

The Lejeuneae of the United States and Canada

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(PLATES 16-22)

The subtribe Lejeuneae, as defined by Schiffner, is made up of the large and comprehensive genus *Lejeunea* as understood by Spruce. The latter author divided this genus into thirty-seven natural divisions, which he looked upon as subgenera, while Schiffner raised nearly all of these subgenera to generic rank. Each of these authors has his own adherents. Writers on the hepaticae of Europe, where the Lejeuneae are poorly represented, tend to follow Spruce, recognizing but a single genus, while writers on the hepaticae of tropical regions, where the Lejeuneae attain a most luxuriant and varied development, tend to follow Schiffner. It is probable that an intermediate course would be more nearly correct, that some of Schiffner's genera are worthy of generic rank, but that others ought to be united. Until, however, the many species are more clearly defined and more accurately understood than they are at present, it seems most practicable, and perhaps wisest, to recognize Schiffner's genera as such, at least in a tentative way—a course which is adopted in the present paper.

For descriptions of the various genera, the reader is referred to the writings of Spruce * and of Schiffner.† Reference may also be made to a recent paper by the writer,‡ where the division of the group into genera is more fully discussed.

HISTORICAL

The earliest work devoted to North American hepaticae is that of Schweinitz, published in 1821. In this paper the genus *Jungermannia* is still used in its old sense and includes the Junger-

* Hep. Amaz. et And. 63-308. 1884.

† Engler & Prantl, Nat. Pflanzenfam. 1³: 117-131. 1893.

‡ The Hawaiian Hepaticae of the Tribe Jubuloideae. Trans. Conn. Acad. 10: 387-462. 1900.

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manniaceae and the Metzgeriaceae of recent American authors. Among the species referred to this genus are three which would now be included in the Lejeuneae. These are *J. serpyllifolia*, *J. transversalis* and *J. clypeata*. The first of these is a species which we share with Europe. It is the type-species of the genus *Lejeunea*, as originally described, and is now known as *Lejeunea serpyllifolia* Lib. or preferably as *L. cavifolia* (Ehrh.) Lindb. Apparently Schweinitz did not really know this species from America, the specimens so named in his herbarium being partly *Radula tenax* Lindb. and partly *Frullania Virginica* Gottsche. The second species is not the true West Indian *J. transversalis* Swartz, as Schweinitz supposed, but is the same as his *J. clypeata*, which he correctly distinguished as new. This third species is now referred to the genus *Archilejeunea*. Apparently in ignorance of Schweinitz's paper, Lehmann, in 1838, described the same species as new under the name *Lejeunea Dorotheae*.

In 1841 and in 1845 two important exsiccatae of North American bryophytes appeared in which several Lejeuneae were included. In the first of these, Drummond's Mosses of the Southern States, the specimens were determined by Wilson and Hooker and, in the case of new species, were accompanied by printed descriptions. The Lejeuneae of this collection are labeled *Jungermannia serpyllifolia*, *J. auriculata* and *J. parvula*, the last two being described as new. The first of these is not correctly determined and is in fact a mixture of two distinct species, *Euosmolejeunea duriuscula* (Nees) and *Lejeunea Americana* (Lindb.), proposed as a species in the present paper. *J. auriculata* is the type of *Mastigolejeunea auriculata* Schiffn., a species now known to have a wide distribution in tropical America. *J. parvula*, however, is apparently the same as the European *Cololejeunea minutissima* (Sm.) Schiffn., which has subsequently been collected many times in our Southern States. In the second exsiccata, Sullivant's Musci Alleghanienses, we find six Lejeuneae—*Phragmicoma clypeata*, *Lejeunea serpyllifolia*, *L. serpyllifolia* var., *L. cucullata*, *L. calcarea* and *L. minutissima*. The first and last of these are correctly determined. Of the remainder, *L. serpyllifolia* is really *L. Americana*; *L. serpyllifolia* var. is *Euosmolejeunea duriuscula*; *L. cucullata*, although compared by Sullivant with a specimen communicated by Montagne,

is not the same as what we now call *Microlejeunea cucullata* (R. Bl. & N.) Jack & Steph., of Java, but is apparently to be referred to *Microlejeunea lucens* (Tayl.), a species at that time undescribed; while *L. calcaria* is not precisely the same as the European *Cololejeunea calcaria* (Lib.) Schiffn. but agrees better with the North American representative of this species, *C. Biddlecomiae* (Aust.), which was not published until 1890.

The next notes we find on our Lejeuneae are by European writers. From 1844 to 1847 Gottsche, Lindenberg and Nees von Esenbeck issued their classical Synopsis Hepaticarum in five parts. The Lejeuneae are treated in the second and third parts, which appeared in 1845, and in the fifth or supplementary part, which was published two years later. In the second and third parts the following five Lejeuneae are recorded from North America: *Phragmicoma versicolor*, *Lejeunea transversalis*, *L. catenulata*, *L. Dorotheae* and *L. serpyllifolia*. The first of these species is a composite; so far as American material is concerned, it is the same as *Jungermannia auriculata* Wils. & Hook., which is unjustly reduced to it as a synonym. *Lejeunea transversalis* is admitted solely on the authority of Schweinitz. *L. catenulata*, under which *Jungermannia transversalis* Schwein. strangely appears as a synonym, is *Neurolejeunea catenulata* (Nees) Schiffn. It is a species of tropical America, but there is no adequate evidence that it occurs within the United States. The last two species require no comment. In 1846 Taylor described a large number of new hepaticae from various parts of the world and among them six Lejeuneae, presumably from North America. Many years later it was proved that four of these species, viz.: *Phragmicoma testudinea*, *P. cyclostipa*, *Lejeunea polyphylla* and *L. longiflora*,* did not come from Ohio at all, as Taylor supposed, but were really collected near Pará in Brazil. A fifth species, *L. calyculata*, is a synonym of *Archilejeunea clypeata*. It is probable that the sixth species, *L. lucens*, was also originally collected at Pará. This plant, however, has a wide

* All four of these species are reduced to synonymy by Stephani (Hedwigia, 29: 1890). *Phragmicoma testudinea* is *Pycnolejeunea macroloba* (Mont.) Schiffn., *Phragmicoma cyclostipa* is a mixture of *Archilejeunea Auberiana* (Mont.) Steph., and *Lopholejeunea Sagracana* (Mont.) Schiffn.; *Lejeunea polyphylla* is *Acrolejeunea torulosa* (Lehm. & Lindenb.) Schiffn.; while *L. longiflora* is a form of the widely distributed *Euosmolejeunea trifaria* (Ness) Schiffn., of tropical regions.

range, extending into the United States and is apparently the same as Sullivant's *L. cucullata*. In the supplementary part of the Synopsis Hepaticarum these six species of Taylor are quoted with little comment, and *L. minutissima*, *L. calcarea* and *L. cucullata* are recorded from North America on the authority of Sullivant.

The first and second editions of Gray's Manual contain descriptions of the hepaticae by Sullivant. In the first edition, published in 1848, only four Lejeuneae are included. These are *L. serpyllifolia*, *L. clypeata*, *L. calcarea* and *L. cucullata*. In the second edition, published in 1856, species from the Southern States are added, and we find eleven Lejeuneae. The list includes the four species quoted above, Taylor's six new species, as well as *L. minutissima* and *L. auriculata*. *L. lucens* Tayl., however, is quoted merely as a synonym of *L. cucullata*.

In Austin's papers on hepaticae, published from 1869 to 1879, we find seven species of Lejeuneae described as new and three species recorded for the first time from the United States. Two of the new species, *L. Sullivantiae* ('72) and *L. Mohrii* ('75) are now reduced to synonymy; the first being referable to *Euosmolejeunea duriuscula* and the second to *E. opaca* (Gottsche) Steph. A third species, *L. biseriata* ('69) proved to be a moss, as Austin himself afterwards decided. Three other species, *L. Ravenelii*, *L. Caroliniana* and *L. laete-fusca*, all published in 1876, are so incompletely described that we know little about them. Even the type specimens, where accessible, do not aid us; they are very fragmentary and are either sterile or in poor condition. Under the circumstances it seems advisable to allow these three names to disappear from our literature. Austin's seventh species, the only one here retained, is *L. Jooriana* ('75), which belongs to the genus *Cololejeunea*. Of the three species which Austin first accredited to the United States, *Phragmiconia xanthocarpa* does not agree with authentic specimens of this widely distributed tropical species but should be referred to *Archilejeunea Sellowiana* Steph.; the specimens referred to the European *Lejeunea ovata*, now *Harpalejeunea ovata* (Hook.) Schiffn., are probably correctly named; while those referred to *L. laete-virens* Mont., a West Indian species, are in too poor a condition to be definitely determined.

In 1875 the Finnish botanist, Lindberg, in a lengthy paper on

Irish hepaticae, includes interesting notes on some of the Lejeuneae in American exsiccatae. The most important of these are the following: *Lejeunea ulicina*, of Europe, is accredited to North America; *L. parvula* (the *Jungermannia parvula* of Drummond's collection) is recognized as a species, and Sullivant's *L. minutissima* is reduced to it as a synonym; the American specimens of *L. serpyllifolia* are all referred to the new var. *Americana* Lindb.; *L. Sullivantiae* Aust. is given the new name *L. Austini* Lindb., on account of the previously described *L. Sullivantii* Gottsche. The evidence that *Microlejeunea ulicina* (Tayl.) occurs in North America does not seem to be conclusive. *Lejeunea parvula* and *L. Sullivantiae* have already been commented upon. Lindberg's var. *Americana* is a composite, and, while it includes the *L. Americana* of the present paper, it includes also typical *L. cavifolia*.

In 1884 Spruce, in his important work on South American hepaticae, accredits the rare European *L. diversiloba* Spruce to North America. He apparently refers to this species the specimens which Sullivant called *L. cucullata*, although this is not definitely stated. Three years afterwards Spruce referred Sullivant's specimens somewhat doubtfully to *L. lucens* Tayl.

