker-Arnott is right in saying that they cannot be satisfactorily distinguished.

There are some discrepancies in the various descriptions of *S. Arbuscula*. By some authors the style is described as elongate or long; by others as very short or mediocre, which in the majority of cases it is. The capsule is sometimes said to be sessile, whereas it has a pedicel of varying length but always much shorter than the rather elongate nectary, a character which distinguishes it from *S. phlycifolia*, whose pedicel is always longer than the short nectary. The stipules are described as absent or very rare; but small stipules may often be seen on the young shoots. The coma of the seeds is sometimes described as having a reddish tinge; but in all our specimens it is white.

Some other points in which *S. Arbuscula* varies may be briefly noticed. The leaves, which exhibit a considerable range in shape and size, vary also in the pubescence and colour. The underside is sometimes glaucous, sometimes green or with white dots; sometimes distinctly pubescent when young, and at others glabrous. The young branches and buds are often silky, though frequently

described as glabrous. The scales vary in colour, pubescence, length, and shape (roundish, obovate, and oval); the style from nearly none to almost one third the length of the ovary, and, with the stigmas, in being thick or thin; and the capsule in the amount of pubescence and colour. With all these variations there is, however, usually no difficulty in easily recognizing the species.

× SALIX DICKSONIANA, Sm. (*S. phyllicifolia* × *S. Arbuscula*.)

Although Wimmer was inclined to think that *S. humilis*, Willd., might be a hybrid between *S. phyllicifolia* and *S. Arbuscula*, he does not, in the 'Salices Europææ,' go the length of describing it as such, and Andersson says that it is a modification only of *S. phyllicifolia*.

Hybrids between *phyllicifolia* and *Arbuscula* might be expected to occur; but if they do they must be very rare. As mentioned under *S. phyllicifolia*, it seems quite within the bounds of possibility that *S. Dicksoniana*, Sm., is such a hybrid. Though originally found in "Scotland" by Dickson, and in Breadalbane by Winch, only cultivated specimens appear to be now known, and the characters of these, as well as those given in Smith's description, are in many ways intermediate between *phyllicifolia* and *Arbuscula*. As already stated (p. 399), there is some doubt whether Smith's plant and Forbes's are the same; but the probability seems to be that they are only different conditions of one species, and I have therefore retained Smith's name of *S. Dicksoniana*.

As regards the specimens I have seen, the leaves might belong to either *S. phyllicifolia* or to *S. Arbuscula*, though, perhaps, on the whole nearer the latter species. From *S. Arbuscula*, also, has been derived the small stature of the plant ("a foot high," *Smith*; "18 inches to 2 feet," *Forbes*), the small catkins (♀) appearing with the leaves and with leafy peduncles, the small capsules, which in colour and aspect recall those of *Arbuscula*, and the shortish styles; but from *phyllicifolia* the thicker catkins, more longly-pedicelled capsules with stronger pubescence, and stouter styles and stigmas. The scales are somewhat intermediate in colour and structure.

Both Smith (who places it, in *Engl. Fl.*, next *S. carinata*)

and Forbes (next *Salix prunifolia*) seem to have had some thoughts of the relationship of *Dicksoniana* to *Arbuscula* forms.

Neither Smith's plate (in which the catkins are much too young) nor Forbes's (in which the figured leaves resemble those of *nigricans*) can be called very good.

It is to be hoped that the wild state of *Salix Dicksoniana* will be rediscovered.

#### Group 7. VIMINALIS.

##### 11. SALIX VIMINALIS, L.

Though, like other species, liable to modification, *S. viminalis* is, in Western Europe at least, one of the less variable willows, and has no varieties worthy of distinct names, though one or two have been described.

Amongst these are var. *intricata*, Leefe (distinguished chiefly by the cloven, reflexed, and entangled stigmas), and var. *stipularis*, Leefe (with broader leaves and longer stipules).

The ♀ catkins vary a good deal in size. Most of the British and many of the foreign specimens I have seen have much shorter, but proportionately broader, catkins than in Wimmer's published examples, but apparently do not belong to Döll's var. *abbreviata*, in which the catkins are described as linear-oblong.

##### × SALIX SMITHIANA, Willd. (*S. viminalis* × the *Capreæ*.)

The hybrids which *S. viminalis* makes with the *Capreæ* form a group the treatment of which is very difficult—a difficulty not diminished by the manner in which the group has been dealt with by botanists.

For not only have different names been given to one and the same plant, but different plants have had the same name ascribed to them. Thus four, more or less distinct, forms have been called "*S. acuminata*," and the true *S. acuminata* has been described under two other names. Much of this confusion has doubtless arisen, not only from the great variability of the hybrids, but from the fact that the plants described by British authors were not familiar to the Continental salicologists, nor those of the latter to British botanists.

As the group is so specially a British one, it will be of interest to notice its constituents according to the views of some of the later British botanists. It includes, according to:—

1. W. J. Hooker and Borrer: *S. stipularis*, Sm., *S. Smithiana*, Willd., *S. ferruginea*, "And., MS.," *S. acuminata*, Sm., *S. holosericea*, "Willd." (= *S. acuminata*, var. *rugosa*, Sm.).

2. Walker-Arnott: *S. stipularis*, Sm., *S. Smithiana*, Willd., *S. acuminata*, Sm., *S. ferruginea*, And., *S. holosericea*, "Willd.?"

3. Leefe (Journ. Bot. 1871): *S. stipularis*, Sm., *S. Smithiana*, Willd., *S. acuminata*, Sm.

4. Boswell-Syme: *S. stipularis*, Sm., *S. Smithiana*, Willd. (with var. *stipularis*), *S. ferruginea*, And. (with var. *rugosa*), *S. acuminata*, Sm.

5. Babington (1881): *S. stipularis*, Sm., *S. Smithiana*, Willd. (with var. *rugosa* and *ferruginea*), *S. acuminata*, Sm.

6. J. D. Hooker (1884): As supposed hybrids of *S. viminalis*—*S. stipularis*, Sm., *S. Smithiana*, Willd., *S. acuminata*, Sm., *S. ferruginea*, G. And., *S. holosericea*, Willd., *S. rugosa*, Leefe (= *holosericea*, Hook. & Arn.).

7. London Catalogue (1886): *S. stipularis*, Sm., *S. Smithiana*, Willd. (with var. *pseudo-stipularis*, Lond. Cat.), *S. ferruginea*, G. And., *S. rugosa*, Leefe, *S. acuminata*, Sm.

Wimmer has as the constituents:—

*S. Caprea-viminalis*, Wimm. (= *S. Smithiana*, Willd.).

*S. cinerea-viminalis*, Wimm.

*S. aurita-viminalis*, Wimm.

*S. stipularis*, Sm.

*S. Calodendron*, Wimm. (= *S. acuminata*, Sm.).

*S. holosericea*, Willd.

Andersson praises Wimmer's arrangement, but remarks that authors have described individual specimens rather than the main forms themselves. His own arrangement is as follows. I have added within brackets the equivalents in Wimmer's 'Salices' and in the 'London Catalogue':—

*S. stipularis*, Sm. (also of Wimmer and Lond. Cat.).

*S. Smithiana*, Willd.

α. *sericans* (Tausch). (*S. Caprea-viminalis*, Wimm.

*S. cinerea-viminalis*, Wimm., p. p.

*S. aurita-viminalis*, Wimm., p. p.

*S. Smithiana*, Willd., Lond. Cat.)

β. *velutina* (Schrad.). (*S. cinerea-viminalis*, Wimm., p. p.

*S. holosericea*, Willd., Wimm.

*S. rugosa*, Leefe, at least p. p.)

- Var. *ferruginea* (Forbes). (*S. cinerea-viminalis*, Wimm.  
*S. ferruginea*, G. And., Lond. Cat.)  
 γ. *acuminata* (Sm.). (*S. Calodendron*, Wimm.  
*S. dasyclados*, Wimm.  
*S. acuminata*, Sm., Lond. Cat.)

The weak point of this arrangement is that under one specific name (*Salix Smithiana*) several hybrid plants—having one only of the parents in common—are included. If *S. Caprea*, *S. cinerea*, and *S. aurita* are retained as distinct species—and Andersson did not unite them,—their several combinations with *S. viminalis* should necessarily, according to the method adopted by Andersson in the case of other hybrids, have separate recognition. On the other hand, comes the almost unsurmountable difficulty of distinguishing between them, especially when, as in several cases, the exact parentage has not been proved, and when it is by no means improbable that a second hybridization, either with one or other of the parents or with a third species, has taken place. For this reason I am inclined to adopt provisionally the following modification of Andersson's arrangement:—

- S. Smithiana*, Willd.  
 α. *stipularis* (Sm.).  
 β. *sericans* (Tausch).  
 γ. *velutina* (Schrad.).  
 δ. *ferruginea* (G. And.).  
 ε. *acuminata* (Sm.).

Before proceeding to notice each of these varieties, I may say that, as the result of the study of a very large series of specimens (many of them authentically named), both British and Continental, I have failed to find such a permanence of characters as will serve to definitely separate one form from another. Certain examples can be, without much hesitation, placed satisfactorily under one or other of the varietal names. There are many, however, that cannot really be referred to one variety more than to another, and which, combining to some extent the characteristics of each, form connecting-links. Of some others little more can be said than that they are modifications of *S. Smithiana*.

α. *stipularis*. (*Salix stipularis*, Sm.)

From the statement given above, it will be seen that most of the authors cited retain *S. stipularis* as a species. Even Andersson, who has united the other forms, gives it separate rank. But

from a study, both of descriptions and specimens, I cannot find any grounds for giving *Salix stipularis* a higher position than that which some of the other forms (as, e. g., *S. acuminata*) have been considered entitled to.

Of all the varieties, *stipularis* is the one which is most closely related to *S. viminalis*. From that species it may be distinguished by the broader leaves with less shining pubescence on the under surface, longer and broader stipules, larger catkins, and less sessile capsules; but whilst these are its normal characteristics, they may be all more or less so modified as to afford gradations into *S. viminalis* on the one side or into  $\beta$ . *sericans* on the other. From the latter, its usually tomentose twigs, larger and darker catkins, more sessile capsules, and longer and more filiform stigmas serve to distinguish it, as do also, in the more typical examples, the shape and size of the leaves and of the stipules. But the latter are subject to modification and are not always present; and the former, which vary even in the same specimen, are not unfrequently so similar to those of some conditions of *sericans* that, were it not for the other characters, some examples would certainly be, and frequently are, called *sericans*. In a word, there is no sharp boundary between *S. viminalis* and *stipularis* nor between *stipularis* and *sericans*.

Willows more or less resembling *stipularis* have been named *S. viminalis* var. *stipularis*, Leefe, and *S. Smithiana* var. *pseudo-stipularis*, Lond. Cat. Of these the first includes mere modifications of *S. viminalis*, as well as forms of *stipularis* approaching *viminalis*; whilst "*pseudo-stipularis*" seems to be applied to plants connecting *stipularis* with *sericans*.

The ♂ of *stipularis* seems now to be unknown\*, though it is figured both by Smith and by Forbes. The parentage, other than from *S. viminalis*, is doubtful, and some authors have thought that *S. cinerea* is the unknown factor in its origin. Wimmer suggests that it is a hybrid between *S. viminalis* and *S. dasyclados*, Wimm. (= *S. acuminata*, Sm.). I suspect that Wimmer is so far right in supposing that it has originated from a cross between *S. viminalis* and one of the *viminalis-Caprea* hybrids; but whether this hybrid is *acuminata* is doubtful.

*S. stipularis* is almost confined to Britain, but, though its value as an osier is said to be small, whether it is really more than an escape from cultivation is very uncertain.

\* Since this was written I have found a single ♂ bush—apparently self-sown—near Perth. I fear, however, that it has been lately eradicated.

β. *sericans*. (*Salix sericans*, Tausch.)

This, which includes "*Salix Smithiana*," as generally understood, is a most variable plant, and is almost inseparably connected with *stipularis* on the one side and *velutina* on the other.

From the former, its smaller and paler-coloured catkins, longer-stalked capsules, and usually shorter and thicker stigmas, and from the latter its rather larger catkins and shorter-stalked capsules, are the best points of distinction; whilst another, which separates it from both, is to be found in the usually glabrous twigs. But in any large series of specimens all these points will be found to be subject to much variation.

The leaves are very variable, not only in shape and size, but in the nature and amount of the pubescence. In shape the leaves pass—even in the same example—from ovate-oblong to linear-lanceolate; whilst the pubescence of the underside may either be silky or woolly, shining or dull, copious or almost altogether absent. As a rule, the margin is entire or very slightly crenate; but in forms which approach *velutina* it is more evidently crenate or even subserrate. These latter forms Andersson places in modification 3. *subobscura* (of *sericans*).

Some of the forms, as 1. *latifolia*, And., and 2. *angustifolia* (Wimm.), And., are, as Wichura has proved by experiment, hybrids of *S. viminalis* with *S. Caprea*; but the origin of others (as, e. g., 3. *subobscura*, And.) is not so clear.

Under *subobscura* Andersson cites, as belonging in part, Winner's *S. cinerea-viminalis* and *S. aurita-viminalis*; and from the characteristics of this form it seems very probable that *S. cinerea* and *S. aurita* are concerned in the production of some of its modifications. Some of the specimens which have been referred to *S. rugosa*, Leefe, should probably find a position here.

To these forms Andersson adds a fourth—*serotina*, which, however, he thinks is only accidental. It is distinguished by the catkins being shortly but distinctly stalked, and the peduncle furnished with small leaves. Many of our ♀ plants have catkins of this nature.

Var. *sericans* seems to be the most common of the varieties of *S. Smithiana*, but appears to occur more frequently as a cultivated plant or as an escape from cultivation than as a truly wild one. The most abundant form of it is 2. *angustifolia*, or near it. It presents, however, great variability in small particulars.

*γ. velutina.*

(*Salix velutina*, Schrad., *S. holosericea*, Willd., *S. cinerea-viminalis*, Wimm. p. p., *S. Micheliana*, Forbes, Sal. Wob.)

Var. *velutina*, which is often closely connected with *sericans*, and especially with the form *subobscura* (from some states of which it can scarcely be separated), is distinguished by its usually tomentose twigs, serrulate leaves, shorter style and stigmas, and more longly pedicelled capsule. Whilst in *stipularis* the capsule is scarcely stalked, and in *sericans* the stalk is about as long as the nectary, or at most twice as long, in *velutina* it is twice or three times the length. Just as in the other varieties, however, all the characters are liable to modification; so that it becomes impossible to say where certain specimens should be placed.

Though the leaves are normally more or less serrate, they are not invariably so. Forms of this group which have serrate leaves seem to have derived their origin from the hybridization of *S. cinerea* or *S. aurita*, rather than *S. Caprea*, with *S. viminalis*. This appears to be in a measure indicated by the position of the marginal glands. In *S. viminalis* the position of these is somewhat remote from the entire margin. In *S. Caprea* they are also rather remote from the margin, which, however, is by no means always entire. In *S. cinerea* and *S. aurita* the glands are much nearer, if not on the margin, and are often at the apex of teeth. The position, therefore, of the glands and nature of the margin seems to afford a frequent (though not a constant) guide to the possible origin and position of some of the varieties of *S. Smithiana*, such as *velutina* and *ferruginea*.

Var. *velutina*, which, in a greater degree than all the other varieties, appears to have arisen from the crossing of *S. viminalis* with *S. cinerea*, is said to be everywhere rare. Specimens which seem to be referable to it I have seen from Kelvington, N. Yorkshire (J. G. Baker), named *S. cinerea-viminalis*, Wimm., and well marked. Less well-marked are examples from Llangarren, Herefordshire (A. Ley); and Pendeford Mill, Staffordshire, named *S. rugosa* (Dr. Fraser). Dr. Fraser has also found plants near Wolverhampton, which both Leefe and Boswell-Syme have referred to *S. holosericea*, Willd., Koch (= *S. velutina*, Schrad. sec. And.). These, which are ♂, are certainly rightly placed under or near *velutina*, but they are not very like Wimmer's examples of *S. holosericea*, Willd.; and the flowering-twigs and buds are more glabrous than Koch's comparison of them with those of *S. cinerea*

would imply. Koch says that the catkins, buds, and twigs of *holosericea* bear so great a resemblance to those of *cinerea*, that it is impossible to separate the two plants except by the leaves.

Some of the plants named *Salix rugosa*, Leefe, seem to properly belong to *velutina*. Leefe's own specimens (*Sal. Brit. Exs.* No. 30, and *Sal. Exs.* i. No. 22)—of which he writes, "I find it difficult to say whether this plant is nearer to *S. holosericea*, W., or *S. Smithiana*, W.; with much hesitation I have thought it on the whole to belong to the latter"—are very like Wimmer's example (*Coll. Sal.* No. 100) of *holosericea*, Willd., except that Wimmer's is more pubescent. (Andersson remarked of the *Sal. Brit. Exs.* No. 30 specimens that they seemed to him to be *S. acuminata*, Sm.; but Leefe justly says that they do not at all resemble *S. acuminata*, Sm. *Eng. Bot.*, and Ward declares them to be true "*holosericea*, Hook.") Between Dr. Fraser's *holosericea* and the plants from Pendeford Mill, named by him *rugosa*, I see no essential difference in the leaves. The latter are ♀ plants, and from the tomentose twigs &c. seem to be *velutina*. So also is a "*rugosa*" from Clevedon (J. W. White); but other plants, from various sources, named *rugosa* pass by degrees into *sericans* f. *subobscura*.