The numerous papers on hepaticae by Underwood contain frequent references to the Lejeuneae. In his preliminary list of North American species, published in 1882, fourteen species of Lejeuneae are noted. In his Descriptive Catalogue of 1884, descriptions are given of these fourteen species and of four others omitted from the earlier list. All of these species had been previously recorded. In the sixth edition of Gray's Manual, published in 1890, Underwood described the hepaticae, and it is interesting to note that the four Lejeuneae which he there recognizes are the same ones which Sullivant described in the first edition of the Manual, forty-two years before. In the same year Underwood published a description of *Lejeunea Macounii* Spruce, and Pearson, a plate of *L. Biddlecomiae* Aust., accompanied by descriptive notes. Both of these species belong to the genus *Cololejeunea*. Two years later Underwood recorded another *Cololejeunea*, the European *L. Rossettiana* Massal., but there seems to be no very adequate evidence that this species has been collected in America.

The last published list of North American Lejeuneae is that of

Stephani, which appeared in 1892. Twenty species are recognized; of these, *Lejeunea* (*Eu-Lejeunea*) *Underwoodii* and *L.* (*Micro-Lejeunea*) *Cardoti* are described as new, while *L.* (*Euosmo-Lejeunea*) *trifaria* Nees and *L.* (*Colo-Lejeunea*) *Wrightii* Gottsche are recorded for the first time from the United States. The first of the new species, judging from authentic specimens, is identical with *Lejeunea Sullivantiae* Aust. and is therefore a form of *Euosmo-lejeunea duriuscula*; the second, however, seems to be distinct. The specimens referred to *Euosmolejeunea trifaria* are dioicous and agree with *E. opaca*, while those referred to the undescribed *Lejeunea Wrightii*, from Cuba, are apparently an abnormally developed form of *Cololejeunea minutissima*. In 1895 Stephani accredited *Lejeunea flava* Swartz to Florida. The occurrence of this widely distributed species is certainly to be expected within our limits, but a specimen from Florida collected by Rau and determined as *L. flava* by Stephani himself seems to be referable to Spruce's var. *albida* of this species, a plant which the writer is unable to distinguish from *L. Americana*.

In the Hepaticae Americanae of Underwood and Cook, the first decade of which appeared in 1887, and which is still unfinished, a number of Lejeuneae have been distributed. Those from the United States or Canada will be noted in connection with the description of species.

It will be seen from the preceding account that the opinions of writers with regard to several of our species have been both varied and uncertain. This fact becomes even more evident when we consult the Lejeuneae in herbaria or in published exsiccatae. We are almost certain to find many false determinations among them. In some cases a single species will appear under several different names; in other cases several distinct species will appear under the same name. This confusion is partly because the Lejeuneae often grow mixed together, partly because certain of the species are extremely variable, and partly because the published descriptions, especially those of the older writers, are often so general and so incomplete as to be quite valueless. It becomes often necessary therefore to examine type-specimens, in order to learn upon what particular form a given species was originally founded. It becomes equally necessary, in the case of a variable species of wide

range, to examine a large series of specimens from as many different localities as possible. It is only by this latter method that one can acquire a sufficient knowledge to distinguish between specific characters and those peculiarities which are simply due to variability. It should also be remembered in this connection that plants which grow under abnormal conditions tend to develop abnormally or imperfectly, and this is most strikingly true of the *Lejeuneae*. It may even happen that a specimen bearing perianths and capsules may utterly fail to show the foliar characters of the species, on account of the crowding together of the fruiting branches. Such abnormal specimens, although interesting from a morphological point of view, cannot always be determined with certainty, and yet it is unfortunately true that many species of *Lejeuneae* have been founded on just such forms. It is sometimes a question as to what should be done with species whose type-specimens are of this character, but probably in doubtful cases the best course is to discard them altogether.

DISTRIBUTION OF SPECIES

As a result of his own studies the writer is able to distinguish twenty-three species for the United States and Canada. Three of these are proposed as new, one is raised from varietal rank and six are recorded for the first time. The remaining species have all been previously noted. Four of our species occur in Europe, thirteen are more or less widely distributed in tropical America and six appear to be endemic. It should be noted, however, that two of these six species have near relatives in Europe and that the remaining four are closely allied to species of tropical America. It is very probable also that the ranges of several of these apparently endemic species will be extended into tropical regions by future explorations. Three of our species, *Lejeunea cavifolia*, *L. patens* and *Cololejeunea Macounii* are distinctly northern in their distribution. *Archilejeunea clypeata*, *A. Sellowiana* and *Cololejeunea Biddlecomiae* all have wide ranges extending from eastern Canada or New England to or beyond the Gulf States. *Harpalejeunea ovata* has been found from Virginia to northern Georgia, while *Microlejeunea Ruthii* has been collected only in Tennessee. Our other species are characteristically southern, although *Lejeunea*

Americana and *Cololejeunea Jooriana* have been found as far north as North Carolina, and *Microlejeunea lucens* apparently occurs in Virginia. Six of these southern species have not been collected outside of Florida. With the exception of *Cololejeunea Macounii*, of British Columbia, no species are known from the Pacific Coast region; no species moreover have been reported from the Rocky Mountains nor from the Great Plains east of the Rocky Mountains, their absence or scarcity apparently being due to the dry atmospheric conditions. With regard to the number of species in individual States, Florida leads with fifteen, Louisiana ranks second with nine and Alabama third with eight. Few of the remaining States have more than three species apiece, and even east of the Mississippi River there are several States which have had no Lejeuneae whatever reported from them.

The brief notes which have just been given are mainly of temporary value. The Lejeuneae have been so largely neglected by collectors that our knowledge of their geographical distribution is at best very incomplete. The rich harvest of species which Underwood gathered in Florida shows how little we had previously known about the Lejeuneae of that state and indicates that much is still to be learned. The collections of Langlois in Louisiana and of Mohr in Alabama point to similar conclusions. Even in the north, the recent discovery of *Lejeunea patens* in Newfoundland and in Cape Breton shows how fragmentary our knowledge really is. It should be noted also that specimens exist in herbaria, too incomplete for identification and yet undoubtedly distinct from any recorded species. Some of these are probably identical with described species from tropical America, others are probably undescribed; but for the present they must be left in doubt. It is clear, therefore, that much remains to be done to complete our knowledge of the Lejeuneae, and it is to be hoped that the present paper may incite collectors to pay more attention to these inconspicuous but beautiful plants.

The revision which follows is based largely on the collections of Lejeuneae in the Underwood herbarium, in the United States National Herbarium and in the herbaria at Yale University. The curators of other herbaria have also been most generous in allow-

ing the writer to examine type specimens in their charge, and other correspondents have kindly furnished material for study.

Analytical Key to the Species

1. Underleaves present, undivided. 2.
Underleaves present, bifid. 6.
Underleaves absent. 19.
2. Plants pale, perianth five-keeled. 3.
Plants more or less tinged with brown or purple. 5.
3. Lobule bluntly pointed at the apex or apiculate. 1. *Archilejeunea clypeata*.
Lobule with a long and slender apical tooth. 4.
4. Lobe widely spreading, slightly convex or plane, averaging 1.2×0.95 mm., postical margin usually forming a distinct angle with keel. 2. *Archilejeunea Sellowiana*.
Lobe obliquely spreading, strongly convex, averaging 0.7×0.45 mm., postical margin usually forming a continuous line with keel. 3. *Archilejeunea conchifolia*.
5. Lobule entire on margin or with a single apical tooth, median leaf-cells averaging $21 \times 12 \mu$, ♀ inflorescence usually innovating or only one side, perianth trigonous throughout. 4. *Mastigolejeunea auriculata*.
Lobule crenulate on margin with about four teeth, median leaf-cells averaging $23 \times 16 \mu$, ♀ inflorescence usually innovating on both sides, perianth six- to eight-plicate in upper part. 5. *Brachiolejeunea corticalis*.
6. Lobe acute, at least on well developed leaves, underleaves with rounded division, and broad, shallow sinus. 6. *Harpalejeunea ovata*.
Lobe rounded or rarely obtuse, underleaves with obtuse to acute divisions and narrow sinus. 7.
7. Plants firm in texture, yellowish- or brownish-green, inflorescence dioicous. 8.
Plants delicate in texture, whitish or pale green, varying to dark green. 10.
8. Underleaves small, distant, narrowed toward base. 7. *Euosmolejeunea duriuscula*.
Underleaves large, contiguous to imbricated, rounded or cordate at base. 9.
9. Leaves loosely imbricated, the lobe broadly ovate, obliquely spreading. 8. *Euosmolejeunea opaca*.
Leaves densely imbricated, the lobe orbicular, widely spreading. 9. *Cheilolejeunea polyantha*.
10. Branches sometimes flagelliform and leafless but with persistent underleaves, lobule inflated, perianth (so far as known) with a plane antical face. 11.
Branches never flagelliform. 12.
11. Lobes without basal ocelli, median leaf-cells averaging 21μ in diameter, inflorescence autoicous. 10. *Cheilolejeunea phyllobola*.
Lobes with basal ocelli, median leaf-cells averaging 10μ in diameter, inflorescence dioicous. 11. *Cheilolejeunea versifolia*.
12. Lobule filiform, not inflated, inflorescence autoicous, perianth plane or nearly so on antical face. 12. *Cheilolejeunea pililoba*.
Lobule inflated, perianth with a distinct antical keel. 13.
13. Lobe widely spreading, inflorescence autoicous. 14.
Lobe obliquely spreading to suberect, inflorescence dioicous. 16.