δ. *ferruginea* (*Salix ferruginea*, G. And.).

This, which Andersson makes a variety of his γ. *velutina*, resembles an intermixture of *S. aurita* and *S. viminalis*, though whether it is really a hybrid of these species requires proof. Wimmer quotes English specimens (from Pinley, T. Kirk), named *S. ferruginea*, under his *S. cinerea-viminalis*; and the examples I have seen from the same locality and collector seem probably referable to *velutina*, which, as has been already mentioned, includes in part *S. cinerea-viminalis*, Wimm.

Var. *ferruginea* is normally a smaller plant in every respect than any of the foregoing varieties, and has more slender and more glabrous twigs, smaller leaves, usually broader above the middle and almost destitute of pubescence, and smaller catkins. Andersson points out that *ferruginea* may be the same as *S. obscura*, Döll, a plant very difficult to distinguish from the smaller states of the modification *subobscura* of *sericans*, from which statement it may be gathered that that form is one of the links between *ferruginea* and *sericans*. Boswell-Syme makes *S. rugosa*, Leefe, a variety of *ferruginea*, distinguished by the different style and

stigmas and more pubescent leaves—all very variable characters in this group. *Salix rugosa*, as said already, I prefer to place under *velutina*, though often passing into *sericans*. Some states of plants which I believe to be *ferruginea* very much resemble Wimmer's examples of *S. holosericea*, Willd.; and just as *sericans* passes into *velutina*, so does the latter, I think, into *ferruginea*.

Herbarium specimens named *ferruginea* are rather a mixed lot, including not only *S. cinerea* and *velutina*, but even perhaps *sericans*. Leefe's *ferruginea* (*Sal. Exs.* iv. No. 89), received from Woburn, seems to be the same as N. J. Andersson's *ferruginea*; and Leefe says that it is G. Anderson's plant, but not that of *Eng. Bot.* On the other hand, another *ferruginea* published by Leefe (*Sal. Brit. Exs.* No. 35, and *Sal. Exs.* iii. No. 63), brought from Essex, is rather a different plant. Leefe says that it is the same as *Eng. Bot.* Sup. t. 2665, but I cannot say that I see the resemblance. Andersson said of it that it was nearest to *S. holosericea*, Willd., and it seems to be very close to if not identical with *velutina*.

Many of the plants called *ferruginea* by English botanists have the leaves densely hairy below, and, apart from the other differences which they display, cannot well be the same as the plant defined by Borrer as minutely hairy.

In a living and wild condition, *ferruginea* is known to me in one locality (in Perthshire) only. Here it has all the appearance of being a natural hybrid between *S. viminalis* and *S. cinerea*, since *S. aurita* does not occur in the immediate neighbourhood. I suspect that here, therefore, it is really a hybrid between *viminalis* and *cinerea*, with a greater proportion of the latter than of the former in it; and that, since the common British form of *S. cinerea* is unlike the common Continental form, *ferruginea* has not been so readily recognized as a state of *S. cinerea* × *S. viminalis*.

*e. acuminata* (*Salix acuminata*, Sm.).

Wimmer, thinking that the name *acuminata*, having been variously applied, is ambiguous, replaced it by his own name *Calodendron*, which, on account of the doubtful origin of the plant, he prefers to his earlier *Caprea-dasyclados*. Andersson quotes *S. Calodendron*, Wimm., as a synonym of *S. acuminata*, Sm., and says that the latter is closely allied to, if not identical with, *S. dasyclado*, Wimm. (= *S. longifolia*, Host sec. Wimm.).

Comparing Leefe's specimens (*Sal. Brit. Exs.* No. 37, and *Sal. Exs.* ii. No. 27) of *Salix acuminata* with Wimmer's *dasyclados* (*Coll.* No. 99) I find that they are practically identical. Wimmer's exponent (*Coll.* No. 100) of *acuminata* is also like Leefe's specimens, but with a somewhat greater look of *Caprea*. Of Leefe's No. 37, Andersson remarked that it was most certainly *dasyclados*, and very markedly distinct from *acuminata*, Sm.; but Leefe maintained that it was the *acuminata*, Sm., *Eug. Bot.*, and cites Borrer as confirming the name. From a capsule preserved with Smith's original drawings, I have no doubt that Leefe is right as regards his plant, and I have also no doubt that *dasyclados* is a synonym of *acuminata*.

From the specimens which I have seen I am rather inclined to think that *acuminata* deserves a more distinct position than the other varieties of *Smithiana*; but as Andersson has placed it among them, I do not venture to remove it. Its large catkins, densely hairy with crisped hairs, and the long erect woolly pubescence of the capsules, make it easily recognizable. The stout twigs are also most generally densely tomentose, and the large leaves are usually broader upwards and glaucous below.

Andersson defines three modifications—*glabrescens* (to which most of the British specimens belong), *virescens*, and *cinerascens* (also British).

The parentage of *acuminata* is doubtful. Andersson, by saying that its characters are intermediate between *S. viminalis* and *S. Caprea*, seems to think that it has sprung from these species. But Wichura has proved by experiment that *sericans* is produced by the union of *viminalis* and *Caprea*; and it is difficult to believe that in *acuminata* we have not a different combination, arising perhaps from a second hybridization with *S. Caprea*.

From the dubiety which involves the parentage of most of the varieties of *Smithiana*, a series of experiments in hybridizing *S. viminalis* with *S. Caprea*, *S. cinerea*, and *S. aurita*—both separately and in combination with the resulting hybrids—is much to be desired. Till this is done it seems hopeless to expect that the various forms can be extricated from the confusion in which they are at present.

#### Group 8. N I V E E.

#### 12. SALIX LANATA, L.

This handsome species seems to be a little more variable than

the British descriptions of the plant generally indicate. The leaves vary a good deal in size; in shape from suborbicular to oblong-obovate; and in the amount of pubescence from being persistently woolly to nearly quite glabrous almost from the beginning. The catkins vary in size and in the colour of the pubescence of the scales, which, though usually yellow, sometimes fading to grey, is occasionally grey from the first.

Andersson describes several modifications, but there are none which deserve varietal rank.

*Salix lanata* seems almost confined (in Britain) to Forfarshire and Aberdeenshire, or at any rate is most common in these counties. Whilst recorded long ago from Perthshire, it seems to have been lost sight of there till recent years, when it was rediscovered by Messrs. Brebner and Haggart and myself in a few places in the Glen Lochay hills.

Var. *Sadleri* (Boswell-Syme).

The plant described by Boswell-Syme as *Salix Sadleri* has now been in cultivation for several years, and has developed some features not seen in the original wild specimens. The stems have increased in thickness and become tolerably stout; the leaves have become larger (some being  $1\frac{1}{2} \times 1\frac{3}{4}$  inch). Many of them are more decidedly cordate at the base, and many are also furnished with large ovate-acute glandular-toothed stipules. Though the margins of the leaves were described as entire, yet even in the original specimens the edges of some of the leaves are, more especially towards the base, very finely glandular-serrate or crenate, the teeth, however, being almost reduced to glands. In mature leaves the margin is recurved or thickened. The catkins, which, so far as I have seen, have not increased much in size, may be described as either terminal or as terminal and lateral, according to the view taken of the structure of their peduncles. They are situated at the end of shoots which have two or three leaves. These shoots might be considered to be leafy peduncles, but as their leaves are furnished with stipules and have buds in their axils they are really perhaps a permanent part of the plant, and in this case the peduncle of the catkin must be described as leafless. The scales are oblong and concave, with the tip rounded, emarginate or truncate; in colour they are greenish, with the apex occasionally tinged with red or very shortly black-tipped, and are clothed with long white hairs. The greenish-yellow

style is about as long as the naked young ovary; the yellow stigmas are bifid and spreading, and half as long as the style; the nectary and the pubescent pedicel of the ovary resemble those parts in *Salix lanata*.

*S. Sadleri* has been supposed to be a hybrid of *S. lanata* and *S. reticulata*; but after long and repeated study of both wild and cultivated specimens, I cannot recognize in it any trace of *S. reticulata*, nor of any species but *S. lanata*, a remarkable form of which I think it must be considered to be.

Serrate leaves are not common in *S. lanata*, though Andersson mentions their occurrence, and I have seen examples. Moreover, in *S. Sadleri* the serration is obscure and not constant. The chief differences lie in the small catkins and in some parts of their structure, but even in these the *lanata* element is preeminent. The whole facies of the plant is that of a small form of *S. lanata*.

× *SALIX SUPERATA*, n. hybr. (*S. lanata* × *S. reticulata*.)

A willow which grows, in company with *S. lanata* and other mountain-species, on the rocks at the head of Allt Innis Choarach, Glen Lochay, Perthshire, has required a considerable amount of study to decipher. At first sight the facies of it does not distinctly suggest any particular affinities; but on examination, and keeping in mind the species with which it is associated, a clear relationship to *S. lanata* is revealed. The other parentage seemed very difficult to guess, but a certain undescribable appearance of the plant hinted that it might be found in *S. reticulata*. The possibility of this suspicion being correct further study has made a probability.

The following description is taken from dried specimens:— A very low bush, with erect or ascending branches; stems rather stout, twigs moderate. Bark rich brown, rather shining; young shoots greenish, sparingly hairy, but soon glabrous. Buds shortly oval-oblong, obtuse, at first greenish and very slightly hairy, then pale brown and glabrous. Leaves more or less obovate, base attenuate and often unequal, apex shortly pointed and plicate-twisted; leaves at the top of the shoots the largest (average size about  $1\frac{1}{4} \times \frac{2}{3}$  of an inch), those below smaller and proportionately narrower; upper surface yellowish green, scarcely shining, flat, with slightly impressed veins; lower subglaucous dull, with the chief veins conspicuously raised and reticulate; upper surface slightly woolly with short hairs, under with long and short hairs,

both soon nearly glabrous; margin slightly cartilaginously thickened, entire or with a few minute glandular teeth, especially towards the base; petiole medium in length, channelled above, more or less tinged with purple, which colour sometimes also spreads to the midrib, veins, and margin, though these are more frequently yellowish; stipules, when present, rather small, ovate, glandular-toothed. Catkins ( $\sigma$ ) terminal on the branches, sessile, short but stout ( $\frac{1}{2} \times \frac{1}{4}$  inch); scales roundish, spathulate, rather broad, thin, brown with darker veins, densely pubescent on both surfaces with long straight white hairs; filaments glabrous; nectary half surrounding the base of the filaments, short, split into 2 or 3 obtuse pieces.

From *Salix lanata* the more erect growth, shape of the leaves, and sessile woolly catkins seem to have been derived; whilst to *S. reticulata* the smaller size and glabrosity of the leaves, the brighter green of the upper surface, the colour of the petioles, veins, and margins, the rounded scales of the catkins, and above all the structure of the nectary, appear to be due. The elevated reticulation of the underside of the leaves is not greater than that which may often be seen in *S. lanata*, but the faint glandular tothing is very similar to what is shown by some specimens of *S. reticulata*.

I have seen other plants which may also prove to be hybrids of *S. lanata* and *S. reticulata*, but judgment on them must be reserved till a larger series of specimens has been obtained.

× SALIX STEPHANIA, n. hybr. (*S. lanata* × *S. herbacea*.)

Near Coire Dhubh Ghalair, Glen Lochay, Perthshire, Mr. D. A. Haggart found, two or three years ago, a very small willow whose affinities at first sight were rather difficult to determine, but which after much consideration I concluded to be with *S. lanata* and *S. herbacea*, in whose company it grows. More recently I have found in the same locality another form of the plant, and its characteristics seem to point pretty clearly to a parentage from these species.

It may be expedient to describe both forms. Though I have seen the original plant growing, the following description of it is taken mostly from dried specimens.

Stems more or less buried; branches short, moderately slender, and rather tortuous; young shoots downy, but soon becoming

195  
glabrous. Leaves nearly orbicular, slightly cordate at the base, slightly longer than broad (the largest about  $\frac{3}{4}$  inch long); margins more or less crenate-serrate; surfaces bright pale green, but not shining, slightly hairy with white woolly pubescence, more especially on the margin; veins pellucid, anastomosing, above impressed (when young) or slightly raised (when old), below elevated; stipules minute, gland-like. Catkins (large for the size of the plant, being  $\frac{3}{4}$  inch in length) rather lax-flowered, on lateral peduncles which are furnished with one or two leaves; scales small, roundish, fuscous-brown but paler at the base, clothed with long white hairs; ovary lanceolate-conic, rather obtuse, glabrous except at the extreme base and on the very short pedicel (thus resembling some forms of *S. herbacea*); pedicel equal to or shorter than the nectary; style moderately long, slender, purple (which colour occasionally tinges the ovary also); stigmas slender, bipartite.

The more recently found form was described when living. It makes a low plant, with flexuous slender rooting stems buried amongst moss. Bark of the twigs rich but pale brown (becoming dark when dried) or greenish brown, glabrous or slightly downy; young shoots greener and sparsely pubescent with long white hairs; buds rather long, oblong, blunt, at first green and hairy, then brown and glabrous. Leaves wavy and half-folded, from orbicular to oblong in shape (the largest  $1\frac{1}{2} \times 1\frac{1}{4}$  inches); base cordate, rounded, or slightly attenuated; tip often shortly pointed and twisted; upper surface rather dark green and somewhat shining, lower paler and subopaque, both with numerous minute white dots, which disappear more or less in the dried plant; youngest leaves more or less clothed with long white hairs, but soon becoming glabrous; veins pellucid, reticulate, impressed above (or slightly raised in the older leaves when dried) and elevated below; margin crenate-serrate, pinkish (as are the veins) in the youngest leaves (this colour disappears in the dried plant); stipules few, ovate, glandular-serrate. Catkins (the largest 1 inch long) terminal on leafy stalks; scales spatulate and involvent, mostly pale and either scarcely or distinctly darker-coloured at the apex, clothed with long white hairs; ovary subulate, glabrous, on a pedicel as long as or slightly shorter than the long thin linear nectary; style pale, long and slender; stigmas long, bifid, spreading.

Whilst in both of these forms the *herbacea* element is very per-

ceptible in all the parts, the derivation from *lanata* is shown chiefly in the catkins, though it has left its impression in the other organs as well.

I have some willows (from the same locality) under observation which may prove to be forms of *Salix Stepania* more nearly related to *S. lanata* than the two described above.

In Just's Botan. Jahresber. for 1885 a hybrid willow found by Strömfelt (in Iceland?) is referred to *S. herbacea* × *lanata*, n. hybr. f. *α. pubescens*, Lundstr., and *β. glabrata*, Lundstr.

### 13. SALIX LAPPONUM, L.

Out of *S. Lapponum*, as in the case of many other willows, several supposed species were manufactured in the early times of salicology. Most of these have now been abandoned, though in the British lists three are still retained as varieties, viz.:—*a. arenaria* (L. *ex p.*), *b. Stuartiana* (Sm.), and *c. pseudo-glauca*, Syme (= *S. glauca*, Sm.). Regarding these, Boswell-Syme says that in his opinion they are scarcely distinguishable; J. D. Hooker characterizes *a* and *b* as only slight varieties, and doubts *S. glauca*, Sm., being the same species; and Babington thinks that *S. glauca*, Sm., is probably not a native, and that it is hardly the same as *a* and *b*.

These varieties are not admitted by the Continental salicologists, who, however, distinguish some other forms. Anderson admits one only—*helvetica* (Vill.), which Wimmer considers to be a distinct species more allied to *S. glauca*, L., than to *S. Lapponum*. Wimmer gives two varieties—*b. marrubifolia* (Tausch), a very woolly form; and *c. Daphneola* (Tausch), a narrow-leaved glabrous or almost glabrous plant.

Of the British varieties, *a. arenaria* and *b. Stuartiana* have no claim to be maintained as distinct. *b* differs from *a* only in the greater woolliness of the leaves, and is probably the same as Wimmer's var. *b. marrubifolia*, which also cannot well be retained. As regards *S. glauca*, Sm., the case is different, as will be explained in treating of the var. or subspecies *helvetica* (Vill.).

But whilst no varietal names can well be given, it is not to be denied that *S. Lapponum* shows a considerable range of variation. The leaves of our Scottish plant vary both in shape and size and in the amount of pubescence. In shape they range from narrowly-lanceolate to roundly-ovate, some of the latter simulating the form

107

*argentea* or *arenaria* of *Salix repens*, whence arose Linné's confusion of the name *arenaria*. Whilst the leaves are usually well-clothed with pubescence, specimens occur which approach a glabrous condition, but in the absence of fruit cannot be identified with Wimmer's var. *Daphneola*. The catkins vary a good deal in size, and the capsules both in shape and in the structure of the styles and stigmas. In flowers, which seem to be about the same age, and hence comparable, one set has lanceolate-subulate subacute capsules, distinctly pedicelled, but with the pedicel usually shorter than and very rarely as long as the nectary; whilst another set has ovate-conic smaller sessile capsules with longer styles. In other respects the plants do not present much difference, and intermediate forms connect the two sets.

Though *S. Lapponum* is most usually a truly alpine species, rarely descending (in Central Scotland) below an altitude of 2000 feet or thereabouts above sea-level, it does occasionally occur in the low ground. On the south side of the Ochil Hills, in Perthshire, a few bushes (discovered by my friend Mr. W. Martin) grow at the edge of a field at an elevation of only 700 feet above sea-level. So far as I know, *S. Lapponum* has not been found in any other part of that range of hills, which, moreover, are as regards that neighbourhood almost devoid of alpine plants. In this locality (which I have visited) it grows with *S. pentandra*, and could not, to all appearance, have been brought down by water from any sufficiently high altitude.

As mentioned in the 'Student's Flora' and elsewhere, *S. Lapponum* has also been found near Edinburgh. The recorded locality is Colinton (sometimes erroneously written Collington) Woods; and in Edinburgh University Herbarium is a specimen (with ♀ catkins) collected there by Greville in 1824. More recently I have seen, in the same herbarium, other specimens, collected many years ago, from Craigerook and Dalkeith Woods, both of which places are near Edinburgh. Whether the species has any claim to be considered native in these three localities, or whether it still occurs there, local botanists must decide.

In England this species has been found on Helvellyn only (*B. King*, 1880).

*S. Lapponum* hybridizes with several other species, and some of these hybrids have been found in Britain. Others probably occur and should be looked for.

Var. or Subspecies *Salix helvetica*, Vill.

Whilst Andersson considers *S. helvetica*, Vill., to be a variety of *S. Lapponum*, Wimmer treats it as a distinct species, placing it in his ninth tribe, whereas *S. Lapponum* is in the fifth. At the same time he says that it must be left to the Swiss botanists to decide whether it is a variety or hybrid of *S. Lapponum* or a distinct species.

*S. helvetica* combines to a certain degree the characters of *S. glauca* and *S. Lapponum*. From the latter it differs chiefly by the leaves being always or finally glabrous above, by the catkins being on distinct leafy peduncles, by the styles being bifid or subbifid, and by the paler scales. One or other of all these characters may occasionally be seen to a certain extent in true *S. Lapponum*, but yet *S. helvetica* seems to merit varietal or sub-specific rank.

From a comparison of specimens and descriptions, I had already come to the conclusion that Smith's *S. glauca* (which is not the Linnean species) was the same as *S. helvetica*, when I noticed that Walker-Arnott had apparently expressed what is practically the same opinion. As a synonym under his variety  $\beta$  of *S. arenaria* (= *S. Lapponum*) he mentions *S. glauca*, Sm., and in the notes he says: "For our var.  $\beta$  we give no stations because we have no reason to believe it indigenous, . . . it is commonly cultivated . . . and is common in Switzerland, where we believe our var.  $\alpha$  does not occur." Though he is wrong in the latter opinion, yet *S. helvetica* is evidently the Swiss plant he had in view.

Whilst, therefore, there is no doubt that Smith's *S. glauca* is the same as *S. helvetica*, Vill., it is not quite certain that it is a British plant. Smith gives as localities "in the Highlands of Scotland. Mr. Dickson. On the Clova mountains; Mr. G. and Mr. D. Don. Hooker." Walker-Arnott says that "Mr. Don's specimens now before us from the Clova Mountains are the same as *S. arenaria*, E. Bot.;" and Babington states that Smith's specimens came from Mr. Crowe's garden. On the other hand, there is before me a specimen in Edin. Univ. Herbarium labelled by Winch "*Salix glauca*, Ben Lawers." This agrees with the plant cultivated by Mr. Leeffe as *S. glauca*, Sm., "received many years ago from the Cambridge Botanic Gardens," and both are, without doubt, referable to *S. helvetica*. If Winch's specimen really came from Ben Lawers (and I see no

reason why it should be doubted), then *Salix helvetica* must be admitted as a British plant. At the same time it is desirable that it should be rediscovered.

As regards the figures of Smith's *glauca*, Wimmer condemns, on the authority of Tausch, *Eng. Bot.* t. 1810, as representing *S. glauca*, L., and though he cites *Sal. Wob.* t. 68 under that species, he remarks that it is not good, which, as it illustrates a form intermediate between *S. glauca*, L., and *S. Lapponum*, it could not well be expected to be. Smith cites Haller *Hist.* t. 14 as well representing his *glauca*, and Wimmer cites the same under *S. helvetica*, which affords further evidence of the identity of Smith's species. Smith himself, however, gives *S. helvetica*, Vill., as a synonym of *S. arenaria*, L. (= *S. Lapponum*).

In Europe, whereas *S. Lapponum* is both arctic and alpine, *S. helvetica* is alpine only (Switzerland, Tyrol, and Dauphiné).

× SALIX AURITA-LAPPONUM, *Wimm.*

In Edinburgh University Herbarium is an old specimen of a willow collected, I think, by the late Prof. J. H. Balfour, and labelled "Colinton, Edin.," but without a date. It has one ♀ catkin, and is undoubtedly a hybrid between *S. Lapponum* and *S. aurita*, both of which species occur, or used to occur, at Colinton, although, as mentioned under that species, it is doubtful whether *S. Lapponum* is native there. Even if it were planted, that is no reason either for or against the hybrid being of spontaneous origin. There is also a leaf-specimen, collected near Craigerook in 1832 by the same botanist, which, from the structure of the leaves, I refer to this hybrid. As stated under *S. Lapponum*, that species has also been found at Craigerook.

Andersson combines the hybrids of *S. Lapponum* with *S. Caprea*, *S. cinerea*, and *S. aurita*, under the name *S. Læstadiana*, Hartm., and places *S. aurita-Lapponum*, Wimm., as  $\beta$ . *opaca*, 2° *subaurita*.

Like other hybrids, *S. aurita-Lapponum* exhibits various combinations of the characters of its parents, but is best known from its close ally *S. cinerea-limosa*, Læst., by the rugosity of the leaves, especially the young ones. It occurs in several parts of Europe (Lapland, Sweden, Silesia, Switzerland), and ought to be found in the Scottish Highlands, where the parent species not unfrequently grow in sufficient proximity.

A willow, in Kew Herbarium, collected by Lightfoot, but without locality, date, or name, seems to be *Salix aurita-Lapponum*.

× *SALIX CINEREA-LIMOSA*, *Læstad*. (*S. Lapponum* × *S. cinerea*.)

A specimen, in Edinburgh University Herbarium, labelled "*Salix cinerea*, Carlowrie, 1838" by, I think, J. H. Balfour, is evidently a hybrid of *S. Lapponum*, and is very like *S. aurita-Lapponum*. From the densely black-pubescent twigs, the abundant rusty *cinerea*-like hairs on the underside of the leaves, and the absence of the rugosity of *aurita*, it is most probably a hybrid with *S. cinerea* rather than with *S. aurita*. The specimen has numerous ♀ catkins, but only young leaves.

Carlowrie is near Edinburgh, and though there is no record of *S. Lapponum* having been found, it may have been planted there as well as in the other places in the district. The hybrid itself is not at all likely to have been introduced, but rather to have had a spontaneous origin.

*S. cinerea-limosa*, *Læstad*. (*S. cinerea-Lapponum*, Wimm.; *S. Læstadiana*, Hartm., *β. opaca*, 1° *subcinerea*, And.), seems to be of rare occurrence, recorded from North Scandinavia only. It is not so likely to occur on our hills as *S. aurita-Lapponum*.

× *SALIX SPURIA* (*Schleich.*), *Willd.* (*S. Lapponum* × *S. Arbuscula*.)

Since *S. Lapponum* and *S. Arbuscula* are (with the exception of *S. herbacea*) probably the two commonest of our alpine willows, they, as might be expected, cross with each other, though, on the Continent at least, apparently not so frequently as might be supposed. The hybrid, though at first at least not recognized as such, has been known for a considerable time under the name of *S. spuria*, *Schleich.*, *Willd.*; but Wimmer, according to his custom, altered the name to *S. Lapponum-Arbuscula*. It occurs both in Switzerland and the Tyrol, but, judging by its absence from many herbariums, seems to be rare. In Britain, though it is about seventy years since it was first gathered, it has not, until quite recently, been identified, having usually been passed over as a form of *S. Arbuscula*.

Although I have not been able\* to examine European examples of *Salix spuria*, I have before me a series of willows which are beyond doubt hybrids between *S. Lapponum* and *S. Arbuscula*, and which must therefore be called *S. spuria*.

Though, as in the case of other hybrids, some specimens show more affinity with one parent than with the other, the examples I have seen are all tolerably intermediate in character. Judging from the words of Andersson and Wimmer, and from the names given to it by Seringe and Gaudin, the Continental plant seems to have a greater resemblance to *S. Lapponum* than has the British one. Andersson says that it is so similar to that species that it can scarcely be distinguished, except by the shorter and more compact catkins surrounded by a few leaves, but especially by the much harder and more glabrous leaves finely serrated on the margin. Wimmer describes it as approaching *S. Lapponum* in the size and clothing of the leaves, and shape and length of the catkins; but to *S. Arbuscula* in the glandular-serrate leaves, which are somewhat shining above, in the narrower ferruginous scales, and in the structure of the stigmas.

The Scottish plant, on the other hand, is more likely to be taken—as indeed it has been—for *S. Arbuscula* than for *S. Lapponum*. In size it is nearer the former than the latter, but otherwise it shows a combination of the characters of both. From *S. Arbuscula* it may be distinguished generally by the duller colour of the leaves, which are more or less, but never excessively, pubescent—the pubescence combining the silkiness of *Arbuscula* with the woolliness of *Lapponum*, by the finer and more scanty serration of the leaf-margins, by the longer shape of the capsules, longer styles, and usually narrower scales darker at their tips; and from *S. Lapponum* by the firmer and more shining leaves, which are more nearly glabrous and have more or less serrate margins, by the smaller catkins with short leafy peduncles, and by the short stigmas. The characters, however, are more readily seen than described.

I have seen British specimens from the Breadalbane Mountains. In the former it seems to have been first gathered by Sir J. D. Hooker, since in Mr. Hanbury's "Boswell Herbarium" is

\* Since this was written I have received (through the kind services of Mr. A. Bennett) Scandinavian specimens of *Lapponum* × *Arbuscula*, which prove to be identical with some of our Scottish examples.

a specimen (without date and without flowers) labelled *S. Arbuscula*. Of recent years it has been found in several places in Breadalbane, with both ♂ and ♀ catkins, by Messrs. Meldrum, Haggart, and Brebner, and by myself.

#### Group 9. NITIDULÆ.

##### 14. SALIX MYRSINITES, L.

Considering how, on the whole, well-marked this species is, great discrepancies occur in the various descriptions. Andersson says that the ovary is sessile, with the nectary passing its base; Wimmer (with whom Grenier agrees) that it is shortly pedicellate with the nectary reaching its body; W. J. Hooker that it is sessile (in *S. procumbens* nearly sessile); Walker-Arnott (for both "species") that the pedicel is usually as long as or at length longer than the nectary; Boswell-Syme that the pedicel is about as long as the nectary; Babington that the ovary is subsessile; and J. D. Hooker that it is distinctly pedicelled.

Then as regards the shape of the ovary, Andersson describes it as ovate-conic rostrate (in  $\beta$ . *Jacquiniana*, thickly ovate and scarcely pedicellate); Wimmer, conic-oblong, always obtuse in  $\alpha$ , more slender and often somewhat acute in  $\beta$ . *Jacquiniana*; Koch, lanceolate-acuminate from an ovate base, at first sessile and hairy, at length very shortly pedicellate and glabrous; Grenier, ovoid shortly conic; W. J. Hooker and Walker-Arnott, lanceolate; Boswell-Syme, lanceolate-conical or conical-subulate; Babington, ovate-subulate.

(By Andersson the ♂ catkins are described as yellowish, the anthers at length becoming blackish; but Wimmer more correctly says that the filaments are purplish, and the anthers purple-violet.)

From the descriptions of the ovary, it would appear that British botanists attribute a longer pedicel to the species than the Continental botanists do, and that on the whole they are inclined to describe the shape of the ovary as lanceolate.

The result of the examination of a number of specimens shows that there is a considerable range of variation in the length of the pedicel and shape of the ovary, without, however, any notably extreme forms. The Central-European plant seems usually to have a shorter capsule and pedicel than the North-European. Scottish examples are more (though not altogether) in accord-

113

ance with the latter than with the former. In them the pedicel is always (so far as I have seen) present, and is often twice as long as the nectary, though it varies in length even in the same catkin.

In addition to these variations in the ovary, the structure of the style and stigmas, the shape and size of the catkins and of the leaves, as well as the habit of the plant, are all subject to modification, so that as regards the varieties *serrata* and *arbutifolia* of British lists there is no reason for which they deserve to be retained.

Nor is it by any means evident that *Salix procumbens*, Forbes (now considered by most botanists to be a form of *S. Myrsinites*) has any characters to warrant its retention. Walker-Arnott maintained it as a distinct species chiefly on account of its elongate catkins; but, as Boswell-Syme points out, this is not a character of any constancy in *S. Myrsinites*, nor are there any sufficiently distinct characteristics in the habit of the plant, the shape of the leaves, or the structure of the style.

× *SALIX WAHLENBERGII*, And. (*S. Myrsinites* × *S. nigricans*.)

In the 'Prodromus' Andersson uses the name *S. myrsinitoides*, Fr., for the willow which Wimmer calls *S. Myrsinites-nigricans*; but in Blytt's 'Norges Flora,' pt. ii. 1874, he alters the name to *S. Wahlenbergii*, And., and gives as synonyms *S. punctata*, Wahl., *S. myrsinitoides*, Fr., *S. nigricans* \**borealis* β. *punctata*, Hartm., and *S. Myrsinites-nigricans*, Wimm.

Both Andersson (in the 'Prodromus') and Wimmer (in his 'Salices') appear not to have been very well acquainted with the species, as their descriptions do not altogether agree, and neither was sure of the distribution. From the 'Norges Flora,' however, it would seem that Andersson had become more familiar with the plant, since the description is greatly amplified. After remarking that, through the hybridization of the very variable *Myrsinites* with the still more variable *nigricans*, a great number of intermediate forms occur, he proceeds to notice three chief modifications, namely, a. *subnigricans*, b. *coriacea*, and c. *sub-Myrsinites*. Since, however, these forms pass imperceptibly into each other, it seems scarcely worth while retaining these names as those of distinct varieties.

In its best form *S. Wahlenbergii* combines the characteristics of its parents, deriving from *Myrsinites* the rigidity, glossiness,

and in part the venation of the leaves, the often erect leafy-peduncled catkins, and the structure and colour of the style and stigmas; and from *nigricans* the somewhat tomentose twigs and leaves, the greater thinness of the latter, and their greater tendency to become black in drying, the often longer petioles, and the often longer pedicels of the capsules. But, as Andersson remarks, some specimens are very difficult to separate from *nigricans*, and others pass imperceptibly into *Myrsinites*, and thus it is often by no means easy to determine some of the less intermediate examples.

In Britain *Salix Wahlenbergii* is possibly not very much rarer than *S. Myrsinites* itself, since it occurs in many of the localities of the latter, though it has been passed over as *Myrsinites* and sometimes as *nigricans*. I have seen good intermediate specimens from Perthshire, Forfarshire, and Aberdeenshire—first gathered in the latter two counties by J. H. Balfour, Greville, and their contemporaries; and in addition many examples gradually passing into either *Myrsinites* or *nigricans*, and often very difficult to separate.

Neither Wimmer nor Andersson seem to have been acquainted with the ♂ plant, though the former quotes of the catkins “♂ elongati, graciles.” The ♂ has, however, been found on Ben Laoigh by the Messrs. Groves, and on Ben Heasgarnich by myself. These ♂ plants have leaves near *Myrsinites*, catkins short, thick, on leafy peduncles, and anthers subglobose and yellow, this yellow colour being the chief point in which they differ from *Myrsinites*.

*Salix MacNabiana*, MacGillivray (‘Edinb. New Philos. Journ.’ ix. p. 335, 1830), is possibly this hybrid, but MacGillivray’s own herbarium specimens (now in the possession of Dr. Roy, of Aberdeen)—from the Corrie of Loch Kandor, where the hybrid is common—are very close to, if not identical with, *Myrsinites*, though they are too poor for absolute certainty.

A hybrid between *S. Myrsinites* and *S. phyllifolia* probably occurs in Britain, but I have not yet seen examples sufficiently certain to enable me to include it in the list.

× *SALIX SAXETANA*, n. hybr. (*S. Myrsinites* × *S. aurita*.)

A willow gathered by myself some years ago, and more recently by Messrs. Groves, on Ben Laoigh, Perthshire, puzzled

me for a long time. I have found quite lately, however, several bushes which, by their range of variation, indicate pretty clearly the affinities. The plant seems, with little doubt, to be a hybrid of *Salix Myrsinites* and *S. aurita*, both of which occur on Ben Ladoigh, but is so altered that at first sight it does not suggest either of the parents. As yet I have seen ♀ catkins only—from at least three bushes, but I think that the ♂ also occurs\*.

The following description is made from a form tolerably intermediate in its characters. It makes a low thick-stemmed bush, with olive-green (turning brown when dried) slightly shining twigs, which are at first somewhat pubescent, but soon become glabrous. Leaves rather large (2 × 1 inches), especially at the top of the shoots, obovate, with a more or less oblique short point; margin wavy, coarsely crenate-serrate; upper surface dark shining green, with (when living) the veins slightly impressed; under surface dull pale green or subglaucous, with the primary veins raised; young leaves slightly pubescent, soon becoming glabrous, except on (to a greater or less extent) the midrib and rather long petiole. Stipules very small,  $\frac{1}{2}$ -cordate, glandular. Catkins moderate in size, erect or spreading, on long or short peduncles which are furnished with several small leaves whose axils have buds in them; scales narrow, pointed, with the upper half or third fuscous black; capsule rather small, conical-subulate, clothed with dense white hairs, and on a pedicel which is three to four times as long as the small quadrate yellow nectary; style rather short, bifid to, or nearly to, the base; stigmas rather short, bifid, spreading.