14. Lobes and underleaves distinctly crenulate on the margins, underleaves smaller than lobules. 13. *Lejeunea patens*.
Lobes and underleaves entire or nearly so. 15.
15. Plants pale to dark green, underleaves as large as lobules or larger, not rounded at base, perianth abruptly narrowed at base. 14. *Lejeunea cavifolia*.
Plants pale, underleaves larger than lobules, rounded at base, perianth gradually narrowed toward base. 15. *Lejeunea Americana*.
16. Median leaf-cells 18–20 μ in diameter. 17.
Median leaf-cells 12–13 μ in diameter. 18.
17. Underleaves longer than broad, deeply bifid, often unidentate on sides. 16. *Microlejeunea lucens*.
Underleaves as broad as long, bifid to middle, never unidentate on sides. 17. *Microlejeunea Ruthii*.
18. Lobule much smaller than lobe, often obsolete, lobe indistinctly ocellate at base, averaging 0.25 mm. in length. 18. *Microlejeunea Cardoti*.
Lobule nearly as large as lobe, lobe not ocellate at base, averaging 0.17 mm. in length. 19. *Microlejeunea bullata*.
19. Lobule three fourths the length of lobe or longer, lobe rounded at the apex and without hyaline cells, crenulate on the margin, stylus reduced to a single papilla, inflorescence autoicous. 20. *Cololejeunea minutissima*.
Lobule about half as long as lobe. 20.
20. Outer surface of lobe rough from projecting cells or wart-like thickenings or both, hyaline cells absent, inflorescence dioicous or autoicous. 21.
Outer surface of lobe almost smooth, the cells scarcely if at all convex, hyaline cells often present at the apex and along antical margin, stylus usually two cells long, inflorescence synoicous or paroicous. 23. *Cololejeunea Joviana*.
21. Lobe narrowed toward the apex, with strongly convex or conical cells, the projecting wall sometimes thickened, stylus usually two to ten cells long. 21. *Cololejeunea Biddlecomiae*.
Lobe broad at the apex, with slightly convex cells, each bearing in the middle a large globoid thickening, stylus usually two cells long. 22. *Cololejeunea Macounii*.

DESCRIPTION OF SPECIES

I. ARCHILEJEUNEA CLYPEATA (Schwein.) Schiffn.

PLATE 16, FIGS. I–II

Jungermannia clypeata Schwein. Spec. Fl. Amer. Sept. Crypt. Hep. 12. 1821.*Jungermannia transversalis* Schwein. l. c. (not Swartz).*Phragmicoma clypeata* Nees, Naturgesch. Eur. Leberm. 3: 248. 1838.*Lejeunea Dorotheae* Lehm. Pugillus, 7: 17. 1838. G. L. & N. Syn. Hep. 332. 1845.

ARCHILEJEUNEA CLYPEATA

Lejeunea Carolinensis Mont.; G. L. & N. *l. c.* (as synonym).

Lejeunea calyculata Tayl. Lond. Jour. Bot. 5: 388. 1846.

G. L. & N. Syn. Hep. 752. 1847.

Lejeunea clypeata Sull.; Gray, Manual, Ed. I., 685. 1848.

Symbiezidium calyculatum Trevis. Mem. r. 1st. Lomb. III. 4: 403. 1877.

Lejeunea (*Archi-Lejeunea*) *clypeata* Spruce, Hep. Amaz. et And. 90. 1884.

Archilejeunea clypeata Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1³: 130. 1893.

Pale glaucous-green or whitish, growing in broad depressed mats: stems prostrate, 0.085 mm. in diameter, closely appressed to matrix, irregularly branched: rhizoids scanty, simple or branched: leaves imbricated, the lobe obliquely spreading, slightly falcate, broadly oblong to suborbicular, convex, averaging 0.6 mm. long and 0.45 mm. wide, slightly revolute at the rounded apex, margin crenulate from projecting cells, antical margin rounded at base and arching across or just beyond axis; lobule inflated, ovate-triangular, 0.2 mm. long, 0.12 mm. wide, keel straight or slightly curved, forming a very obtuse angle with postical margin of lobe and sometimes almost continuous with it, free margin slightly curved, involute to beyond apex, then obliquely truncate to end of keel, apex blunt or subacute, consisting of a single projecting cell or rarely of two cells; cells of lobe convex with rather thick projecting walls and thin vertical walls, trigones distinct though sometimes small, acuminate, indeterminate thickenings absent except sometimes near base of lobe, cells at edge of lobe 15 μ in diameter, in the middle and at the base 19 μ : underleaves distant, orbicular, 0.2 mm. long, rounded at the apex, abruptly narrowed and neither rounded nor cordate at base, very short decurrent and attached by a slightly curved line of insertion: inflorescence autoicous or dioicous: ♀ inflorescence usually borne on a leading branch, rarely on a short branch, innovating on one or rarely on both sides, the innovations usually simple and sterile; bracts complicate, unequally bifid, scarcely or not at all winged on keel, the lobe obovate, slightly falcate, rounded at the apex, 0.75 mm. long, 0.45 mm. wide, crenulate on the margins, lobule oblong, rounded at the apex, 0.4 mm. long, 0.12 mm. wide; bracteole ovate-oblong, 0.6 mm. long, 0.4 mm. wide, slightly narrowed toward base, truncate or rarely retuse at the broad apex; perianth obovoid, 0.85 mm. long, 0.6 mm. wide, cuneate toward base, truncate above and with a short broad beak, lateral keels sharp, antical keel short and low, postical keel long, broad and sharply two-

angled when young, the keels roughened from projecting cells or sometimes with narrow rudimentary wings: ♂ spikes occupying short branches, oblong; bracts closely imbricated in two to four pairs, strongly inflated, slightly and subequally bifid with rounded lobes and strongly arched keel; bracteoles similar to the underleaves but smaller, limited to base of spike: antheridia in pairs.

Type-locality, Salem, North Carolina (Schweinitz).

On rocks and trees. Connecticut (Hall, Evans); New York (Peck); Pennsylvania (James, Lea); Delaware (James, Commons); District of Columbia (Coville, Holzinger); Virginia (Mrs. Britton and Miss Vail); West Virginia (Millspaugh); North Carolina (Schweinitz); South Carolina (Green); Tennessee (Underwood); Georgia (Underwood, Small); Alabama (Mohr); Mississippi (Lloyd and Tracy); Missouri (Russell); Arkansas (Coville); Louisiana (Langlois).

EXSIC.: Musc. Alleg. 262 (as *Phragmicoma clypeata*). Hep. Bor.-Amer. 95 (as *Phragmicoma clypeata*). Hep. Amer. 50 p.p. (as *Lejeunea (Archi-Lej.) clypeata*).

Archilejeunea clypeata and the two following species are very closely related. They differ from typical members of the genus in their pale color, less robust habit and short antheridial spikes. In these peculiarities they show an approach to the genus *Cheilolejeunea*, from which their undivided underleaves should probably exclude them. Recent writers on the hepaticae, however, tend to ascribe less value to this character than was originally done by Spruce, and species with undivided underleaves have been described in the genera *Euosmolejeunea*, *Cheilolejeunea* and *Pycnolejeunea*. Under these circumstances the generic position of *A. clypeata* and its immediate allies cannot be regarded as thoroughly established.

In studying *A. clypeata*, the writer has been able to examine the type of *Jungermannia clypeata* from the Schweinitz herbarium, the type of *Lejeunea Dorotheae* from the Lindenberg herbarium and a portion of the type of *L. calyculata* from the Taylor herbarium. The specimens in the Schweinitz herbarium labeled *Jungermannia transversalis* have also been examined, as well as the plants which Schweinitz sent to Torrey under this name. All of these various specimens evidently belong to the same species. In *L. Dorotheae* and in the plants labeled *J. transversalis*, the apex of the lobule

is sometimes composed of two superposed cells, instead of a single cell as is usual in the species. They show, however, even on robust stems, no other approach to either of the following species.

2. ARCHILEJEUNEA SELLOWIANA Steph.

PLATE 16, FIGS. 12-20

Phragmicoma xanthocarpa Aust. Hep. Bor.-Amer. 95 b. 1873.
Not *Jungermannia xanthocarpa* Lehm. & Lindenb.; Lehmann, Pugillus, 5: 8. 1832 (*Lejunea xanthocarpa* Lehm. & Lindenb.; G. L. & N. Syn. Hep. 330. 1845).

Archilejeunea Sellowiana Steph. Hedwigia, 34: 62. 1895.

Lejeunea velata Gottsche; Stephani, l. c. (as synonym).

Pale glaucous-green or whitish, growing in broad depressed mats: stems prostrate, often radiating from a center, 0.17 mm. in diameter, closely appressed to matrix, irregularly branched: rhizoids abundant: leaves closely imbricated, the lobe widely spreading almost at right angles with axis, ovate-oblong, sometimes slightly falcate, plane or slightly convex, 1.2 mm. long and 0.95 mm. wide on robust individuals, slightly revolute at the rounded apex, margin entire or subcrenulate from projecting cells, antical margin rounded at base and arching across or just beyond axis; lobule somewhat inflated toward base, oblong, 0.6 mm. long, 0.25 mm. wide, keel slightly arched, forming a distinct but very obtuse angle with postical margin, free margin curved, slightly inflexed near base, otherwise plane, apex acuminate, sometimes hamately curved, the apical tooth mostly three to eight cells long and two to four cells wide at base, ending in a single row of two or three cells, sinus beyond apex deep and rounded then passing very obliquely into postical margin, free margin of lobule, except for apical tooth usually entire but, in rare cases, bearing one or two supplementary teeth between base and apex or between apex and end of keel, lobules on small branches often poorly developed; cells of lobe convex with rather thick projecting walls and thin vertical walls, trigones large, acuminate to obtuse, intermediate thickenings not infrequent in middle of lobe and abundant toward base, mostly circular in outline, cells at edge of lobe $12\ \mu$ in diameter, in the middle and at the base $18\ \mu$: underleaves contiguous to imbricated, broadly orbicular to reniform, 0.6 mm. long, 0.7 mm. wide, rounded, truncate or retuse at the apex, rounded or subcordate at base, attached by a slightly curved line of insertion: inflorescence autoicous: ♀ inflorescence usually borne on a short branch, more rarely on a leading branch, inno-

vating one side, the innovation simple and sterile; bracts complicate, unequally bifid, sometimes with a narrow and rudimentary wing along keel, the lobe oblong-ovate to obovate, suberect to widely spreading, rounded at the apex, 0.9 mm. long, 0.6 mm. wide, lobule oblong, rounded to subacute, 0.5 mm. long, 0.2 mm. wide; bracteole oblong to obovate, 0.5 mm. long, 0.45 mm. wide, narrowed toward base, truncate at the apex; perianth obovoid, about half exserted, 0.9 mm. long, 0.7 mm. wide, cuneate toward base, broad and truncate above and with a short, narrow beak, lateral keels sharp, antical keel short and low, postical keel long, broad and prominent, sharply two-angled when young and sometimes showing a short supplementary fold between the angles near apex, keels slightly roughened from projecting cells: ♂ spikes occupying short branches, similar to those of *A. clypeata*: spores brownish-green, angular, variable in length, with thickened walls marked by minute verruculae and small orbicular patches of low, radiating ridges, averaging $23\ \mu$ in short diameter.

Type-locality, Brazil (Sellow).

On trees and rocks: Rhode Island (Bennett); Delaware Commons; Virginia (Seymour, Mears); North Carolina (Johnson); South Carolina (Miss DuBois); Tennessee (Ruth, Scoville); Georgia (Underwood); Florida (Austin, Farlow, Lighthipe, Underwood, Straub, Nash); Alabama (Mohr, Earle and Baker, Maxon and Pollard); Mississippi (Hall, Lloyd and Tracy); Louisiana (Langlois); Texas (Mohr).

Exsic.: Hep. Bor.-Amer. 95 b (as *Phragmicoma xanthocarpa*).

A. Sellowiana was first distinguished from *A. clypeata* by Austin, who considered it identical with *Lejeunea xanthocarpa* Lehm. & Lindenb., a widely distributed tropical and subtropical species occurring in both America and Africa. Austin distributed the plant as *Phragmicoma xanthocarpa* and it has since been known in America under this name. Through the kindness of Stephani, the writer has been enabled to study a specimen of *A. Sellowiana* collected at Petropolis, Brazil, by Rudolph. This specimen, which is quoted immediately after the type in the original description, agrees very closely with the specimens from the United States. It is probable, therefore, that the range of the species extends through Mexico and Central America into Brazil. It is worthy of note that the sterile type-specimens, collected by Sellow, were first referred doubtfully by Stephani to *A. clypeata*.*

* Hedwigia, 29: 20. 1890.

Austin incorrectly referred to his "*Phragmicoma xanthocarpa*," as synonyms, *Jungermannia transversalis* Schweinitz and *Lejeunea catenulata* Nees.* The first of these has already been commented upon. The second is a distinct species of the genus *Neurolejeunea*,† and its presence in the United States has not been definitely established. According to the synopsis it was found in "*Hymenophyllo ciliato* et *Neckera abietina* Hook. Americae septentrionalis." Unfortunately the genus *Hymenophyllum* is not known from the United States, *H. ciliatum* itself being found in tropical America. *Neckera abietina* (*Alsia abietina* Sull.), on the other hand, is found in California and northward along the Pacific coast, a region from which no *Lejeuneae* have been recorded except the recently described *Cololejeunea Macounii* of British Columbia. Under the circumstances we must exclude *Neurolejeunea catenulata* from our list.

The most important differences between *A. Sellowiana* and *A. clypeata* are drawn from their vegetative organs. *A. Sellowiana* is the more robust of the two species; the lobes of its leaves spread more widely and are at the same time more falcate; the lobule is oblong instead of ovate-triangular in outline, and its apex is acuminate instead of apiculate; the cells of the lobe have more conspicuous trigones and more numerous intermediate thickenings, the latter being practically absent in *A. clypeata*; its much broader underleaves finally are more crowded together and are usually subcordate at the base. The perichaetial bracts and perianths are so variable in both species that the slight differences between them are of little diagnostic value. In *A. Sellowiana*, however, the female flower is usually borne on a short branch, while in *A. clypeata* it is usually borne on a leading branch. Unfortunately even this difference is inconstant. The perigonial spikes are essentially the same in both species.

In the true *A. xanthocarpa* (Lehm. & Lindenb.) Steph., the lobe is much more strongly convex than in *A. Sellowiana*, and the margin is revolute both at the apex and along the entire postical side. In the lobule also the free margin is strongly involute for the greater part of its length. The leaf-cells are similar in the two

* Syn. Hep. 323. 1845.

† Spruce, Hep. Amaz. et And. 84. 1884; Schiffner; Engler & Prantl, Nat. Pflanzenfam. 13: 131. 1893.

species, but intermediate thickenings in *A. xanthocarpa* are very infrequent.

3. *Archilejeunea conchifolia* sp. nov.

PLATE 17, FIGS. 1-9

Pale yellowish-green or whitish, growing in depressed mats: stems prostrate, 0.1 mm. in diameter, closely appressed to matrix, irregularly branched: rhizoids abundant: leaves densely imbricated, the lobe obliquely spreading, not falcate, ovate, very convex, 0.7 mm. long, 0.45 mm. wide, strongly revolute at the rounded apex and along the postical margin, antical margin slightly rounded at base, arching across or just beyond axis, margin entire or very vaguely and sparingly crenulate; lobule inflated, oblong, 0.45 mm. long, 0.17 mm. wide, keel more or less arched, usually forming a continuous line with the revolute postical margin but sometimes slightly indented at junction with postical margin, free margin curved, involute to or beyond apex, sinus beyond apex deep and rounded then passing very obliquely into the revolute postical margin, apex acuminate, the apical tooth mostly three to six cells long and three or four cells wide at base, ending in a single row of two or three cells; cells of lobe slightly papillose, with thickened free walls and thin vertical walls, trigones small, intermediate thickenings very scanty near base of lobe, otherwise wanting, cells at edge of lobe $14\ \mu$ in diameter, in the middle and at the base $20\ \mu$: underleaves contiguous or imbricated, broadly orbicular, 0.25 mm. long, 0.35 mm. wide, broadly truncate at the apex, abruptly narrowed and neither rounded or truncate at base, very shortly decurrent and attached by a slightly curved line of insertion: inflorescence autoicous: ♀ inflorescence usually borne on a leading branch, rarely on a short branch, innovating on one side, the innovation usually short, simple and sterile; bracts complicate, shortly and unequally bifid, not winged on keel, the lobe ovate, obliquely or widely spreading, rounded at the apex, entire, 0.7 mm. long, 0.45 mm. wide, lobule narrowly ovate to lingulate, obtuse to acute at the apex, 0.45 mm. long, 0.17 mm. wide; bracteole obovate, 0.5 mm. long, 0.35 mm. wide, narrowed toward base, truncate or slightly retuse at the broad apex; perianth obovoid, about half exserted, 0.85 mm. long, 0.5 mm. wide, cuneate toward base, rounded or truncate above and with a short beak, lateral keels sharp, antical keel distinct, about half as long as perianth, postical keel long, broad and sharply two-angled when young, keels smooth or nearly so: ♂ spikes occupying short branches, similar to those of *A. clypeata*.

Type-locality, Orange Bend, Florida (Underwood, 60).

On trees. South Carolina (Ravenel, Miss Du Bois); Alabama (Baker); Florida (Underwood).

EXSIC.: Hep. Amer. 50 *p. p.* (as *Lejeunea* (*Archi-Lej.*) *clypeata*).

A. conchifolia is of about the same size as *A. clypeata*, and agrees with it in the position of its female flowers. It differs in its obliquely spreading, convex lobes with revolute apex and margin, in its oblong lobule with acuminate apex and in its imbricated underleaves, usually broader than long. From *A. Sellowiana* it differs mainly in its smaller size and in the characters of its convex leaf-lobes, which are not at all falcate.

A. conchifolia is perhaps closer to *A. xanthocarpa* than is the preceding species, agreeing with it in its convex leaf-lobes with revolute postical margins. It is, however, much less robust, its lobes spread more obliquely, its lobules are relatively larger and their apices can usually be made out without dissection.

4. MASTIGOLEJEUNEA AURICULATA (Wils. & Hook.) Schiffn.

PLATE 17, FIGS 10-19

Jungermannia auriculata Wils. & Hook.; Drummond, Musc. Amer. St. Merid. 170. 1841.

Phragmicoma versicolor Lehm. & Lindenb. *p. p.*; G. L. & N. Syn. Hep. 297. 1845.*

Phragmicoma teretiuscula Lindenb. & Gottsche, *p. p.*, *l. c.* 745. 1847.

Lejeunea auriculata Sull.; Gray, Manual, Ed. II., 699. 1856.

Ptyccoleus auriculatus Trevis. Mem. r. Ist. Lomb. III. 4: 405. 1877.

* *Phragmicoma versicolor* of the Synopsis Hepaticarum is based on specimens collected at Madras by Wight and on Drummond's Louisiana specimens, the type of *Jungermannia auriculata* Wils. & Hook. In the supplement to this work, the authors refer some of Wight's specimens to *P. repleta* Tayl. (Lond. Jour. Bot. 5: 392. 1846) and the remainder to the newly described *P. teretiuscula* Lindenb. & Gottsche (p. 745), in which certain Mexican specimens collected by Liebman are also included. This last species, according to Stephani (Hedwigia, 29: 8. 1890), is also a composite, the Indian specimens being referable to *P. ligulata* Lehm. & Lindenb. (Syn. Hep. 301) and the Mexican specimens to *P. versicolor*. It is evident from the above notes that the name "versicolor," although finally restricted by the authors of the Synopsis to Drummond's specimens, cannot justly supersede the older name "auriculata." According to the strict rules of priority, however, it might still be made to replace the name "repleta" of Taylor, but apparently there is enough reason for giving it up altogether. Of course the name "teretiuscula" has no claims whatever.

Lejeunea (*Mastigo-Lejeunea*) *auriculata* Spruce, Hep. Amaz. et And. 102. 1884.

Mastigolejeunea auriculata Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1³: 129. 1893.