Specimens from another bush show much the same characters,

\* Since this was written, the supposed ♂ plant has flowered in cultivation. The following description was taken from a living specimen:—Catkins ovate-oblong, lateral, on a peduncle with about three leaves which are as long as the catkin. Peduncular leaves minutely stipulate, glabrous, pale dull green, with the chief veins yellowish green and impressed above; below clothed with rather straight hairs on the midrib, chief veins, and apical margin, dull paler green, with the principal veins yellowish and raised; veins translucent, those which arise from the midrib becoming subparallel to it; margin finely glandular-serrate. Scales broad, greenish white below, the upper third or fourth becoming black (the scales at the top of the catkin are red between the pale and black portions); upper part sparingly hairy with long whitish hairs; apex usually emarginate or erose. Filaments pale, glabrous. Anthers (with cells unequal) subquadrate, at first tinged with red, becoming yellow. Nectary rather small, thick, oblong, usually entire, but sometimes divided into two or more irregular pieces, green or yellowish-green. The date of flowering was the end of May.

but the capsule is less subulate and more cylindrical and obtuse, and seems to show below the hairs a trace of the scaly pubescence which is sometimes characteristic of *Salix Myrsinites*.

A third bush, while practically the same as the others, shows rather a greater affinity with *S. aurita*. The twigs are more slender; the young leaves more pubescent; the margins of the leaves more serrate; the catkins smaller, with narrower, more ferruginous scales; the capsule more like that of *aurita*, with usually an almost obsolete undivided style, and very short, bifid, and erect stigmas.

It will be seen from the foregoing that, though the leaves have to a great extent retained the outline of those of *S. aurita*, they have lost the rugosity characteristic of that species, though in their young state they show in part the pubescence. From *S. Myrsinites* the shining upper surface has been derived, but the substance is thinner than in that plant. The capsule structure shows varying affinities with both species.

Besides the Ben Laoigh examples, I have seen specimens collected in Clova, Forfarshire, by the Rev. W. R. Linton, which—although there are no catkins—I believe to be another form of *S. saxetana*. In shape the rather small leaves recall both *S. Myrsinites* and *S. aurita*. They are roundish- or oblong-ovate, with short more or less oblique points; green but (at least when dried) only slightly shining on either surface; margins finely crenate-serrate; both surfaces sparingly pubescent—the pubescence becoming scantier, but scarcely altogether vanishing in the older leaves; young leaves rugose, with impressed veins above and raised veins below; older leaves flatter above, but with conspicuous pale (when dried) raised veins below; petioles rather long; stipules present, but small. I think that, so far as the leaves go, there can be no doubt as to the parentage of this plant.

× *SALIX SERTA*, n. hybr. (*S. Myrsinites* × *S. Arbuscula*.)

A specimen in Mr. F. J. Hanbury's "Boswell Herbarium," labelled "*Salix Arbuscula*. Breadalbane Mts., Lyon," seems almost certainly a hybrid between *Myrsinites* and *Arbuscula*.

The leaves recall both species, and are rather small, slightly obovate, shining above, and dull and glaucous below, finely crenate-serrate on the margins, quite glabrous (except when very young, when they have the pubescence of *Arbuscula*), and veined

in the style of *Myrsinites* rather than *Arbuscula*. The catkins (♀), which are borne on terminal and lateral, rather long, leafy peduncles, are  $1\frac{1}{2}$ -2 inches long, stout and cylindrical; scales small and rather narrow, very hairy; capsules sessile or nearly so, oblong-conical, obtuse, coloured like those of *Arbuscula*, and hairy; style slender, rather short, with the apex bifid; stigmas short, slender, bifid. The plant is quite intermediate between its supposed parents.

Here also may belong a scrap in the same herbarium labelled "*Salix prunifolia*. Breadalbane Mts. J. D. Hooker." If it does, it is nearer *Arbuscula*. The small leaves are rather intermediate; the capsule more slender than in the above; the style very short, and the stigmas very short and thicker.

Under *S. Arbuscula*, Walker-Arnott describes a var.  $\beta$  from Ben Lawers, with "leaves (broadly or roundish ovate, prominently veined above) green, but scarcely shining on both sides." Of it, he says that it is precisely intermediate between *Arbuscula* and *Myrsinites*, and may perhaps be a hybrid. It was found only once.

#### 15. SALIX HERBACEA, L.

*S. herbacea* varies in many small particulars, such as size, shape and extent of serration of the leaves, downiness of the young shoots, &c. The pedicel of the capsule varies a little in length, and in being glabrous or silky, the silkiness sometimes extending to the base of the capsule. The style also varies in length. Occasionally the capsule has a few hairs on it, and more rarely well-developed lines of hairs. The most extreme state of this form which I have seen is in a plant, collected by Dr. Greville in Corrie Kandor in 1830, which has, moreover, the style bifid to the base. A less extreme form I have found near Glen Tilt. Andersson describes a var. *subpolaris* whose capsule has lines of hairs, but it differs from the type in also having entire leaves.

× *SALIX GRAHAMI* (*Borr.*), *Baker.* (*S. herbacea* × *S. phylicifolia*?)

Under *S. Myrsinites* Sir J. D. Hooker has the following note:—" *S. Grahami*, *Borr.* MS., is only known from ♀ specimens, cultivated in the Edin. Bot. Garden, said to have been brought by Prof. Graham from Frouvyn in Sutherlandshire.

It appears to me to be a form of *Salix Myrsinites*, with smaller catkins, paler scales, and a perfectly glabrous capsule with a rather long very silky pedicel; and not allied to *S. polaris* or *herbacea*. Syme suggests it to be a hybrid between *herbacea* and *nigricans* or *phylicifolia*; and Nyman a subsp. of *S. retusa*, L. The Engl. Bot. figures of the ovary and scale are very incorrect. A similar plant occurs in Muckish Mt., Donegal."

Having examined living specimens of both the Scottish and Irish plants, I think that Boswell-Syme is probably correct in his suggestion of the parentage; but I cannot agree with Leefe in considering that the Irish plant "is as nearly as may be identical" with the Sutherland form. In fact, I suspect (although, till it is proved by experiment, it is only a conjecture) that whilst *S. herbacea* is one of the parents of both, *S. phylicifolia* is the other parent of the Scottish plant, and *S. nigricans* of the Irish. If this be the case, the former must bear the name of *S. Grahami*, and the latter that of *S. Moorei*.

The published descriptions of neither of them are absolutely correct, but it will be sufficient to indicate the points in which the two differ.

× *S. Grahami* (Borr.), Baker.

Young leaves brighter and more shining, rather broader, less pubescent, the pubescence being more of the nature of that of *S. phylicifolia*, but not markedly so. Scales involvent, broader upwards, obtuse, subemarginate at apex, hairy at the base and ciliate on the margin. Pedicel of the ovary silky-hairy, the pubescence spreading more or less over the base of the ovary, which is otherwise glabrous. Style rather stouter; nectary oval-oblong.

× *S. Moorei* ("Watson, L. C.").

Young leaves duller, narrower, and more hairy, the pubescence resembling that of *S. nigricans*. Scales much longer in proportion, narrow oblong, subobtuse at apex, and more hairy. Pedicel of ovary apparently longer, glabrous or slightly hairy; ovary more or less pubescent towards the apex. Nectary linear-oblong, about as long as the pedicel, finally much shorter.

The most apparent differences between the two lie in the very differently shaped scales and in the pubescence of the ovary.

Boswell-Syme describes the peduncle of the catkin of the Suther-

land plant as glabrous, but, in all the specimens I have seen, it, as well as the rhachis, is distinctly pubescent. Stipules were unknown to him and are certainly rare, but when present are small, more or less narrowly ovate, and toothed. Possibly they are more frequent in *Salix Moorei* than in *S. Grahami*.

In some wild specimens of *S. Moorei* (kindly lent me by Mr. F. Moore) there are ripe capsules. These are subulate from an ovate base, and about  $\frac{1}{4}$  inch long. The facies of the wild specimens favours the theory that *nigricans* is one of the parents.

The late Dr. Moore, in recording the occurrence of the Irish plant, says that it is the same as specimens of *S. Grahami* from the Sow of Athole in Perthshire. I have not been able to learn anything about this Sow of Athole plant; but in Borrer's Herbarium at Kew is a plant, placed under *S. Arbuscula*, which was collected on that hill by Mr. J. Ball. Its condition is bad, but it seems not to be *S. Arbuscula*, and may be a form of the Sutherland *Grahami*, though not agreeing with it in the scales or leaves.

× SALIX SIMULATRIX, n. hybr. (*S. herbacea* × *S. Arbuscula*.)

Under this name I place specimens of four plants from the Breadalbane Mountains, which, though unlike each other, seem to be probably hybrids of *S. herbacea* with *S. Arbuscula*. They all, however, require further investigation. These plants and their characters are as follows:—

1. From Coire Dhubb Ghclair (J. Brebner). Nearer *S. Arbuscula* than *S. herbacea*. From the latter it derives its habit, slender arcuate branches, roundish oval thinner leaves, and pseudo-terminal catkins (*i. e.* at the end of a branch and subtended by a leaf, but with a bud between the leaf and the peduncle); from *S. Arbuscula* it has the thicker trunk and more oval leaves, dull glaucous green below and with the smaller veins less prominent. Whilst bearing a strong resemblance to *Arbuscula*, it is not exactly like any of the numerous specimens which I have seen. Compared with examples of the latter of the same age, it may be distinguished by the leaves being thinner, more shining above, and roundish oval in shape; by the habit and slender branches; and by the position of the catkins. There is only one catkin on the specimen, and that not in good condition. The capsules, whilst resembling those of *Arbuscula*,

seem to be a little longer in proportion to their size than in that species.

2. A specimen in F. J. Hanbury's "Boswell Herbarium," on a sheet with the label "*Salix prunifolia*, Breadalbane Mts., J. D. Hooker." This has no flowers, but is in habit nearer *herbacea* than No. 1, with which in the leaves it quite agrees.

3. Meall Dhuin Croisg (W. Barclay and R. H. Meldrum). In habit and leaves near *herbacea*, but in its catkins nearer, apparently, *Arbuscula*. I once thought that this might be a form of *S. Moorei* nearer *S. herbacea*, but now I suspect that *S. Arbuscula* is more likely to be one of its parents. The catkins are lateral on leafy peduncles, and are moderately long. The capsules are pubescent, intermediate in shape between those of *Arbuscula* and *herbacea*, and pedicellate, with the pedicel about as long as the long linear nectary. The style is of medium length, and the stigmas rather short, thick, and cleft. The leaves much resemble those of *herbacea*, but are not quite identical. It is beyond doubt a hybrid of *herbacea*, but whether with *Arbuscula* is a little uncertain.

4. A specimen in the Edinburgh University Herbarium, labelled "*Salix vacciniifolia*, Craig Chailleach, Perthshire; Dr. Hooker." This has young catkins and young leaves only. The leaves seem essentially the same as those of Nos. 1 and 2. The catkins are lateral and terminal, on leafy peduncles, very small and subglobose. The scales are glabrous on the back and ciliate on the margins, and very similar to those of *herbacea*. The ovaries are like those of *Arbuscula*, but the style and stigmas like *herbacea*. Larger and older specimens are desirable.

× *SALIX SOBRINA*, n. hybr. (*S. herbacea* × *S. Lapponum*.)

A morsel of a willow gathered on the east side of Ben Chat, in Athole Forest, Perthshire, by Dr. Roy, of Aberdeen, and by myself, had long been a puzzle to me (especially as it had no catkins) till I came to examine a plant found by the Rev. E. S. Marshall in Glen Fiagh, Clova, Forfarshire, in 1888. These latter specimens, being in better condition and having ♀ catkins, show that it is a hybrid between *S. herbacea* and *S. Lapponum*.

The examples which I have seen are so intermediate between the parent species, that they are not strikingly like either of them. In size the plant is like *herbacea*, but in habit more like *Lapponum*, especially in the comparatively (to the size) stout,

knotty, tortuous, reddish-brown glabrous branches. The leaves are small, oval, at first woolly on each side, but becoming subglabrous, and slightly shining on each surface; margin obscurely serrate; base rounded; tip (sometimes twisted) subacute and subcartilaginuous, as in *Lapponum*; veins and margin pellucid; veins finally raised and reticulate on the upper surface; lower surface lineately veined and reticulate with raised veins. Catkins short, few-flowered, lateral on long leafy peduncles; scales large and broad, obovate, subtruncate, brown with darker tips and long white hairs; capsules sessile, white-woolly, at first conical, then subulate-conical; style moderate, about as long as the rather thick entire or bifid suberect stigmas; nectary long linear. Young shoots pubescent.

A willow from Clova (Dr. Greville, 1824), in Edinburgh University Herbarium, may belong here, but if it does it is nearer *herbacea* than the above. It has leaves only.

Since this description was written I have received specimens of *S. Lapponum-herbacea* (no authority for the name, and *S. alpestris*, And., given as a synonym) from Sweden. These are, to all intents, the same as the Scottish plant, though rather more luxuriant. "*Alpestris*" is the name adopted by Andersson (in the 'Norges Flora') for the hybrid between *S. herbacea* and *S. glauca*, and is placed with four other, variously composed, hybrids under *S. norvegica* (Fr.), And.

I have also seen a more numerous series of specimens collected in Clova by the Messrs. Linton, as well as what appears to be another form (collected by the same botanists) from Craigna-dala Beg, Aberdeenshire. These specimens exhibit various degrees of combination between the supposed parents.

× *SALIX MARGARITA*, n. hybr. (*S. herbacea* × *S. aurita*.)

In Messrs. Groves' herbarium is a very curious willow, found by them on Craig Loigste, on the south side of Ben Challum, in Perthshire, in 1855; and growing in the Edinburgh Botanic Garden are two willows (for specimens of which I am indebted to Mr. Lindsay, the Superintendent) which, though not identical with the Messrs. Groves' plant, are apparently another form of the same species. The Edinburgh Garden plants were found in 1875, by the late Prof. Dickson and the late Mr. J. Sadler, near Tyndrum, and probably both on Ben Challum, since a specimen

sent by Mr. Sadler to Mr. Leefe, and now in Kew Herbarium, has Ben Challum given as the locality.

Mr. Sadler describes the wild plant as having "a dwarf procumbent habit;" and Messrs. Groves' specimens show this, but the cultivated specimens sent to me look as if they had become more upright.

The following is a description taken from living specimens of the plant found by Mr. Sadler, and now in cultivation:—

Twigs divaricate, slender, straight or subflexuose, purple-brown, glabrous, shining; older bark brown or very dark olive-green, roughened but shining; youngest shoots with white pubescence, when older green, or where exposed to the light dark red-brown or purplish, shining, but with a few hairs. Buds at first pubescent, then glabrous, yellowish-red, acute. Stipules (rare) half-cordate, hairy, glandular-serrate on the margin. Leaves thin, dark green, slightly shining above, paler and dull below, at first densely woolly with brownish-white hairs, at length almost or quite glabrous; roundish; base rounded, subcordate, or unequal and slightly cuneate; tip with a twisted point, or truncate, or subemarginate; upper surface concave; margin thickened and incurved serrate-crenate, with incurved glandular teeth; upper surface rugose from the impressed veins, under surface with raised reticulate veins, smaller veins pellucid; petioles rather long and slender; the largest leaves  $1\frac{1}{4}$  inch long and broad, but most of them much smaller; vernation involute. Catkins (♀) small (less than  $\frac{1}{2}$  inch long), dense-flowered, on lateral leafy peduncles of about the same length as the catkin; peduncle-leaves 2-4, ciliate, with buds in their axils, and stipulate; peduncle and rachis downy; scales oblong, narrow and long, concave, glabrous on the back, ciliate at the apex, and with a few hairs on the inner surface, greenish yellow, those at the top of the catkin tinged with pink at their tips; ovary conical from an ovate base, sub-obtuse, with coarse woolly white pubescence; pedicel downy, nearly three times as long as the nectary, which is thin in texture, oblong or widened upwards, entire or cleft once or twice at the apex or nearly to the base; style very short, thick, greenish yellow; stigmas bifid, suberect, as long as the style.

In one specimen the uppermost scales are widened upwards, broader and involute, and have a few hairs on the back.

In Prof. Dickson's plant the characters are much the same. The older bark is duller, the buds are less acute, and the catkin-

123

scales more uniformly narrow, the catkins rather larger, and the stigmas spreading.

Messrs. Groves' specimens have often obovate and sometimes oblong leaves, the largest about 1 inch long by  $\frac{3}{4}$  inch broad, but most of them less than half that size; slender, more flexuous twigs; young leaves less hairy; petioles rather shorter; the solitary catkin more slender, with scales shorter, broadly obovate, and involvent, the pedicel of the ovary rather shorter, and the stigmas larger and spreading.

There can, I think, be no doubt that this species is a hybrid between *Salix herbacea* and *S. aurita*. The Edinburgh Botanic Garden plants are, in the shape of the scales and in the capsules, nearer *aurita* than *herbacea*, to which, in these parts, Messrs. Groves' specimens are more related. Both sets are, however, intermediate in character between their parents.

#### 16. SALIX RETICULATA, L.

In several small points *S. reticulata* departs from the usual descriptions of this well-marked species, but these variations require no special notice. The margin of the leaf is described as entire, but on the apparent margin (though not usually on the real edge) there is frequently a row of glands which give the appearance of a minute serration.