Glaucous green, varying to brownish or purplish in older parts, growing in depressed tufts: stems prostrate or pendent, 0.15 mm. in diameter, arising from a creeping caudex, irregularly pinnate or on ♀ plants rarely dichotomous, branches widely spreading, sometimes small-leaved and flagelliform: rhizoids scanty: leaves densely imbricated, closely appressed when dry, widely spreading and subsquarrose when moist, the lobe ovate-oblong, more or less falcate, 1 mm. long, 0.5 mm. wide, apex usually obtuse, sometimes rounded or subacute, margin entire or subrepand, antical margin rounded to auriculate at base, postical margin more or less revolute, especially on robust axes; lobule more or less inflated, very variable, averaging 0.35 mm. long and 0.2 mm. wide, on small branches ovate, the free margin more or less rounded, somewhat involute, apex apiculate, acute or obtuse, sinus beyond apex broad and shallow, passing very obliquely into postical margin of lobe, lobule on robust stems and branches often appearing simply as a broadening out of the postical margin of lobe, without showing a distinct apex, these two extreme types of lobule being connected by intermediate conditions, hexagonal or subrhomboid in outline; cells of lobe plane, thick-walled and with distinct trigones, intermediate thickenings occasionally present toward base of lobe, cells at edge of lobe 8μ in diameter, in the middle $21 \times 12\mu$, at the base $23 \times 14\mu$: underleaves imbricated, broadly orbicular, 0.5 mm. long, 0.55 mm. wide, with a broad, median ridge, truncate or slightly retuse at apex, cuneate toward base, indistinctly decurrent or minutely auriculate at base and attached by a slightly curved line of insertion, margin irregularly sinuate, more or less revolute at apex and near base: inflorescence autoicous or dioicous: ♀ inflorescence borne on a leading branch, innovating on one or rarely on both sides, the innovations once or repeatedly floriferous; bracts complicate, unequally bifid, the lobe ovate, suberect to widely spreading, 1.2 mm. long, 0.6 mm. wide, the apex usually subacute, but varying from rounded to acuminate, margin irregularly sinuous, lobule oblong to obovate, bluntly pointed, truncate or retuse at apex, 0.7 mm. long, 0.35 mm. wide; bracteole 0.8 mm. long, 0.7 mm. wide, obovate from a slightly narrowed base, at the apex rounded, truncate, retuse or emarginate with a lunulate sinus, margin sinuous, more or less revolute toward base; perianth oval in outline, about one third exserted, 1.5 mm. long, 0.6 mm. wide, rounded at base and at apex, beak short and broad, strongly compressed and

with a high, narrow, postical keel, antical surface plane or nearly so, keels not winged: ♂ inflorescence borne on ♀ plants, occupying ordinary branches or innovations, usually proliferating and sometimes repeatedly floriferous; bracts in six to twelve pairs, similar to the leaves, but with smaller, less widely spreading lobes, more strongly arched keels and larger, more inflated lobules, truncate to retuse at apex; bracteoles similar to underleaves, found throughout spike; antheridia borne singly: spores greenish, thick-walled, minutely verruculose, averaging 34μ in short diameter.

Type-locality, New Orleans and Louisiana (Drummond).

On trees. Florida (J. D. Smith, Underwood, Straub); Alabama (Mohr); Louisiana (Drummond, Langlois). The species is widely distributed in tropical America.

EXSIC.: Musc. Amer. St. Merid. 170 (as *Jungermannia auriculata*). Hep. Amer. 133 (as *Lejeunea (Mastigo-Lej.) auriculata*).

Mastigolejeunea auriculata belongs to a tropical and subtropical genus which has no other known representatives in the United States. The species bears, however, a certain superficial resemblance to *Brachiolejeunea corticalis*, with which it has been confused. The latter species is readily distinguished by its crenulate lobules, larger leaf-cells, usually double innovation and pluriplicate perianth.

According to Spruce,* *M. auriculata* can scarcely be distinguished from the Javan *M. humilis* (Gottsche) Schiffn., to which he would also reduce *M. repleta* (Tayl.). Stephani† states that all three species are amply distinct. The writer has examined a specimen of *M. humilis* and finds that this species, although very close to *M. auriculata*, differs in its smaller size, in its much less variable lobule, which ends in a long outwardly curved tooth consisting of three or eight cells in a single row, in its more emarginate underleaves and in the broader lobes and lobules of its perichaetial bracts. According to Stephani *M. repleta* is distinguished by its apiculate leaves.

5. BRACHIOLEJEUNEA CORTICALIS (Lehm. & Lindenb.) Schiffn.

PLATE 18, FIGS. 1-11

Jungermannia corticalis Lehm. & Lindenb.; Lehmann, Pugillus, 4: 50. 1832.

* Hep. Amaz. et And. 103. 1884.

† Hedwigia, 29: 9. 1890.

Frullania Leprieurii Nees & Mont. ; Mont. Ann. des Sc. Nat. II. 14: 333. pl. 20. f. 1. 1840.

Phragmicoma corticalis Lehm. & Lindenb. ; G. L. & N. Syn. Hep. 297. 1845.

Phragmicoma melanophloea Mont. & Nees, l. c. 297 (as synonym).

Lejeunea linguaefolia Tayl. Lond. Jour. Bot. 5: 390. 1846. G. L. & N. Syn. Hep. 754. 1847 (*fide* Stephani).

Phragmicoma Leprieurii Mont. Sylloge, 86. 1856.

Ptychocoleus corticalis Trevis. Mem. r. Ist. Lomb. III. 4: 405. 1877.

Lejeunea (Brachio-Lejeunea) corticalis Steph. Hedwigia, 29: 8. 1890.

Brachiolejeunea corticalis Schiffn. Hedwigia, 33: 180. 1894 (in obs.).

Brownish-green, growing in depressed tufts, ♂ and ♀ plants mixed together: stems prostrate, appressed to substratum, 0.2 mm. in diameter, irregularly pinnate or on ♀ plants more or less dichotomous, branches never flagelliform, widely spreading but at less than a right angle: rhizoids often abundant: leaves imbricated, more or less appressed when dry, widely spreading when moist, the lobe ovate, falcate, 0.85 mm. long, 0.5 mm. wide, apex broad, rounded or very obtuse, margin entire, antical margin curved, arching across axis and rounded or subcordate at base, postical margin distinctly indented beyond end of keel; lobule strongly inflated about half its width, broadly ovate, measuring, when inflated, 0.45 mm. long and 0.25 mm. wide, keel straight or slightly arched, subcrenulate from projecting cells, free margin plane and appressed to lobe, rounded at inner edge, then straight or slightly curved and passing obliquely into postical margin of lobe, usually bearing four scattered papilla-like teeth, each consisting of a single blunt cell or rarely of two cells, and, near outer end, a fifth angular tooth, the last sometimes obsolete; cells of lobe plane or somewhat papillose, thin-walled, trigones distinct, usually with two convex sides and one concave side, intermediate thickenings very infrequent, cells at edge of lobe $13\ \mu$ in diameter, in the middle $23 \times 16\ \mu$, at the base $28 \times 23\ \mu$: underleaves slightly imbricated, orbicular-quadrate to reniform, 0.45 mm. long, 0.45 mm. wide, truncate or retuse at the broad apex, sides parallel or converging toward base: inflorescence dioicous: ♀ inflorescence borne on a leading branch, usually innovating on both sides, more rarely on one side, the innovations usually once or twice floriferous; bracts complicate, unequally bifid,

keel broadly winged in lower half, the wing entire, semicircular to semiovate in outline, lobe ovate, obliquely spreading, rounded at apex, subcordate at base, irregularly sinuous on margin, 0.95 mm. long, 0.5 mm. wide, lobule lanceolate-ligulate, rounded at apex, sinuous on margin, 0.85 mm. long, 0.2 mm. wide; bracteole free, oblong, 0.85 mm. long, 0.4 mm. wide, truncate to retuse at apex, broadening out slightly toward base, irregularly sinuous on margin; perianth oblong-obovoid, about one third exserted, 1.1 mm. long, 0.6 mm. wide, rounded at apex and with a short, broad beak, somewhat compressed in upper half with sharp lateral keels, postical keel broad, sharply two-angled and with a short, supplementary fold near apex, antical keels one to three, low and short: ♂ spikes borne on leading branches, usually proliferating and repeatedly floriferous, bracts in about six pairs, less spreading than the leaves, the lobe not falcate, lobule nearly as long as lobe but narrower, inflated, apex blunt to subacute, margin entire; bracteoles similar to underleaves, found throughout spike.

Type-locality, Jamaica (Herb. Lehm. & Lindenb.).

On trees. Lake Worth, Florida (Underwood). The species has a rather wide distribution in tropical America.

Brachiolejeunea corticalis has not before been recorded from the United States. The Florida specimens, however, agree closely with the type and also with the specimens from Cuba, distributed in Hep. Amer. 144. There is no danger of confusing the species with any of our other Lejeuneae except possibly *Mastigolejeunea auriculata*, under which the most important differences have already been enumerated.

The genus *Brachiolejeunea* has several representatives in tropical America, and among them *B. bicolor* (Nees) Schiffn. is perhaps most closely related to *B. corticalis*. *B. bicolor* is a more robust plant, the lobes of its leaves tend to be more sharply pointed, its underleaves are more or less auriculate at base and its perianth is regularly pluriplicate, usually with ten distinct folds in the upper part.

6. HARPALEJEUNEA OVATA (Hook.) Schiffn.

Jungermannia serpyllifolia β *ovata* Hook. Brit. Jung. 1816 (not figured).

Lejeunea ovata Tayl.; G. L. & N. Syn. Hep. 376. 1845.

Lejeunea (*Harpa-Lejeunea*) *ovata* Spruce, Hep. Amaz. et And. 165. 1884.

Lejeunea Molleri Steph. Hedwigia, **26**: 3. *pl. 1. f. 2.* 1887.

Harpalejeunea ovata Schiffn.; Engler & Prantl, Nat. Pflanzenfam. **1**³: 127. 1893.