Andersson mentions two varieties—*a. typica* and *β. nivalis* (*S. nivalis*, Hooker), the latter being a remarkable small form which occurs in Iceland, Spitzbergen, and N. America. The var. *a. typica* is divided into:—1. *glabra* (leaves quite glabrous on each side), and 2. *sericca* (leaves more or less villous, and the margin towards the base here and there glandularly subserrate). The latter is the more frequent form in limestone districts of S. Europe. Whilst the Scottish plant must be referred to 1. *glabra*, I think that the Glen Callater examples retain the hairs on the underside of the leaf (both surfaces are more or less hairy when young) for a longer period than the Perthshire ones do.

I have seen two Scottish plants which have been referred to *S. reticulata*, but which seem to be evidently hybrids of it with other species. They are well worth further investigation.

One of these plants is in the British Museum Herbarium, and is labelled "*Salicis reticulatæ* varietas?, Ben Lawers, Perthshire, 1793, R. Brown." Unfortunately it has no flowers, but it may be thus described:—

In habit like *S. reticulata*, but stems more slender, rooting, chestnut-brown. Petioles very short, being little, if at all, longer than the bud in the axil. Leaves narrowly oval or elliptic, some of them rather broader beyond the middle, attenuate at the base, flat above and below and glaucous below; midrib and veins slender, primary veins leaving the midrib at a very acute angle and running parallel to it, secondary veins anastomosing; margin cartilaginously thickened, entire; texture apparently thinner than in *reticulata*; young leaves with a few hairs below, soon becoming quite glabrous. Largest leaves nearly 2 inches long by  $\frac{3}{4}$  inch broad; average size  $1\frac{1}{2} \times \frac{1}{2}$  inch. The very short petioles &c. indicate the distinctness of this plant (which may be provisionally called *S. sejuncta*) from *S. reticulata*.

The other plant referred to is in the Kew Herbarium, and is labelled "*Salix reticulata*, L., And." (meaning that Andersson certified it), "Scotland, Herb. Lambert."

It is quite a different looking plant from *S. reticulata*. The stems are straighter than in that species, and more or less woolly. The leaves are less strongly reticulate, quadrately oval, cordate at the base, distinctly and rather closely crenulate-serrate, woolly on each side but more especially above; petiole very short, and very woolly, as is the young shoot. The catkins are lateral; the scales (not in good condition) seem to be larger; capsule (burst) sessile, glabrous, shaped as in *reticulata*; style rather long; stigmas rather long, entire or bifid. This apparently very distinct plant I provisionally name *S. soluta*; but I am unwilling to place either it or the other in the list till they have been rediscovered.

× *SALIX SEMIRETICULATA*, n. hybr. (*S. reticulata* × *S. nigricans*?)

A willow which was discovered at an altitude of 2300 feet on Meall Ghaordie, in Perthshire, by Mr. James Brebner, has a superficial resemblance to *S. Grahami*, chiefly from the habit of the plant and the shape of the leaves. It seems, however, to be a hybrid between *S. reticulata* and probably *S. nigricans*, although it has not much resemblance to either of these species. It may be thus described:—

Branches slender, long and trailing; bark fuscous brown, glabrous and shining; shoots of the year dull paler brown, white-pubescent. Buds red-brown, at first slightly pubescent

with white hairs, finally glabrous, quadrately-ovate and obtuse. Leaves at first half-folded, the older ones flatter, oblong-orbicular, truncate or subcordate at the base, obtuse or slightly twisted at the apex; margin slightly reflexed, slightly and rather remotely glandular serrate-crenate or nearly or quite entire, youngest leaves less obscurely crenate; surfaces at first, and especially below, more or less furnished with white woolly adpressed hairs, afterwards glabrous above and nearly or quite glabrous below; upper surface dark green, shining, reticulately rugose from all the veins, even in the smallest, being impressed (when dried, however, some of the veins are raised); under surface dull paler green, white-dotted as is also the upper surface, the veins including the smaller ones somewhat thickened and reticulately prominent, more especially when young; veins numerous, pellucid; primary veins forming an acute angle with the midrib, those towards the base of the leaf more approximate; larger leaves about  $1 \times \frac{1}{2}$  inch, smaller  $\frac{1}{2} \times \frac{1}{2}$  inch; petiole about  $\frac{1}{4}$  of the lamina in length, grey-woolly above; stipules (rare) minute, roundish, glandular, soon disappearing; leaves involute in vernation. Catkins lateral on peduncles about as long as the catkin, and with three or four leaves with buds in the axils, the leaves similar to the other leaves but smaller, and the upper surface mostly glabrous, narrowly red at and near the apex; catkins ovate, short, compact; rachis stout, woolly; scales membranous, brownish, clothed with long straight white hairs on both surfaces, broadly spatulate, obtusely rounded and erose at the apex; capsules (large for the size of the catkin) ovate subulate, slightly compressed obtuse (acute in the young ovary), green tinged more or less with red-brown, slightly hairy especially towards the top, but sometimes becoming almost or quite glabrous; pedicel silky or glabrous, stout, shorter than the long, linear, very thin nectary; style moderate, bifid at apex; stigmas about as long as the style, bifid, erect, but twisted and recurved at the apex\*.

\* The above description was taken from the rather old catkins of the wild specimens. The following is from a younger catkin from a cultivated plant:—Scales veined, broadly obovate, involvent; apex truncate or slightly rounded, and sometimes slightly emarginate; greenish white at the base, brownish, reddish brown, or red in the middle (the upper scales being the brightest coloured), and black at the apex; upper part of both surfaces clothed with long white hairs. Ovary subulate-conic, shortly pedicellate, both ovary and pedicel hairy with long hairs or somewhat glabrous below; style stout, yellow, its

In some specimens the midrib and primary veins, as well as the petiole and margin, are somewhat reddish in colour.

A willow which Mr. Brebner found on a neighbouring rock to the above much resembles it, but has flatter, more oblong leaves, more closely but shallowly crenate-serrate or almost serrate, more distinctly white-dotted above, less rugose above and less reticulate below, veins less pellucid, and margins less reflexed. I have not yet seen catkins\*.

In Smith's herbarium is a willow labelled in ink "*Salix elliptica*, nov. sp., Clova Mountains, Mr. Thos. Drummond, Mr. W. Robertson, 1825," and in pencil "I have this as a rounder-leaved var. of *S. Myrsinites*." It has no catkins, but—from memory—is much like *S. semireticulata*. I think that it has no connection with *S. Myrsinites*.

× *SALIX SIBYLLINA*, n. hybr. (*S. reticulata* × *S. Lapponum*.)

In Edinburgh University Herbarium are four small specimens of a willow found by Greville near Loch Brandy, Clova, in 1824. They are labelled "possibly a pilose state of *S. reticulata*."

Though without flowers, these specimens so evidently belong, I think, to a hybrid between *S. reticulata* and *S. Lapponum*, that I have ventured to give them a name and a place in this list.

The twigs are intermediate (between the parents) in character, rather stout, shining, chestnut becoming grey; young shoots slender, somewhat pubescent. Leaves small (the largest  $\frac{3}{4} \times \frac{1}{2}$  inch, but many are much smaller), ovate, ovate-oblong, or subrotund, at first woolly on each surface but more especially below, finally nearly glabrous above and slightly shining; upper surface at first slightly impressed by reticulate veins; under surface with primary veins raised, the others scarcely or slightly raised, reticulate; margin incurved, with obscure glands as in *reticulata*; apex obtuse, or with a short cartilaginous point as in *Lapponum*; base subcordate, rounded, or shortly cuneate; petioles very short.

Whilst bearing no striking resemblance to *reticulata*, it yet

base hidden by the scale; stigmas equal in length to the style, thick, bifid, curved, and connivent, yellow. Nectary much longer than the pedicel of the ovary, linear oblong, rather thick, yellowish green.

\* A cultivated plant has since this was written produced ♀ catkins which, though not perfectly identical with those of the other plant, are not essentially different in structure. In the structure of the stigmas and scales there is much resemblance to *S. Grahami*.

shows in the venation, structure of the margin, and shape of the leaves, its relationship to that species. The specimens are too old to show the colour well, but that of the principal veins is in the direction of *S. reticulata*, namely reddish.

From the look of the examples and the dead wood about them, they seem not to have been in robust condition, and probably the plant grows much larger.

### C. SYNANDRÆ.

#### Group 10. PURPUREÆ.

##### 17. SALIX PURPUREA, L.

Whilst both British and Continental salicologists distinguish several modifications or so-called varieties of *S. purpurea*, they are not altogether agreed as to what these are or as to the names they should bear.

In Britain the "species" into which Smith and Borrer divided *S. purpurea* are still retained as varieties of that plant. These are *Lambertiana*, Sm., *Woolgariana*, Borr., and *ramulosa*, Borr. (sometimes included in *Woolgariana*); and according to Babington, *S. Helix*, L.

Andersson has, in addition to the type (*a. gracilis*, G. and Gr. = *S. purpurea*, Sm.), *Lambertiana*, Sm. (including *S. Woolgariana*, Borr.), and *S. Helix*, "L." (which is not the *S. Helix* of British botanists, but seems to be the same as *ramulosa*, Borr.).

Wimmer distinguishes the forms *eriantha*, *gracilis*, *Lambertiana*, *styligera*, *sericea*, and *furcata*.

As characterizing their varieties, British botanists lay stress upon the colour of the twigs and upon the form of the stigmas, points which are almost or quite ignored by the Continental salicologists. That the colour of the bark is not a constant character may be learnt from an examination of almost any living bush, when it will be seen that very frequently the coloration depends to a great degree upon exposure to the light. Moreover, from authentically named specimens it would seem that even British botanists do not attach so much importance to this feature as the descriptions would imply. Thus in Smith's herbarium *Lambertiana* (from Lambert himself), whose twigs modern writers describe as purplish, has in two of the flowering-specimens dark-coloured, and in the third, pale, bark.

As for the shape of the stigmas, I think that not much reliance can be placed on that supposed characteristic.

There remain therefore as primary characters, the form of the leaves, of the catkins, and of the capsules; and following Andersson's views three chief forms may be distinguished by those who wish to retain varietal names. These are:—

1. *gracilis* (or *genuina*), with slender catkins, small subovate capsules, and usually narrow leaves.

2. *Lambertiana*, with larger catkins, ovate-conic capsules, and larger leaves broad throughout (*Lambertiana*), or conspicuously broader above the middle (*Woolgariana*).

3. *ramulosa* (*S. Helix*, And., but since *S. Helix*, L., is dubious, the use of that name is not expedient), with rather stout capsules, and narrow, more elongate, and more acuminate leaves.

After examining an extensive series, the conclusion I come to is that while extreme forms admit of having one or other of these "varietal" names applied to them, the various modifications pass insensibly (as Boswell-Syme remarks) into each other, and that there are many specimens of which it is impossible to say with certainty to which variety they belong. I doubt therefore the expediency of retaining any varietal names.

Regarding Wimmer's forms (other than those mentioned above), there are amongst British specimens plants that might be referred to *eriantha* (catkins more hairy) though not in an extreme state, to *styligera* (ovary with a short style), and to *sericea* (young leaves more or less woolly).

× SALIX RUBRA, *Huds.* (*S. purpurea* × *S. viminalis*.)

Since there has never been perfect unanimity amongst salicologists regarding Linné's *Salix Helix*, I have used for the hybrid between *S. purpurea* and *S. viminalis* Hudson's commonly accepted name of *S. rubra*. At the same time it is by no means clear that *S. Helix* should not be the name to be adopted.

Fries and Koch, and at a later period Andersson, thought that *S. Helix* was only a form of *S. purpurea*. Wimmer, on the other hand, believing that Linné could not have described under two names such a well-marked species (and one which he had seen in a living state) as *S. purpurea*, makes *S. Helix* a synonym of his *S. viminalis-purpurea*. Smith and his followers considered *S. Helix* to be a distinct species; and the later British botanists (with the exception of Babington, who places it under *purpurea*) agree in thinking it to be a variety of *rubra*.

Now, whatever doubt attends the Linnean plant—and it is certainly great,—there is none about Smith's. Both his descriptions and his specimens clearly indicate a hybrid between *purpurea* and *viminalis*, though much more closely related to the former than to the latter. It is to be noted, however, that many herbarium specimens named *Salix Helix* belong to *S. purpurea*.

As a rule, *S. rubra* seems to show a smaller range of variation than most other hybrids, and hence its division by Grenier into two chief varieties—*viminaloides* and *purpureoides*—has some claim for consideration. But this supposed constancy of form is perhaps more apparent than real; and is due, in the first place, to the fact that in many cases the plants have been derived from cuttings, and not from seeds; and, in the second, to the leaves of both parent species being of the linear-lanceolate type, and hence not affording so much scope for difference in outline in the hybrid.

Var. *viminaloides* (or *rubra genuina*) is distinguished by its longer and narrower lanceolate leaves, more or less pubescent below, at least when young, and with the margins more or less revolute; by the paler and more hairy ♀ catkins; and by the longer style and stigmas. The petioles of the leaves are described as longer, but in this and other points there is variability. In some British books the filaments are said to be free except at the base; but in the same catkin filaments almost free or united to any point between the base and the apex may be found.

Var. *purpureoides* (which includes *Forbiana*, Sm.) has leaves broader at the middle, with flat and more or less serrated margins and more entirely glabrous surfaces; darker-coloured and less hairy catkins, and more obtuse capsules with shorter styles and thicker stigmas. The leaves are described as more shortly petioled than in *viminaloides*, and Continental examples often show this, but in authentic examples of the British *Forbiana* the reverse is the case.

Andersson adopts Grenier's division into two varieties; but Wimmer, who distinguishes several forms, does not: and since in places where *rubra* occurs as a spontaneous hybrid, plants combining the characters of *viminaloides* and *purpureoides* may be found, I think that it is not desirable to maintain varieties in this hybrid more than in others. Wimmer's forms are b. *Forbyana*; c. *sericea*, Koch (= *S. eleagnifolia*, Tausch), with the leaves clothed below with silvery-white hairs—a form which I have seen in Perthshire; d. *macrostigma*; and e. *angustissima*. These and other described modifications show that though, for

the reasons given above, there appears to be a constancy of form in *Salix rubra*, a series of conditions can be found connecting *viminalis* and *purpurea*, the chief grades being *sericea*, *rubra*, *Forbiana*, and *Helix* (of Smith).

A Perthshire plant, otherwise intermediate in its characters, has rather remarkable stamens. Whilst the filaments are usually connate half-way or to near the top, in some of the flowers one or both are divided at the apex—the division being of unequal length, and presenting the appearance of a stamen with 2, 3, or 4 irregular branches. It is to be noted that as these branches form acute and not obtuse angles with the main filament, this does not seem to be a true case of what Hayne has termed cladostemmy.

× *SALIX SORDIDA*, Kern. (*S. purpurea* × *S. cinerea*.)

As the name *S. Pontederana*, Schleich., is, according to A. Kerner, dubious, having been applied to hybrids of *S. purpurea* with several of the *Capreae*, it appears advisable to use Kerner's name of *S. sordida* for the hybrid with *S. cinerea*. Andersson, indeed, retains the name *Pontederana*; but he makes it include the hybrids formed not only with *S. cinerea*, but with *S. Caprea*, *S. grandifolia*, and *S. aurita*, since he thinks that there is no sure method of separating them. As, however, he has not united these species, it is scarcely justifiable to unite the hybrids if it is at all possible to distinguish them; and he himself has kept them separate as varieties.

Of *S. sordida* (whose synonyms are *S. subpurpurea-cinerea*, Kern., and *S. cinerea-purpurea*, Wimm.), Andersson, following Wimmer, describes two modifications, viz.: 1. *cinerascens* (nearer *S. cinerea*), and 2. *glaucescens* (approaching *S. purpurea*, and probably *S. Pontederana* of Koch). It is to be noted, however, that in other respects Andersson's and Wimmer's descriptions do not tally in every particular; and that, moreover, Wimmer's published specimens do not always altogether agree with his descriptions, as, for example, in the length ascribed to the pedicel of the capsule.

In the Woody Island near Perth, where both *S. purpurea* and *S. cinerea* abound, *S. sordida* appears to be not uncommon. But while forms quite intermediate between the parent species occur, the majority of individuals are in character much nearer *S. cinerea* than *S. purpurea*—so near, in fact, that in the absence of

flowers, some of them would with difficulty be discriminated from *cinerea* otherwise than as slight modifications.

As belonging to *Salix sordida* I put all plants which, however like *cinerea* they may be, have the filaments of the stamens more or less united to each other. Connate filaments may, according to Wimmer, be distinguished from cladostemmic ones by the branches forming an acute and not an obtuse angle; and one of the best characters of hybridization with *S. purpurea* is the presence of connate stamens.

In these Woody Island plants an extreme degree of connation is rare. Frequently the filaments are united for a little way above the base only; but in the same catkin free, slightly united, and more distinctly connate stamens may all be found—a phenomenon which may be seen in *S. rubra* and other hybrids of *S. purpurea*.

Other points in which these *cinerea*-like plants are variable are the shape, colour, and pubescence of the leaves, stoutness and pubescence of the twigs, shape of the catkins, and colour of the anthers. In all these particulars they approach, or recede from, *S. cinerea* by almost imperceptible gradations. Probably, as Wimmer suggests, the *cinerascens* modifications of *S. sordida* have a somewhat different origin from those which are nearer *S. purpurea*, having been possibly produced by *purpurea* ♀ × *cinerea* ♂, or, what seems more likely, by the crossing of *sordida* with *cinerea*.

The ♀ of the *cinerea*-like forms is a much more difficult plant to distinguish than the ♂, since of course we have not the assistance afforded by the connate filaments. I have indeed found some plants whose catkins are so like those of *cinerea*, that it is only by the resemblance of their leaves and habit to some ♂ plants of *sordida* that they can be referred to that species.

In addition to the Woody Island plants, I have seen specimens from a ♂ bush found at Dalmarnock, on the Tay above Dunkeld, by Mr. C. M'Inotsh, and have found both sexes on the banks of the Tay below Perth.

Another willow from the Woody Island I at present include under *S. sordida* (as var. *rubella*), though I am inclined to suspect that it may be a cross of *S. rubra* (with which it grows) and *S. cinerea* (i. e. *S. purpurea* × *S. viminalis* × *S. cinerea*). In its leaves and habit it is near *S. purpurea*, but has free stamens. The very beautiful catkins are small or moderate in size; the unopened anthers orange-red, but when burst yellow from the

pollen, and finally, when empty, fuscous; leaves oblanceolate, dark green and shining above, very glaucous below, soon quite glabrous, but at first more or less pubescent with brownish hairs; branches slender and straight, glabrous almost from the first.

× *SALIX DICHROA*, Döll. (*S. purpurea* × *S. aurita*.)

To this hybrid belongs the willow published by Mr. Leefe (*Sal. Exs.* iii. No. 59) as "*Salix Pontederana*? Schl.," and found by him at Rothbury in Northumberland.

*S. dichroa* is very similar to *S. sordida*; but the *cinerea* element in the latter is replaced by *aurita*. Mr. Leefe, who describes his plant as "a small shrub with declining branches," has published ♂ specimens only; and these agree so sufficiently well with examples of the hybrid issued by Wimmer and by Kerner, that there can be no doubt about their identity. Mr. Leefe found in the same place a willow which he thought "*might* be the female;" but the catkins are much deformed, being, in fact, hermaphrodite monstrosities. Of this I have seen one catkin only; and from it not much can be learnt. The leaves, however, resemble those of the ♂ plant, but are rather nearer in character to *S. aurita*.

× *SALIX DONIANA*, Sm. (*S. purpurea* × *S. repens*.)

*Salix Doniana* was founded by Smith ('English Flora,' iv. p. 213. 47) on a willow "sent from Scotland, as British, by the late Mr. George Don;" and though it has continued to be retained in our floras, it is probable that the majority of the later botanists had come to the conclusion that its claims to be considered British were very slight. For my own part I had, at the time that this paper was read, decided to omit it from the list of British Willows, because, amongst other reasons, it had not come directly from Don into Smith's hands, but from Borrer, who received it from George Anderson, and in the transmission from hand to hand some particulars of its occurrence might have been accidentally lost. But I have now the pleasure of restoring it to a place in the list, having, during the past summer, found undoubtedly wild specimens on the banks of the river Tummel, near Pitlochry, in Perthshire.

The plants I found were growing with *S. purpurea*, and in the neighbourhood of *S. repens*. They are distinctly intermediate in character between the parents. The following notes were taken

from living specimens:—Bush about 18 inches high. Bark of the twigs shining brownish green, of the shoots redder and slightly downy. Some of the upper leaves subopposite, after the manner of *Salix purpurea*. Leaves dull, rather dark green with white hairs above; below dull pale green, with more copious long white hairs; margin cartilaginous, slightly incurved, very finely and remotely serrate, with reddish glands; veins pellucid, the chief veins impressed on the upper surface and raised on the lower. In shape the leaves are similar to those of the *S. purpurea* amongst which it was growing (*i. e.* similar to *S. Doniana*, Sal. Wob. t. 85). Catkins (♀) rather old, lateral, on a peduncle having three or four small leaves. Scales ovate spatulate, rounded at the apex, upper half black, with long white hairs. Ovary ovate conic, blunt; style distinct, though short; stigmas very short, thick, and rather broad, semi-bifid; ovary white pubescent, on a pedicel about as long as the linear pale yellow nectary.

Though the ♀ plant only has been found in Britain, both sexes are known in Central Europe, where *S. Doniana* is widely distributed. Andersson mentions four forms or varieties, viz. *α. latifolia*, *β. lingulata*, *γ. linearis*, *δ. leiocarpa*. Wimmer describes six forms, but does not give them names. The filaments of the ♂ flowers are connate at the base only, or for a third or half their length.

## DESCRIPTION OF THE PLATES.

## PLATE IX.

A diagrammatic statement of the different views regarding the number of British Willows held at various periods between 1762 and 1886. The dates given are those of the publication of the Works taken as representing the views of the period (see p. 334). The shaded columns indicate the number of *numbered* "species," and are divided into three portions—dark, medium, and light. The dark shaded portion shows the number of true species; the medium shade the number now recognized as hybrids; and the light shade the number of those once supposed to be species, but now considered to be either merely forms or to have no claim to be admitted as British. In the last column is given the estimate for 1890 of the true species (dark shaded) and of the hybrids (medium shaded) which have been found in Britain.

## PLATE X.

A diagram to illustrate the various ways in which compound hybrids (*i. e.* hybrids in whose parentage are included more than two species) may be formed.

## PLATE XI.

A diagram showing the relationship of both Tribes and Species as regards the British simple hybrid Willows. The larger circles represent the Tribes, the smaller circles the Species, and the lines connecting the latter indicate that Hybrids between these species have been found in Britain. The circle containing the Tribe Diandræ has been divided into four sections to show the altitudinal range of the species, since that limits to some degree the number of hybrids. Section I. is strictly lowland, the solitary species in it not ascending above 1000 feet above sea-level. Section II. includes species which, while most common in the low grounds, yet ascend into the alpine region of Section III. Section III. contains the species which rarely, if ever, descend below 1000 feet, and most frequently occur only at a much greater altitude. Section IV. contains two species which properly belong to Section III., but which occasionally, though very rarely, descend far below the 1000-foot line. The Tribes Pleiandræ and Synandræ include lowland species only.

## INDEX.

The Tribes are printed in SMALL CAPITALS, the groups in *italics*, the species and hybrids of *Salix* in Roman type, and unnamed hybrids are doubly indented.

*Caprea*, 377.

DIANDRÆ, 377.

*Fragiles*, 362.

*Nitidula*, 432.

*Nivea*, 421.

*Pentandra*, 359.

*Phylicifolia*, 395.

PLEIANDRÆ, 347.

*Purpurea*, 447.

*Repentes*, 339.

*Salix*

*acuminata*, *Sm.*, 413, 420.

*adscendens*, *Sm.*, 392.

*alba*, *L.*, 370.

*alba* × *decepiens*, 355.

*alba* × *fragilis*, 371.

*alba* × *pentandra*, 361.

*alba* × *triandra*, 354.

*alopeuroides*, *Tausch.* 353.

*Salix*

*alpestris*, *And.*, 441.

*ambigua*, *Ehrh.*, 392.

*amygdalina*, *L.*, 347, 348.

*angustifolia*, *Wulf.*, 391.

*aquatica*, *Sm.*, 381, 389.

*Arbuseula*, *L.*, 392, 410.

*Arbuseula*, *Sm.*, 391.

*Arbuseula* × *phylicifolia*, 412.

*Arbuseula* × *herbacea*, 439.

*Arbuseula* × *Lapponum*, 430.

*Arbuseula* × *Myrsinites*, 436.

*arenaria*, *L.*, 426.

*atrocineræa*, *Brot.*, 380.

*aurita*, *L.*, 382, 384.

*aurita* × *Caprea*, 387.

*aurita* × *cinerea*, 383.

*aurita* × *herbacea*, 441.

*aurita* × *Lapponum*, 429.

## Salix

- aurita × Myrsinites, 434.  
 aurita × nigricans, 409.  
 aurita × phylicifolia, 402, 405.  
 aurita × purpurea, 452.  
 aurita × repens, 392.  
 aurita × viminalis, 414.  
 aurita-Lapponum, *Wimm.*, 429.  
 aurita-nigricans, *Heidenr.*, 409.  
 aurita-viminalis, *Wimm.*, 414.  
 Aurora, *Læstæd.*, 392.  
 bicolor, *Ehrh.*, 403.  
 bicolor, *Forbes*, 403.  
 borealis, *Fr.*, 400.  
 cærulea, *Sm.*, 370.  
 Calodendron, *Wimm.*, 414, 420.  
 campestris, *Fr.*, 400.  
 canariensis, *C. Sm.*, 379.  
 Caprea, *L.*, 385.  
   Caprea × aurita, 387.  
   Caprea × cinerea, 386.  
   Caprea × cinerea × phylicifolia, 402, 406.  
   Caprea × coriacea, 410.  
   Caprea × nigricans, 406.  
   Caprea × phylicifolia, 402.  
   Caprea × repens, 394.  
   Caprea × viminalis, 414.  
   Caprea × viminalis, 413.  
 Caprea-dasyclados, *Wimm.*, 420.  
 Caprea-nigricans, *Wimm.*, 408.  
 Caprea-repens, *Lasch*, 394.  
 Caprea-viminalis, *Wimm.*, 414.  
 capreola, *J. Kern.*, 387.  
 carinata, *Sm.*, 410.  
 cinerea, *L.*, 378.  
   cinerea × aurita, 383.  
   cinerea × Caprea, 386.  
   cinerea × Caprea × phylicifolia, 402, 406.  
   cinerea × Lapponum, 430.  
   cinerea × phylicifolia, 402, 403.  
   cinerea × nigricans, 408.  
   cinerea × repens, 393.  
   cinerea × purpurea, 450.  
   cinerea × rubra, 451.  
   cinerea × viminalis, 414, 418.  
 cinerea-Lapponum, *Wimm.*, 430.  
 cinerea-limosa, *Læstæd.*, 430.  
 cinerea-purpurea, *Kern.*, 450.  
 cinerea-repens, *Wimm.*, 393.  
 cinerea-viminalis, *Wimm.*, 414, 418.  
 conformis, *Schleich.*, 409.  
 contorta, *Crowe*, 347, 348.  
 coriacea, *Forbes*, 409.  
   coriacea × Caprea, 410.  
 cotinifolia, *Sm.*, 407.  
 Croweana, *Sm.*, 398.  
 cuspidata, *Schultz.*, 360.  
 Daphneola, *Tausch*, 426.

## Salix

- daphnoides, *Vill.*, 340.  
 dasyclados, *Wimm.*, 415, 420.  
 decipiens, *Hoffm.*, 348.  
   decipiens × alba, 355.  
 dichroa, *Döll*, 452.  
 Dicksoniana, *Sm.*, 399, 412.  
 Doniana, *Sm.*, 452.  
 eleagnifolia, *Tausch*, 449.  
 elliptica, *Sm.*, 446.  
 excelsior, *Host*, 374.  
 ferruginea, *G. And.*, 414, 419.  
 ferruginea, *Forbes*, 414.  
 finmarchica, *Willd.*, 392.  
 firma, *Forbes*, 407.  
 fetida, *Schleich.*, 410.  
 Forbiana, *Sm.*, 449.  
 formosa, *Willd.*, 411.  
 fragilis, *L.*, 363, 368.  
 fragilis, var. britannica, *B. White*, 368.  
 fragilis, var. porcellanea, *Baenitz*, 350.  
   fragilis × alba, 371.  
   fragilis × pentandra, 360.  
   fragilis × triandra, *Wimm.*, 348.  
 fragilis-triandra, *Wimm.*, 348.  
 Friesiana, *And.*, 391.  
 fusca, *L.*, 391.  
 glauca, *L.*, 426, 428.  
 glauca, *Sm.*, 426, 428.  
 Grahami, *Baker*, 437, 444.  
 grandifolia, *Ser.*, 378.  
 grisophylla, *Forbes*, 409.  
 Hegetschweileri, *Heer*, 399.  
 Helix, *And.*, 448.  
 Helix, *L.*, 447, 448.  
 helvetica, *Vill.*, 426, 428.  
 herbacea, *L.*, 437.  
   herbacea × Arbuseula, 439.  
   herbacea × aurita, 441.  
   herbacea × lanata, 424, 426.  
   herbacea × Lapponum, 440.  
   herbacea × nigricans, 438.  
   herbacea × phylicifolia, 437.  
 hexandra, *Ehrh.*, 361.  
 hippophaifolia, *Thuill.*, 355, 358.  
 Hoffmanniana, *Sm.*, 347.  
 holosericea, *Hook. & Arn.*, 414.  
 holosericea, *Willd.*, 414, 418.  
 humilis, *Willd.*, 412.  
 incubacea, *L.*, 391.  
 Læstadiana, *Hartm.*, 429.  
 Lambertiana, *Sm.*, 447.  
 lanata, *L.*, 421.  
   lanata × herbacea, 424.  
   lanata × reticulata, 423.  
 lanceolata, *Sm.*, 355.  
 Lapponum, *L.*, 426.  
   Lapponum × Arbuseula, 430.  
   Lapponum × aurita, 429.

## Salix

- Lapponum  $\times$  cinerea, 430.  
 Lapponum  $\times$  herbacea, 440.  
 Lapponum  $\times$  reticulata, 446.  
 Lapponum-Arbuscula, *Wimm.*, 430.  
 Lapponum-herbacea, 441.  
 latifolia, *Forbes*, 406.  
 laurina, *Sm.*, 402.  
 laxiflora, *Borr.*, 403.  
 longifolia, *Host*, 420.  
 ludificans, *B. White*, 402, 405.  
 lutescens, *A. Kern.*, 383.  
 Macnabiana, *Mac Gillivray*, 434.  
 margarita, *B. White*, 441.  
 marrubiifolia, *Tausch*, 426.  
 Micheliana, *Forbes*, 418.  
 mollissima, *Ehrh.*, 355, 358.  
 monspeliensis, *Forbes*, 369.  
 montana, *Forbes*, 364, 376.  
 Moorei, "*Watson, L. C.*" 438.  
 multiformis, *Döll*, 355.  
 myricoides, 404.  
 Myrsinites, *L.*, 432.  
 Myrsinites  $\times$  Arbuscula, 436.  
 Myrsinites  $\times$  aurita, 434.  
 Myrsinites  $\times$  nigricans, 433.  
 Myrsinites  $\times$  phylicifolia, 434.  
 Myrsinites-nigricans, *Wimm.*, 433.  
 myrsinitoides, *Fr.*, 433.  
 nigricans, *Sm.*, 396, 400.  
 nigricans  $\times$  aurita, 409.  
 nigricans  $\times$  Caprea, 406.  
 nigricans  $\times$  cinerea, 408.  
 nigricans  $\times$  herbacea, 438.  
 nigricans  $\times$  Myrsinites, 433.  
 nigricans  $\times$  phylicifolia, 401.  
 nigricans  $\times$  repens, 394.  
 nigricans  $\times$  reticulata, 444.  
 nigricans-repens, *Heideur.*, 394.  
 nigricans-Weigeliana, *Wimm.*, 401.  
 nivalis, *Hook.*, 443.  
 norvegica, *And.*, 441.  
 obscura, *Döll*, 419.  
 oleifolia, *Sm.*, 381, 384.  
 palustris, *Host*, 374.  
 pedicellata, *Desf.*, 378.  
 pendula, *Ser.*, 364, 376.  
 pentandra, *L.*, 359, 365.  
 pentandra  $\times$  alba, 361.  
 pentandra  $\times$  fragilis, 360.  
 pentandra  $\times$  phylicifolia, 361.  
 phylicifolia, *L.*, 396.  
 phylicifolia  $\times$  Arbuscula, 412.  
 phylicifolia  $\times$  aurita, 402, 405.  
 phylicifolia  $\times$  Caprea, 402.  
 phylicifolia  $\times$  cinerea, 402, 403.  
 phylicifolia  $\times$  cinerea  $\times$  Caprea, 402, 406.  
 phylicifolia  $\times$  herbacea, 437.  
 phylicifolia  $\times$  Myrsinites, 434.  
 phylicifolia  $\times$  nigricans, 401.