Pale to dark green, loosely depressed-caespitose or scattered among other hepatics: stems prostrate, 0.05 mm. in diameter, closely appressed to substratum, irregularly branched: rhizoids few: leaves contiguous or somewhat imbricated, the lobe convex, obliquely to widely spreading, falcate-ovate, 0.3 mm. long, 0.15 mm. wide, gradually narrowed beyond middle, apex often reflexed, mostly acute or short-acuminate, rarely obtuse, margin subentire or irregularly sinuate, antical margin curved, arching part way across axis and almost straight at base, postical margin slightly rounded near keel and forming with it a distinct angle varying from obtuse to acute; lobule strongly inflated, ovoid, 0.15 mm. long, 0.08 mm. wide, keel strongly arched, crenulate from convex cells, free margin slightly curved, involute to beyond apex, then obliquely truncate or lunulate to end of keel, apex tipped with a single, projecting cell, curving slightly outwards or nearly straight; cells of lobe convex, thin-walled, trigones distinct though sometimes minute, intermediate thickenings scattered, usually distinct, basal ocelli formed of two to five enlarged, thin-walled cells, cells at edge of lobe averaging $14\ \mu$ in diameter and in the middle $18\ \mu$, cells of ocelli $30 \times 24\ \mu$: underleaves distant, broadly cuneiform, 0.08 mm. long, 0.1 mm. wide, lateral margins straight or nearly so near base, apex broad, truncate or usually emarginate-obcordate with a shallow sinus and broad, rounded or very obtuse segments, usually three to five cells long and four or five cells broad at base, margin entire: inflorescence dioicous: ♀ inflorescence on a leading branch, innovating on one or rarely on both sides, the innovations usually simple and sterile; bracts complicate, unequally bifid, sometimes narrowly winged along keel, the wing often interrupted, one or two cells wide, lobe suberect, oblong to obovate, 0.5 mm. long, 0.25 mm. wide, gradually narrowed toward the obtuse or rounded apex, often bearing scattered ocelli, lobule narrowly oblong-ovate, rounded or truncate at apex, 0.4 mm. long, 0.15 mm. wide, margins of bracts entire, bracteole slightly connate on both sides, oblong-ovate to broadly obovate, 0.3 mm. long, 0.2 mm. wide, rounded to emarginate-bifid at apex with rounded segments, sometimes sparingly ocellate, margin entire; perianth obovate-clavate, acutely five-keeled in upper part: ♂ spike occupying a short branch; bracts in one or two pairs, closely imbricated, erect, unequally bilobed, antical lobe oval, obtuse, postical lobe similar but smaller.

Type-locality, Ireland (Taylor).

On trees and fallen logs. Southern States (Sullivant, *fide* Austin); Virginia (Mrs. Britton and Miss Vail); Tennessee (Ruth); Georgia (Underwood). The species also occurs in western Europe but is rare. Pearson * states that it grows on shaded rocks but according to Camus † it is also found on bark.

Harpalejeunea ovata has been illustrated three times within recent years. Stephani's figure, already noted in the synonymy, was drawn from specimens collected in Portugal. The writer has illustrated the specimens from Virginia, ‡ while Pearson has published figures drawn from British material. § The perianth, known only from the brief description in the Synopsis Hepaticarum, does not appear in any of these illustrations.

The American specimens agree closely with the type-material in the Taylor herbarium but show a greater variability in the shape of the bracteole than European writers describe. There are no male specimens among them, and the description given above of the perigonal spike is taken wholly from Pearson.

There is no other species from the United States with which *H. ovata* ought to be confused. The acute lobes of its leaves and its emarginate-bifid underleaves with rounded divisions are unique among our Lejeuneae. The species, however, finds several close allies in tropical regions, where the genus *Harpalejeunea* is largely represented.

7. *Euosmolejeunea duriuscula* (Nees)

PLATE 18, FIGS. 12-13

Jungermannia serpyllifolia Wils. & Hook. *p. p.* Drummond, Musc. Amer. St. Merid. 171. 1841.

Lejeunea duriuscula Nees; G. L. & N. Syn. Hep. 364. 1845.

Lejeunea flexuosa Lindenb. *l. c.* 385. 1845 (*fide* Stephani).

Lejeunea serpyllifolia var. Sull. Musc. Alleg. 273. 1845.

Lejeunea Sullivantiae Aust. Bull. Torrey Club, 3: 15. 1872.

Lejeunea Austini Lindb. Acta Soc. Sci. Fenn. 10: 489. 1875.

Lejeunea (*Cheilo-Lejeunea*) *duriuscula* Spruce, Hep. Amaz. et And. 259. 1884.

* Hep. Brit. Isles, 43. 1899.

† Bull. Soc. Bot. de France, 47: 201. 1900.

‡ Small & Vail, Mem. Torrey Club, 4: pl. 81. 1894.

§ *L. c.* pl. 8.

Lejeunea (*Euosmo-Lejeunea*) *duriuscula* Steph. Hedwigia, 29: 80. 1890.

Lejeunea (*Eu-Lejeunea*) *Underwoodii* Steph. Bot. Gazette, 17: 171. 1892.

Cheilolejeunea duriuscula Schiffn.; Engler's Bot. Jahrb. 23: 592. 1897 (in obs.).

Yellowish-green, sometimes tinged with brownish, depressed-caespitose: stems prostrate, loosely appressed to substratum, 0.08 mm. in diameter, sparingly and irregularly branched: rhizoids scanty: leaves slightly imbricated, the lobe convex, obliquely to widely spreading, falcate-ovate, 0.4 mm. long, 0.35 mm. wide, rounded or very obtuse at the apex, margin slightly and irregularly angular-sinuate, antical margin arching across or just beyond axis, rounded at base, postical margin forming an obtuse angle with keel; lobule strongly inflated, triangular-ovate, measuring when inflated 0.1 mm. long, 0.08 mm. wide, keel slightly arched or almost straight, somewhat decurrent, free margin strongly involute to beyond the obtusely pointed or apiculate apex, then obliquely truncate to end of keel; cells of lobe plane or slightly convex, with somewhat thickened walls and large, triangular trigones, averaging 13 μ in diameter at edge of lobe, 16 μ in the middle and 21 μ at base: underleaves distant, ovate to orbicular, 0.17 mm. long, 0.15 mm. wide, bifid about one half with acute, slightly spreading lobes and narrow usually acute sinus, cuneate and slightly decurrent at base, sometimes very minutely auriculate: inflorescence dioicous: ♀ inflorescence borne on a leading branch, innovating on one or sometimes on both sides, the innovations long, often floriferous; bracts complicate, unequally bifid, the lobe suberect to widely spreading, ovate to falcate-ovate, rounded to obtuse at the apex, margin as in leaves, 0.5 mm. long, 0.3 mm. wide, lobule ovate to lanceolate, rounded to acuminate at the apex, 0.17 mm. long, 0.08 mm. wide; bracteole free, broadly ovate to obovate, 0.45 mm. long, 0.35 mm. wide, bifid about one third with erect, acute lobes and narrow, mostly acute sinus; perianth brownish, somewhat exserted, obovoid, 0.8 mm. long, 0.5 mm. wide, rounded, truncate or slightly retuse at apex and with a short beak, somewhat compressed with sharp lateral keels and a broad, sharply two-angled postical keel, antical keel lower, surface smooth: ♂ spike borne on a leading branch or rarely on a short branch, usually proliferating at the apex; bracts in two to four pairs, very concave and strongly inflated, shortly and subequally bifid with a strongly arched keel and rounded or obtuse lobes, slightly crenulate at apex; bracteoles similar to underleaves but smaller, present only in lower part of spike.

Type-locality, Surinam (Curie).

On trees or rotten logs, often growing with mosses or other hepatics. Florida (J. D. Smith, Farlow, Underwood); Alabama (Sullivant, Mohr); Mississippi (Langlois, Lloyd and Tracy); Louisiana (Drummond, Featherman, Langlois, Faxon). The species has a wide distribution in tropical America.

EXSIC.: Musc. Amer. St. Merid. 171 *p. p.* (as *Jungermannia serpyllifolia*). Musc. Alleg. 273 (as *Lejeunea serpyllifolia* var.). Hep. Bor.-Amer. 96 (as *Lejeunea Sullivantiae*). Hep. Amer. 135 (as *Lejeunea (Eu-Lej.) Underwoodii*).

Lejeunea Sullivantiae Aust. has been more or less of a puzzle to hepaticologists, and yet the original description, although brief, is not misleading. The specimens distributed by Austin and by Sullivant, moreover, are both abundant and characteristic. Unfortunately Austin makes no note in his description of the female flowers, although they are fairly abundant in the material which he studied. The probability is that he overlooked them because they had developed no perianths.

A few years after *L. Sullivantiae* was published, Lindberg studied the specimens in Musc. Alleg. 273 and Hep. Bor.-Amer. 96 and proved that they were identical with the dark tufts in No. 171 of Drummond's exsiccata. He also stated that they could not be distinguished from *L. thymifolia* Nees, ? γ of the Synopsis Hepaticarum,* a plant which he knew from male specimens collected in French Guiana by Leprieur. *L. thymifolia* has since been reduced to *L. flava* Swartz,† and the questionable variety γ is referred by Stephani‡ to *L. duriuscula*, a species with which Lindberg was apparently unfamiliar. Objecting to the name "*L. Sullivantiae*" on account of the older *L. Sullivantii* Gottsche,§ Lindberg gave to Austin's species the name *L. Austini*, and presumably referred to it the var. γ , to which allusion has just been made.

* 373.

† Spruce, Hep. Amaz. et. And. 271; Schiffner, Conspect. Hep. Arch. Ind. 249. 1898.

‡ Hedwigia, 29: 83. 1890. It should perhaps be noted that Stephani's specimens of var. γ were collected by Beyrich in Brazil and are the plants mentioned in the Synopsis. Gottsche (Mex. Leverm. 218. 1863) refers these same specimens to *L. pulvinata* Lehm. & Lindenb. (Syn. Hep. 382).

§ Mex. Leverm. 196. 1863.

The validity of *L. Austini*, so far as the specimens from the United States are concerned, is recognized both by Underwood and by Stephani. The latter author first referred it to the subgenus *Eu-Lejeunea*, but at present considers it a *Cheilolejeunea*. With it he compares his *Eu-Lejeunea Underwoodii*, from Florida, a plant which he is now also inclined to place in *Cheilolejeunea*. It is evident from the above statements that *L. duriuscula*, *L. Austini* and *L. Underwoodii* are all considered distinct species by Stephani.