## Salix

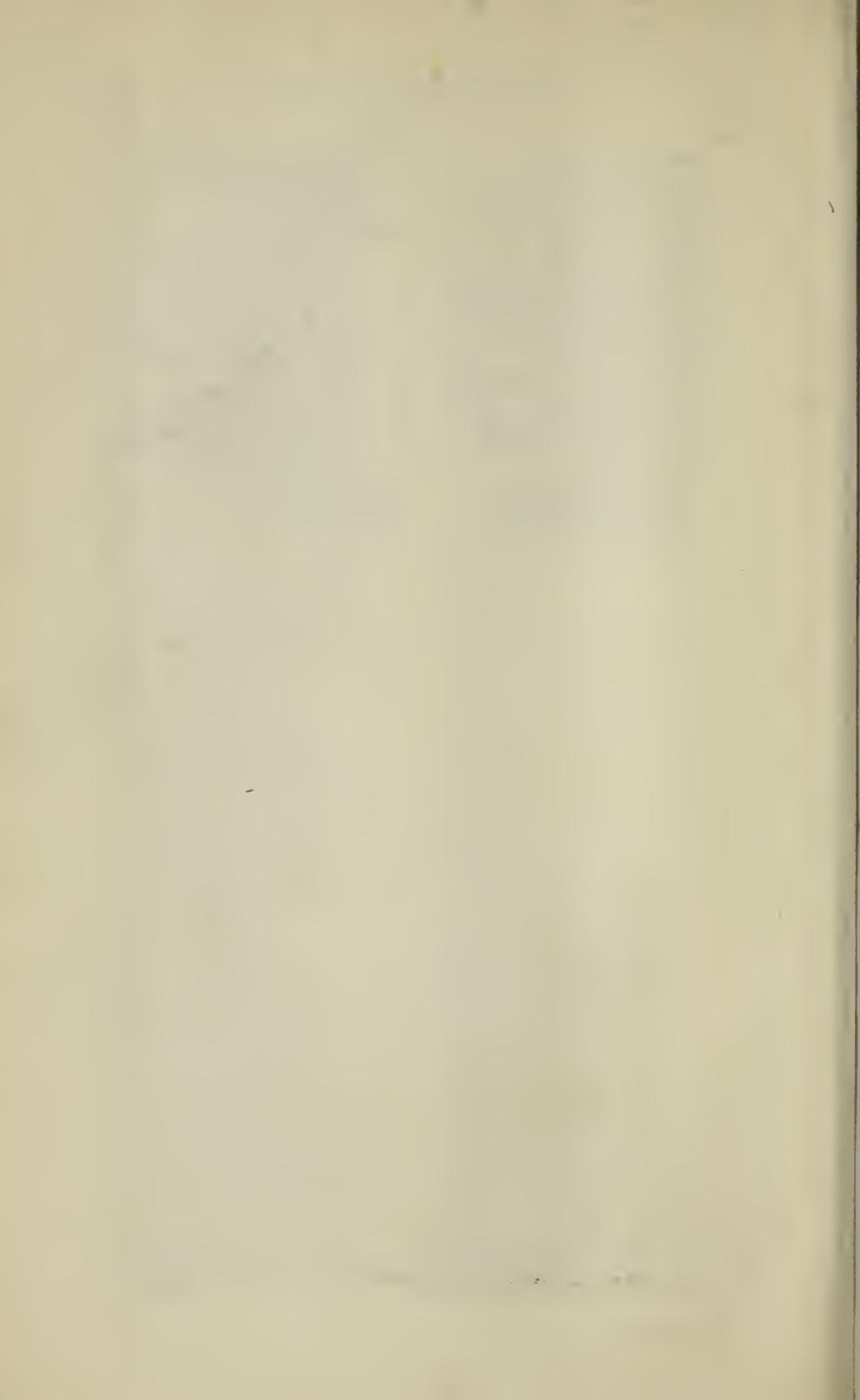
- phylicifolia  $\times$  pentandra, 361.  
 phylicifolia  $\times$  purpurea, 399.  
 phylicifolia  $\times$  repens, 395.  
 phylicifolia-nigricans, *Wimm.*, 397, 398, 400.  
 plicata, *Fr.*, 392.  
 Pontederana, *Koch*, 450.  
 Pontederana, *Schleich.*, 450.  
 procumbens, *Forbes*, 433.  
 prunifolia, *Sm.*, 410.  
 pseudo-stipularis, *Lond. Cat.*, 414, 416.  
 puberula, *Döll*, 408.  
 punctata, *Wahlenb.*, 433.  
 purpurea, *L.*, 447.  
 purpurea  $\times$  aurita, 452.  
 purpurea  $\times$  cinerea, 450.  
 purpurea  $\times$  phylicifolia, 399.  
 purpurea  $\times$  repens, 452.  
 purpurea  $\times$  viminalis, 448.  
 ramulosa, *Borr.*, 447.  
 Reichardtii, *A. Kern.*, 386.  
 repens, *L.*, 389.  
 repens  $\times$  aurita, 392.  
 repens  $\times$  Caprea, 394.  
 repens  $\times$  cinerea, 393.  
 repens  $\times$  nigricans, 394.  
 repens  $\times$  phylicifolia, 395.  
 repens  $\times$  purpurea, 452.  
 repens  $\times$  viminalis, 391.  
 repens-myrtilloides, *Wimm.*, 392.  
 reticulata, *L.*, 443.  
 reticulata  $\times$  lanata, 423.  
 reticulata  $\times$  Lapponum, 446.  
 reticulata  $\times$  nigricans, 444.  
 retusa, *L.*, 438.  
 rhætica, *Kern.*, 399.  
 rosmarinifolia, *L.*, 390.  
 rosmarinifolia, *Sm.*, 391.  
 rubra, *Huds.*, 448.  
 rubra  $\times$  cinerea, 451.  
 rugosa, *Leech*, 414, 417, 419.  
 Russelliana, *Sm.*, 363, 369.  
 Sadleri, *Boswell-Syme*, 422.  
 saxetana, *B. White*, 434.  
 Schraderiana, *Willd.*, 395.  
 sejuncta, *B. White*, 444.  
 semireticulata, *B. White*, 444.  
 sericans, *Tausch*, 414, 417.  
 serta, *B. White*, 436.  
 sibyllina, *B. White*, 446.  
 silesiaca, *Willd.*, 378, 386.  
 simulatrix, *B. White*, 439.  
 Smithiana, *Willd.*, 413.  
 sobrina, *B. White*, 440.  
 soluta, *B. White*, 444.  
 sordida, *Kern.*, 459.  
 sordida, var. rubella, *B. White*, 451.  
 spathulata, *Willd.*, 392.  
 speciosa, *Host*, 353.

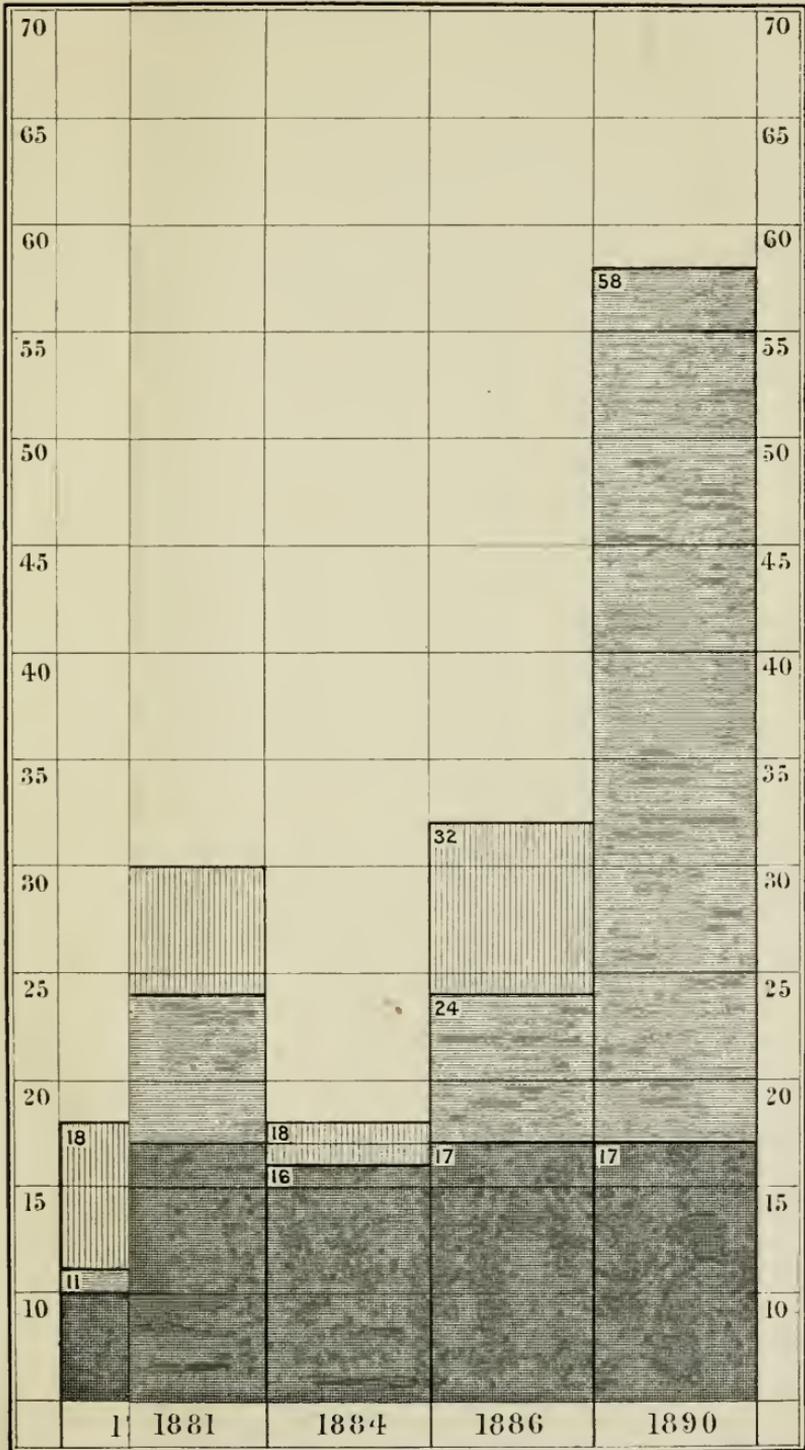
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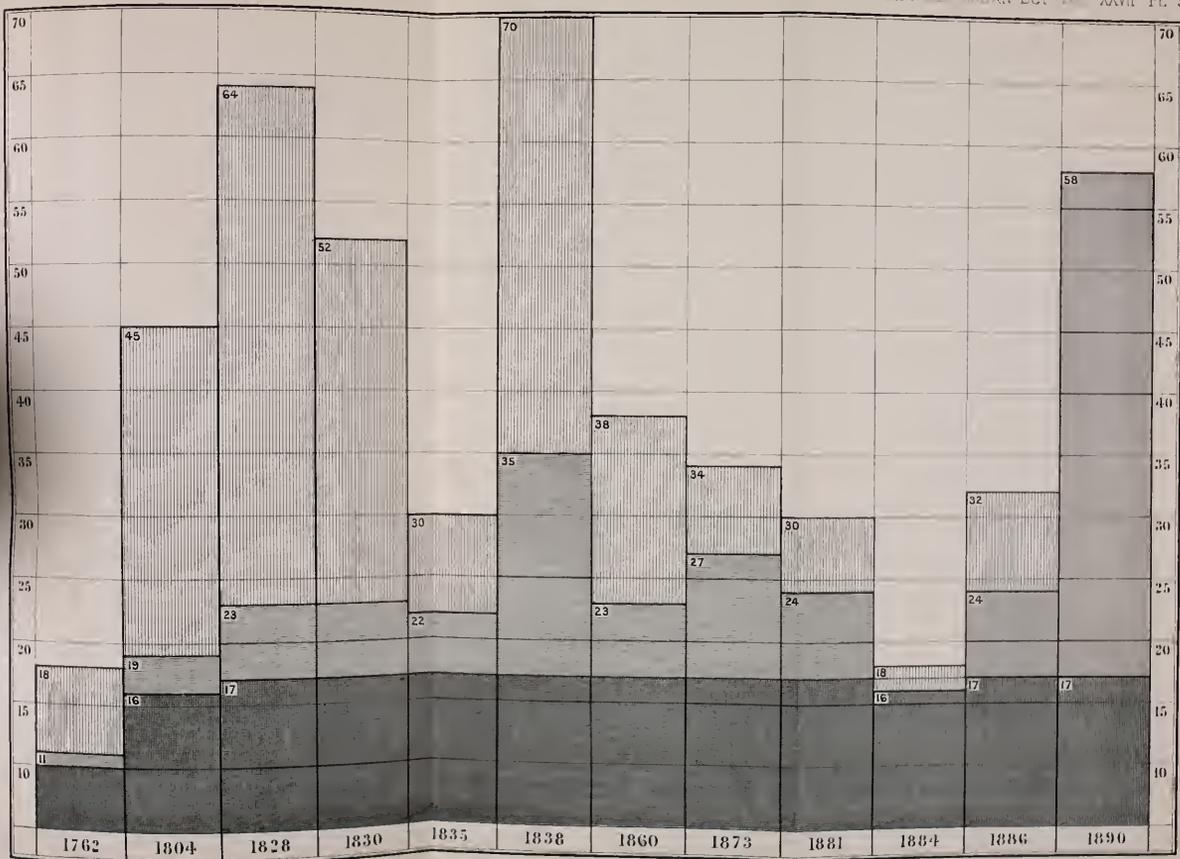
- sphacelata, *Sm.*, 386.  
 splendens, *Bray*, 370.  
 spuria, *Willd.*, 430.  
 Stephania, *B. White*, 424.  
 stipularis, *Sm.*, 414, 415.  
 strepida, *Forbes*, 408.  
 Stuartiana, *Sm.*, 426.  
 subdola, *B. White*, 354.  
 subpurpurea-cinerea, *Kern.*, 450.  
 superata, *B. White*, 423.  
 tenuifolia, *Sm.*, 402.  
 tenuior, *Borr.*, 402.  
 tephrocarpa, *Wimm.*, 402, 406.  
 tetrapla, *Walker*, 400.  
 thymelæoides, *Schleich.*, 411.  
 Trevirani, *Spreng.*, 355, 358.  
 triandra, *L.*, 347.  
     triandra  $\times$  alba, 354.  
     triandra  $\times$  fragilis, 348.  
     triandra  $\times$  viminalis, 355.  
 undulata, *Ehrh.*, 355.

## Salix

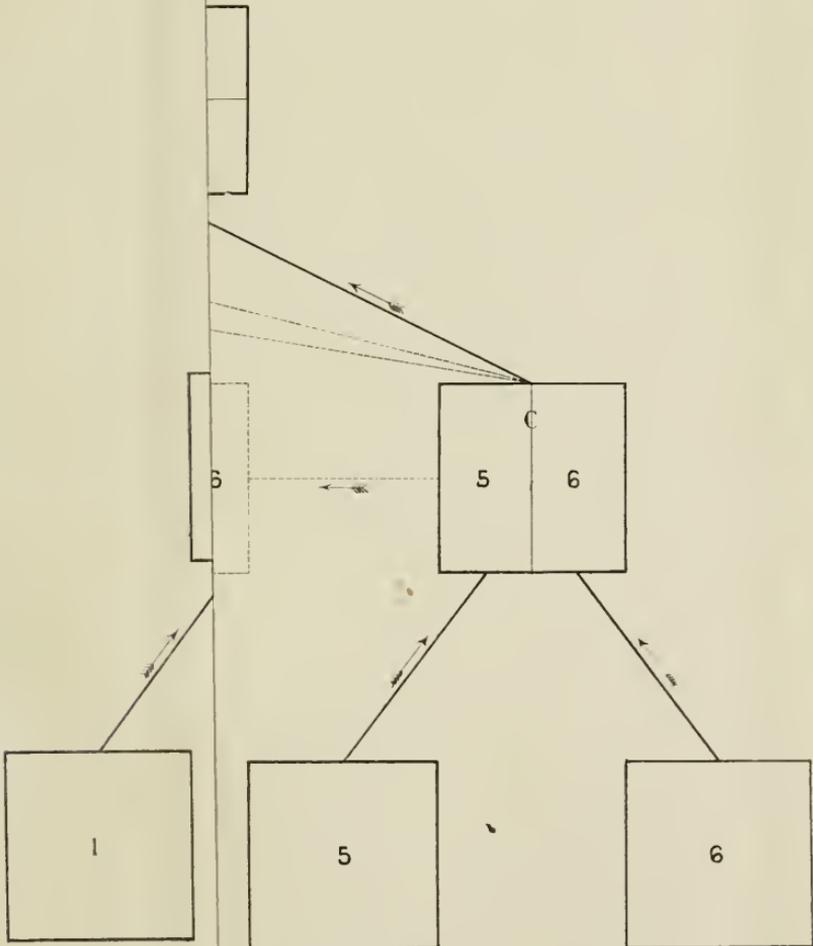
- vacciniifolia, *Walker*, 411.  
 vaudensis, *Forbes*, 408.  
 velutina, *Schrad.*, 414, 418.  
 venulosa, *Sm.*, 410.  
 viminalis, *L.*, 413.  
     viminalis  $\times$  purpurea, 448.  
     viminalis  $\times$  repens, 391.  
     viminalis  $\times$  Capræ, 413.  
     viminalis  $\times$  triandra, 355.  
 viminalis-purpurea, *Wimm.*, 448.  
 viminalis-repens, *Lasch*, 391.  
 viridis, *Fr.*, 363, 367, 371.  
 vitellina, *L.*, 371.  
 Wahlenbergii, *And.*, 433.  
 Waldsteiniana, *Willd.*, 411.  
 Wardiana, *B. White*, 402, 403.  
 Weigeliana, *Willd.*, 400.  
 Woolgariana, *Borr.*, 447.  
 SYNANDRÆ, 447.  
 Triandræ, 347.  
 Viminalæ, 413.







The square species can also be produced in other ways. A (a circle)  $\times$  2) crossing with 3 to produce G (=1  $\times$  2  $\times$  3), crossing with 4 to produce H (=4  $\times$  5  $\times$  6) when C (5  $\times$  6)  $\times$  D (=A (1, 2)  $\times$  B (3  $\times$  4)). Hybrids of C originate in various ways but one example 5  $\times$  6)  $\times$  G (3  $\times$  A (1, 2)) = I (1  $\times$  2  $\times$  3  $\times$  5  $\times$  6). lines & squares.



The squares 1, 2, 3, 4, 5 and 6 represent true species.  
 A (a combination of 1 and 2), B (of 3 and 4), & C (of 5 and 6)  
 represent hybrids of two species. D (a combination of A(1+2)  
 and B(3+4)), and E (B(3+4) x C(5+6)) are hybrids of four-  
 species. F (D(A x B) x E(B x C)) is a hybrid of six species.