The writer has examined all the specimens which Lindberg referred to *L. Austini* with the exception of those from Guiana. He has also examined the specimens of *L. Underwoodii* distributed by Underwood and Cook and those of *Euosmolejeunea duriuscula* in Hepaticae Spruceanae, collected near Pará, in Brazil. All of these plants show female flowers without perianths, and there are no male plants among them. As a result of this study it would appear that all of these specimens are referable to the same species, for which the oldest available specific name, "*duriuscula*," should be retained. The differences stated by Stephani in his published papers and in his manuscript notes are not always apparent and seem hardly sufficient to separate the species. He states, for example, that *L. Austini* has much smaller leaf-cells than *L. Underwoodii*, and that the lobule of the latter species is inflated and has an arched keel, whereas in *L. Austini* the lobule is not inflated and the keel is approximately straight or concavely arched. He states also that the bracteole is free in *L. Underwoodii* and slightly connate on one side in *L. Austini*. The first of these differences does not hold, since the cells of *L. Austini* average fully as large as those of *L. Underwoodii*. The second difference is unreliable, because convexly arched, straight, and concavely arched keels may often be found on a single stem, and the degree of inflation depends largely upon the degree of development. The third difference is at best inconstant as the bracteole is uniformly free in the specimens of *L. Austini* examined by the writer. Stephani has published no descriptive notes on *Euosmolejeunea duriuscula* but has kindly furnished a drawing of this species made from the type-material. This agrees essentially with the specimens distributed by Spruce. In reducing *L. Austini* and *L. Underwoodii* to synonymy the writer regrets differing from so eminent an authority as

Stephani but feels compelled to follow the evidence drawn from the specimens themselves.

Opinions have varied with regard to the systematic position of *E. duriuscula*. By Spruce it was first placed in *Cheilo-Lejeunea*, a disposition now accepted by Stephani and by Schiffner. Spruce afterwards transferred it to *Euosmolejeunea*, thereby agreeing with an earlier view of Stephani. The plant agrees with *Euosmolejeunea* in its color and general habit, in its leaves and cell-structure and in its perianth. Its underleaves, however, are smaller than is usual in the genus and lack the basal cordations which normally occur. Since several species of *Euosmolejeunea* with equally small underleaves have been described, this difference by itself should hardly suffice to exclude *E. duriuscula*. The species certainly has less in common with either *Cheilolejeunea* or *Lejeunea* proper than it has with *Euosmolejeunea*.

E. duriuscula seems to be limited with us to the States bordering the Gulf of Mexico. The specimens from Kirkville, New York, quoted by Underwood as *L. Austini** are referable to *Lejeunea cavifolia*. These specimens were determined by Spruce, who had apparently been misled by plants incorrectly referred to *L. Austini*. In addition to *L. cavifolia*, no fewer than four of our other *Lejeuneae* have been found in herbaria incorrectly determined as *L. Austini*. Our only species, however, which it at all closely resembles is *Euosmolejeunea opaca*, under which the differential characters will be noted.

8. EUOSMOLEJEUNEA OPACA (Gottsche) Steph.

PLATE 19, FIGS. I-II

Lejeunea opaca Gottsche; G. L. & N. Syn. Hep. 362. 1845.

Lejeunea (*Omphalanthus*?) *Mohrri* Aust. Bull. Torrey Club, 6: 20. 1875.

Lejeunea (*Euosmo-Lejeunea*) *laxiuscula* Spruce, Hep. Amaz. et And. 244. 1884.

Lejeunea (*Euosmo-Lejeunea*) *opaca* Steph. Hedwigia, 29: 79. 1890.

Euosmolejeunea opaca Steph. Bihang Svenska. Vet.-Akad. Handl. 23²: 23. 1897.

* Bull. Torrey Club, 19: 299. 1892.

Yellowish-green, growing in depressed tufts: stems prostrate, loosely appressed to substratum, 0.1 mm. in diameter, sparingly and irregularly branched: rhizoids scanty: leaves loosely imbricated, the lobe convex, obliquely spreading, broadly ovate, 0.5 mm. long, 0.4 mm. wide, rounded at the apex, margin entire or sparingly crenulate from projecting cells, antical margin arching across or just beyond axis, rounded at the base, postical margin forming an angle a little greater than a right angle with keel; lobule strongly inflated, triangular-ovate, 0.15 mm. long, 0.1 mm. wide, keel slightly arched, free margin strongly involute to beyond the subacute apex, then obliquely truncate or lunulate to end of keel; cells of lobe plane or convex, with somewhat thickened walls and large, triangular trigones, averaging $13\ \mu$ in diameter at edge of lobe, $18\ \mu$ in the middle and $25 \times 18\ \mu$ at the base: underleaves contiguous or imbricated, orbicular, 0.35 mm. long, bifid about one third with obtuse or acute, erect or subcontiguous lobes separated by an obtuse or acute sinus, rounded or cordate at base and attached by a long, curved line of insertion, margins entire: inflorescence dioicous: ♀ inflorescence borne on a short branch, innovating on one side with a short, simple innovation, very rarely without innovation; bracts complicate, unequally bifid, the lobe erect-spreading, unsymmetrically ovate, usually rounded at the apex, but varying to apiculate or acute, 0.6 mm. long, 0.35 mm. wide, lobule variable, mostly oblong and rounded at the apex, 0.17 mm. long, 0.07 mm. wide; bracteole free, orbicular to oblong, 0.45 mm. long, 0.4 mm. wide, bifid about one third with acute or subacute, erect lobes and narrow sinus; perianth about half exserted, oblong-obovoid, 0.9 mm. long, 0.45 mm. wide, gradually narrowed toward base, rounded at the apex and with a short beak, lateral keels sharp, postical keel about as long as perianth, broad and sharply two-angled, antical keel short, in upper part of perianth: ♂ spike borne on a short branch, sometimes proliferating; bracts and bracteoles similar to those of *E. duriuscula*, but the lobes of the bracts not crenulate at apex.

Type-locality, Surinam (Splitgerber).

On rotten logs. Florida (J. D. Smith, Lighthipe, Underwood, Faxon); Alabama (Mohr). Widely distributed in tropical America.

Exsic.: Hep. Amer. 134 (as *Lejeunea* (*Euosmo-Lej.*) *trifaria*).

The abundant specimens of *E. opaca*, collected by Underwood in Florida, were at first confused with *E. trifaria* (Nees) Schiffn. This species is even more widely distributed, being found in the tropics of both hemispheres, and is certainly to be expected in the southern parts of Florida. It is a more robust plant than *E. opaca*,

and differs from it in its autoicous inflorescence and in its leaf-cells, which are more convex on the free surface of the lobe and show much more conspicuous trigones.

The type-specimens of *Lejeunea Mohrii* in the Austin herbarium are apparently referable to *E. opaca*, although sterile and in rather poor condition. They do not agree fully with Austin's description because they show bifid underleaves, but this is a character which might have been overlooked.

E. opaca differs from *E. duriuscula* in its much larger underleaves, distinctly rounded or cordate at the base, and in the position of its sexual organs, which are borne on short branches rather than on leading branches. Occasionally one meets with specimens of *E. opaca* in which the underleaves are smaller than is normal, but in such cases a careful search will commonly show underleaves of the usual size on some of the axes.

At one time Spruce * threw doubt on the validity of *E. opaca*, suspecting that it was synonymous with *Lejeunea clausa* Mont. Later he apparently changed his mind, for he distributed specimens under both of these names in his *Hepaticae Spruceanae*.

9. *Cheilolejeunea polyantha* sp. nov.

PLATE 19. FIGS. 12-21

Dull green or brownish, growing in depressed tufts: stems prostrate, loosely appressed to substratum, 0.1 mm. in diameter, copiously and irregularly pinnately branched, sometimes dichotomous: rhizoids scanty: leaves densely imbricated, the lobe convex, obliquely spreading, orbicular, 0.4 mm. long, rounded at the apex, margin entire or slightly and irregularly angular-sinuate, antical margin arching across axis and rounded at base, postical margin usually rounded, forming an acute or right angle with keel; lobule strongly inflated, ovoid-cylindrical, 0.12 mm. long, 0.08 mm. wide, keel slightly arched, free margin strongly involute as far as the bluntly pointed apex, then abruptly or obliquely truncate to end of keel; cells of lobe slightly convex, with somewhat thickened walls and distinct, triangular trigones, averaging 12 μ in diameter at edge of lobe, 21 μ in the middle and 23 μ at the base: underleaves imbricated, sometimes densely so, rapidly increasing in size toward a ♀ inflorescence, plane, broadly orbicular to reniform, 0.25 mm. long, 0.35 wide, bifid about one

* Hep. Amaz. et And. 245. 1884.

half the distance from apex to the strongly curved line of insertion, with broad, erect, triangular, obtuse to acute or apiculate lobes and obtuse to acute sinus, rounded to cordate at base, margin entire: inflorescence dioicous: ♀ inflorescence sometimes on a leading branch, sometimes on a short branch, innovating on one or occasionally on both sides, the innovations usually floriferous and sometimes repeatedly so, occasionally sterile; bracts complicate, deeply and unequally bifid, the lobe obliquely spreading, ovate, rounded or sometimes apiculate at apex, margins as in leaves, 0.7 mm. long, 0.4 mm. wide, lobule ovate to lanceolate, rounded to acuminate at the apex, 0.25 mm. long, 0.15 mm. wide: bracteole free, oblong-elliptical to oval, convex (postically), 0.7 mm. long, 0.5 mm. wide, bifid one fourth to one third with triangular, acute or apiculate lobes and broad obtuse to acute sinus: perianth about half exerted, obovoid, 0.85 mm. long, 0.55 mm. wide, cuneate toward base, gradually narrowed toward the rounded apex and with a short beak, antical surface plane or with a low and indistinct keel near apex, postical keel long, broad and bluntly two-angled, lateral keels slightly compressed: ♂ inflorescence not seen: spores measuring $16\ \mu$ in short diameter, elongated, irregularly angular, thick-walled, with small ridge-like thickenings, arranged radiately in circles.

On bark. Eustis, Florida (Underwood, 1380 *p.p.*), the type-locality.

Cheilolejeunea polyantha resembles to a considerable extent the South American *Pycnolejeunea papulosa* Steph.,* a species described by Spruce under the name *Lejeunea* (*Pycno-Lejeunea*) *contigua*, var. *latifolia*.† The new species, however, is much less robust than *P. papulosa*, its leaves are less convex and its leaf-cells have thinner walls and less conspicuous trigones; its underleaves are relatively longer, and its perianth has an obsolete antical keel and a longer beak.