Hybrids of six species can also be produced in other ways,  
 as e. g. by A (1+2) crossing with 3 to produce G (1+2+3),  
 and C (5+6) crossing with 4 to produce H (4+5+6) when  
 G x H = F; or by C (5+6) x D (1+2+3+4) x B (3+4). Hybrids of  
 five species may originate in various ways but one example  
 will suffice. C (5+6) x G (3), A (1+2) x I (1+2+3+5+6).  
 see the dotted lines & squares

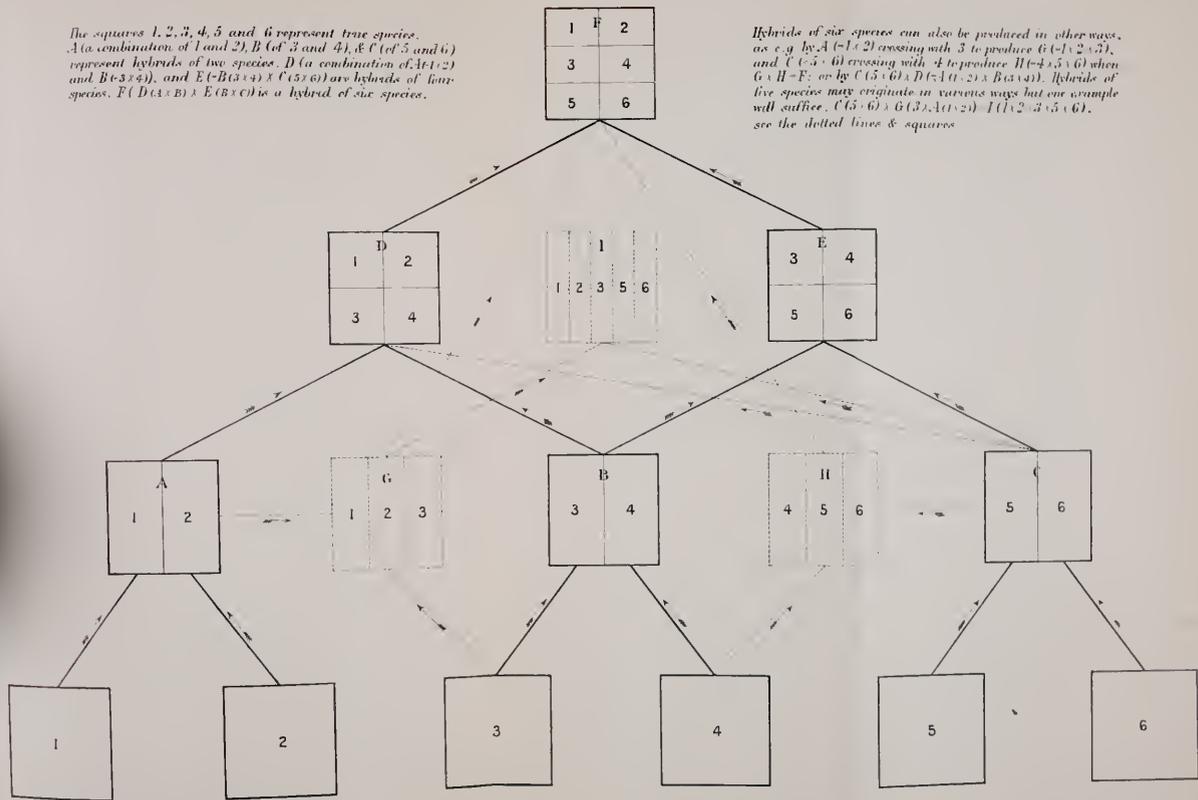
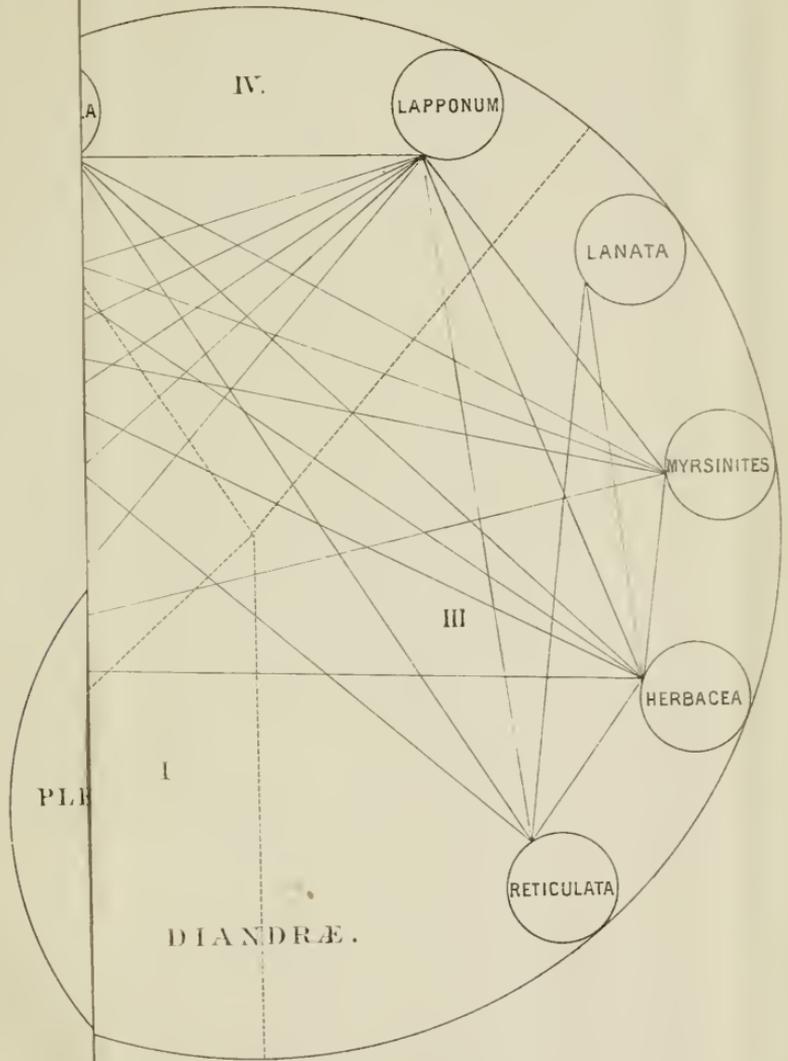


DIAGRAM OF THE PEDIGREE OF HYBRIDS.

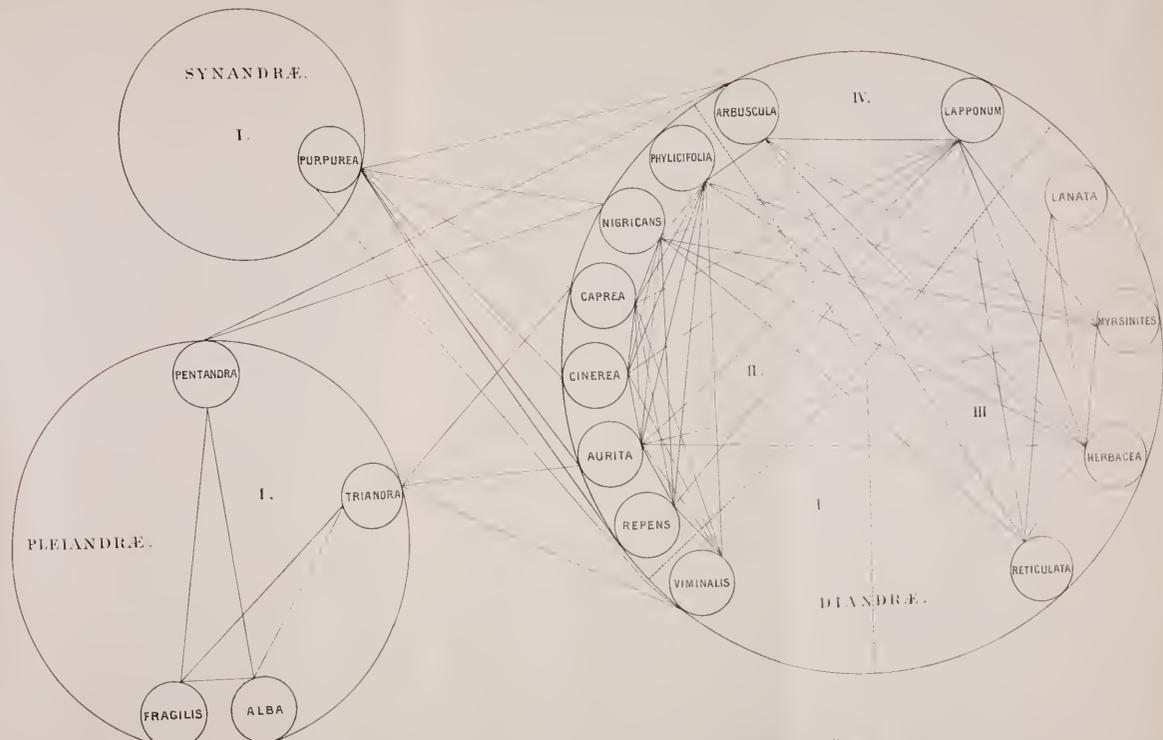


lines indicate:  
 ascending above 1000 feet.  
 descending from below 1000 feet to above 2000 feet.  
 ascending if ever descending to 1000 feet.  
 occasionally descending below 1000 feet.

B.W. 15

Mertens. Bros. lith.

F SALIX.

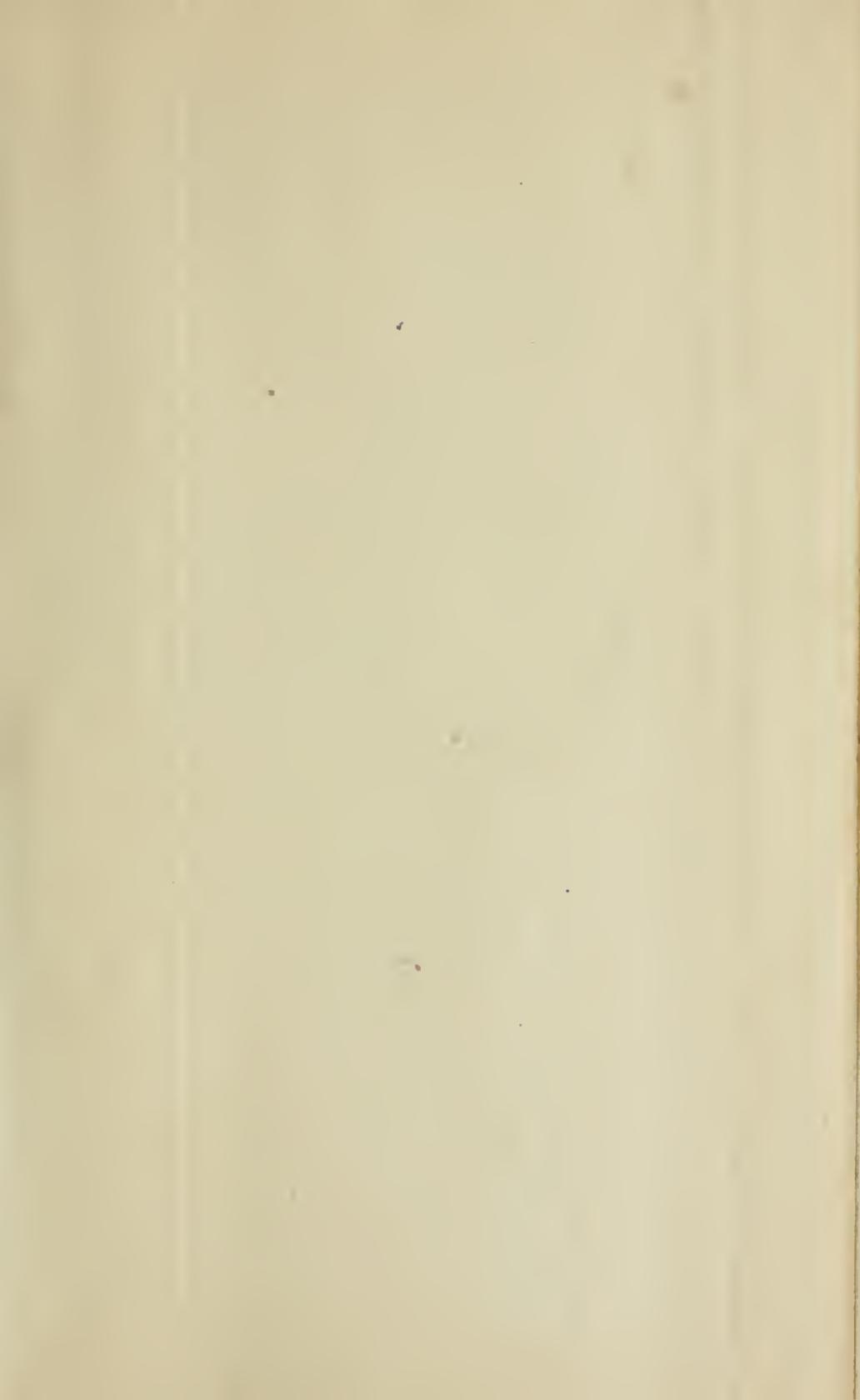


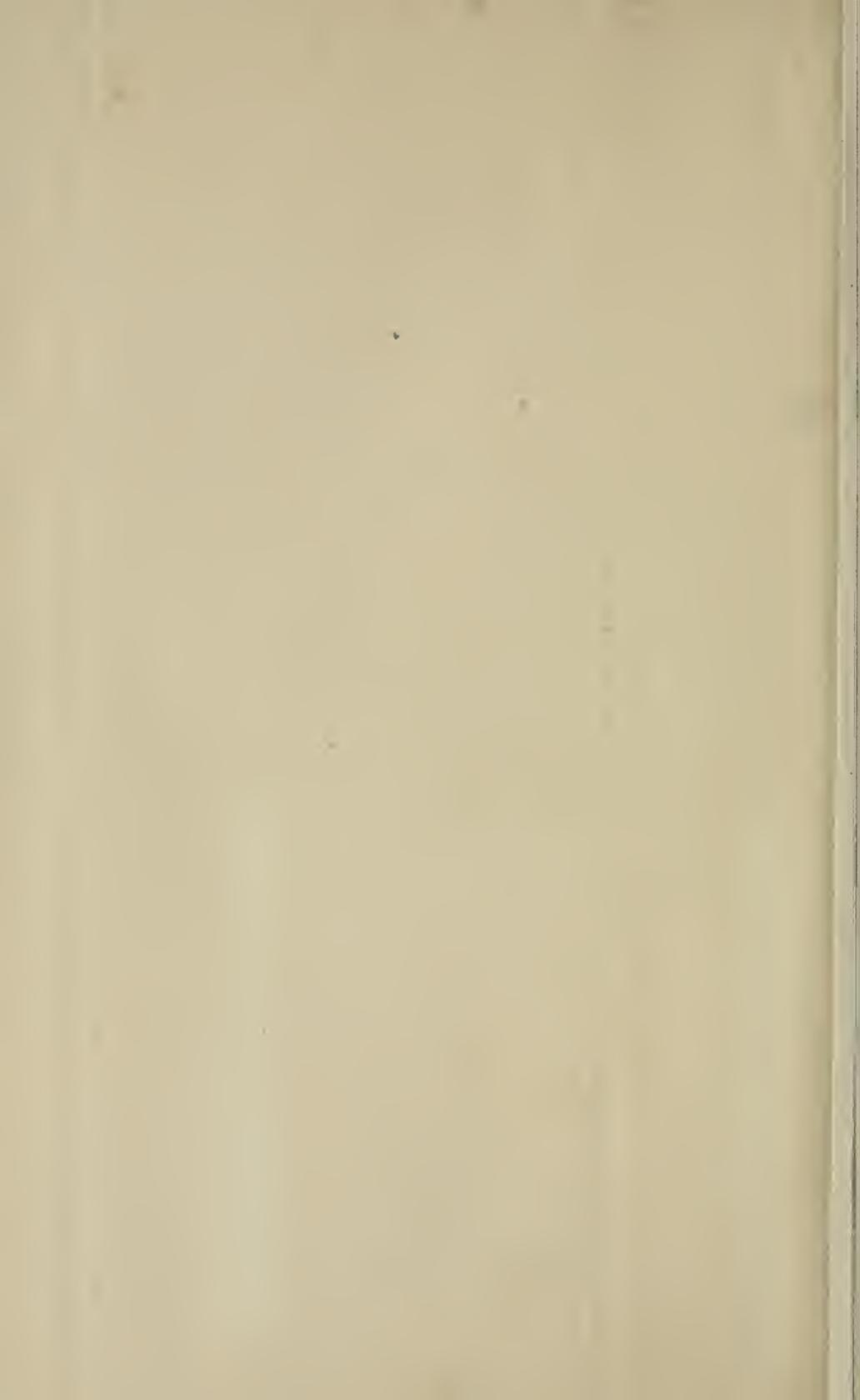
The larger circles indicate the three tribes;  
 the smaller circles the species.  
 The lines connecting the species indicate that  
 those are known to form hybrids

The Sections indicate  
 I, not ascending above 1000 feet.  
 II, ascending from below 1000 feet to above 2000 feet  
 III, rarely if ever descending to 1000 feet  
 IV, occasionally descending below 1000 feet

Edinburgh: Bannister.

DIAGRAM OF THE HYBRIDS OF THE BRITISH SPECIES OF SALIX





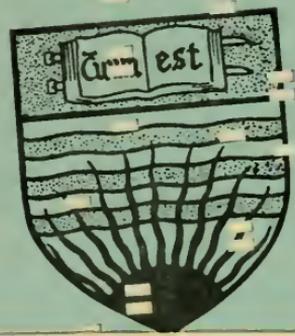




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