The closely imbricated leaves and underleaves of *C. polyantha* will at once distinguish it from any of our other Lejeuneae Schizostipae, although in texture and color it somewhat resembles *Eusmolejeunea opaca* and *E. duriuscula*. From the first of these, it differs also in its more widely spreading and narrower lobules, in its broader underleaves, and in its broader perianth and perichaetial

* Hedwigia, 35: 126. 1896.

† Hep. Amaz. et And. 248. 1884. Afterwards distributed in Hep. Spruceanae as a distinct species under a manuscript name.

bracts. From the second it differs more particularly in its larger size and in its much larger underleaves, which are rounded or subcordate at the base.

10. CHEILOLEJEUNEA PHYLLOBOLA (Nees & Mont.) Schiffn.

PLATE 20, FIGS. 1-13

Lejeunea phyllobola Nees & Mont.; Ramon de la Sagra, Hist. fis. pol. y natur. Cuba, 9: 281. 1845. G. L. & N. Syn. Hep. 369. 1845.

Lejeunea (Hygro-Lejeunea) phyllobola Steph. Hedwigia, 29: 81. 1890.

Cheilolejeunea phyllobola Schiffn. Engler's Bot. Jahrb. 23: 591. 1897.

Hygrolejeunea phyllobola Massal. Mem. dell' Accad. di Verona, 73:—(33). pl. 9. f. 12. 1897.

Pale green, growing in depressed mats: stems prostrate, closely appressed to substratum, 0.07 mm. in diameter, irregularly and rather densely pinnate, the branches sometimes upright and flagelliform, leafless except at apex, but with well-developed underleaves: rhizoids somewhat abundant: leaves loosely imbricated, the lobe obliquely to widely spreading, orbicular-ovate, 0.5 mm. long, 0.45 mm. wide, rounded at the apex, margin entire or very slightly and irregularly sinuate from projecting cells, antical margin arching across axis, but almost straight near base, postical margin straight or slightly curved, forming a very obtuse angle with keel; lobule inflated, ovate, 0.1 mm. long, 0.07 mm. wide, keel almost straight, free margin involute to or just beyond apex, then obliquely truncate to end of keel, apex usually tipped with a single rounded cell, sometimes acute or even ending in a row of two or three cells, lobule often rudimentary and explanate; cells of lobe slightly convex, thin-walled, but with distinct trigones and occasional intermediate thickenings, the latter sometimes very scanty, measuring 10 μ in diameter at edge of lobe, 21 μ in the middle and 25 μ at base; ocelli wanting: underleaves distant, broadly ovate to orbicular, 0.17 mm. long, bifid to or beyond the middle, with narrow more or less spreading divisions and acute to lunulate sinus, the divisions rarely blunt, usually varying from rounded and apiculate to acute or acuminate, tipped with one or two cells, cuneate or slightly rounded toward base, margin subcrenulate, rarely with an angular tooth near the middle of one or both sides: inflorescence autoicous: ♀ inflorescence usually borne

on a short branch, rarely on a leading branch, innovating on one side, the short innovation sometimes sterile, sometimes bearing another ♀ or a ♂ inflorescence, rarely absent; bracts unequally bifid, complicate, the lobe widely spreading, 0.45 mm. long, 0.35 mm. wide, ovate to orbicular, more or less falcate, rounded at apex, margin as in leaves, postical margin strongly curved, lobule ovate to lanceolate, rounded to acuminate at the apex, 0.3 mm. long, 0.1 mm. wide; bracteole free, ovate, 0.35 mm. long, 0.25 mm. wide, bifid about one third with erect, acute divisions and acute sinus, margins indistinctly angular-crenulate; perianth about half exserted, obovoid but distinctly cuneate toward base with almost straight sides, 0.6 mm. long, 0.4 mm. wide, truncate or slightly retuse at the broad apex and with a short beak, antical surface plane or nearly so, lateral keels sharp, postical keel broad and bluntly two-angled: ♂ spike variable in position, sometimes intercalary or terminal on a leading branch, sometimes occupying a short branch, sometimes on an innovation; bracts in one to five pairs, strongly concave and inflated, subsequently bifid with rounded lobes and a strongly arched keel: bracteoles similar to the underleaves but a little smaller, present only in lower part of spike.

Type-locality, Cuba (Herb. Montagne).

On trees. Florida (Underwood). The species is now known from several of the West Indian Islands, from Mexico and from Costa Rica. It has also lately been reported from China.

The determination of the present species is based on the specimens in Wright's *Hepaticae Cubenses*. These were named by Gottsche, and the determination was afterwards confirmed by Schiffrer. The type specimens have not been consulted by the writer.

C. phyllobola is remarkable for the insecure way in which its side-leaves are attached to their axes, the slightest force being sometimes sufficient to break them away. As a result leafless branches are frequent, although these are much less characteristic than in *C. versifolia*. In its leaf-cells the species exhibits considerable variation, the trigones being sometimes conspicuous and sometimes difficult to demonstrate, while the intermediate thickenings are sometimes large and abundant, sometimes smaller and more scattered and sometimes wholly absent. In all the various forms the cell-measurements remain fairly constant.

C. phyllobola has been confused with *Lejeunea cavifolia*, with *Microlejeunea lucens* and even with *Euosmolejeunea duriuscula*.

From the first of these species it differs in the shape of its leaf-lobe, in its smaller lobule, in its smaller and more deeply cleft underleaves and in its more flattened perianth, the antical face being plane or nearly so. It is a much larger plant than *Microlejeunea lucens*, and differs also in its autoicous inflorescence, in the shape of its leaves, underleaves and perichaetial bracts and in its slightly larger leaf-cells, usually with more conspicuous thickenings. From *Euosmolejeunea duriuscula*, it differs in its paler color and more delicate texture, in its autoicous inflorescence, in its slightly larger leaf-cells and in the shape of its leaves and underleaves.

The species is one of those interesting links between genera which are so frequent in the Lejeuneae. Some of the reasons for placing it in *Cheilolejeunea* rather than in *Hygrolejeunea* are stated by Schiffner,* who maintains that, although the leaves and the leaf-cells show an affinity with *Hygrolejeunea*, the underleaves and perianths are more like those of *Cheilolejeunea*. Apparently Spruce was also a supporter of this view, for he described a South American hepatic under the name *L. (Cheilo-Lejeunea) phyllobola*.† Unfortunately the plant which he studied was not *Lejeunea phyllobola* Nees & Mont. but an undescribed species, afterwards distributed under a manuscript name in *Hepaticae Spruceanae*. There seems to be in fact no authentic record of *C. phyllobola* from South America. Specimens from Brazil are quoted in the Synopsis, but these, according to Stephani,‡ are referable to *L. oxyloba* Lindenb. & Gottsche.

11. CHEILOLEJEUNEA VERSIFOLIA (Gottsche) Schiffn.

Lejeunea versifolia Gottsche; Wright, Hep. Cubenses (without description); Schiffner, Engler's Bot. Jahrb. 23: 597. 1897 (as synonym).

Cheilolejeunea versifolia Schiffn. l. c. pl. 5. f. 1-7.

Pale olive-green, growing in depressed tufts, often in company with *C. phyllobola*: stems prostrate, 0.04 mm. in diameter, intricately mixed together, copiously bipinnately branched, some of the branches spreading from substratum, flagelliform, leafless except for two or three rudimentary leaves near apex, but with densely

* Engler's Bot. Jahrb. 23: 591. 1897.

† Hep. Amaz. et And. 259. 1884.

‡ Hedwigia, 29: 81. 1890.

imbricated underleaves: rhizoids rather abundant: leaves imbricated, very fragile, distinctly smaller toward the base of the branches, the lobe subplane, widely spreading, obliquely ovate, 0.45 mm. long, 0.3 mm. wide, rounded at the apex, margin entire or subrepand, antical margin arching across but scarcely beyond axis, rounded at base, postical margin straight or nearly so, forming an obtuse angle with keel; lobule inflated, ovoid-cylindrical, 0.11 mm. long, 0.04 mm. wide, slightly constricted near apex, keel slightly arched, free margin involute to or beyond apex then truncate to end of keel, apex tipped with a long, unicellular outwardly curved tooth; cells of lobe with uniformly thickened walls, averaging $10\ \mu$ in diameter, basal ocelli $40 \times 20\ \mu$, consisting of two to six empty inflated cells: underleaves on ordinary axes contiguous or subremote, on flagelliform branches densely imbricated, plane, rotund-suboblate, often subangulate, 0.16 mm. long, 0.19 mm. wide, scarcely decurrent at the base, bifid almost to the middle with acute sinus and acute subconnivent lobes: inflorescence dioicous: ♀ inflorescence sometimes with a simple innovation; bracts unequally bifid, the lobe obliquely ovate, rounded at apex, entire, 0.47 mm. long, 0.42 mm. wide, lobule rhomboid-lingulate, apex obtuse or more rarely apiculate, 0.3 mm. long, 0.15 mm. wide; bracteole plane, broadly ovate, 0.42 mm. long, 0.35 mm. wide, slightly connate on one side with bract, shortly emarginate, bifid at the apex with rounded divisions and acute sinus, sometimes simply emarginate: perianth unknown: ♂ spikes occupying short branches or intercalary on leading branches, bracts in few pairs, large, subglobose, equally lobed, surface slightly roughened from projecting cells.

Type-locality, Cuba (Wright).

On trees. Lake Worth, Florida (Underwood).

Schiffner has described and figured this peculiar little species so fully and so accurately that the description given above is mostly compiled from his. The specimens from Florida agree closely with those distributed in *Hepaticae Cubenses*.

The leafless flagelliform branches with closely imbricated underleaves are not invariably found in *C. versifolia* and yet they form its most striking peculiarity. They resemble in a marked degree the flagelliform branches of *Frullania Bolanderi*,* a Pacific Coast species found in California and northward. They are much more highly specialized than the leafless branches of the related *C. phyllobola*, where the underleaves are no closer than on ordinary

* Evans, Trans. Conn. Acad. 10: pl. 2, f. 4. 1897.

branches. *C. versifolia* also differs from *C. phyllobola* in its smaller size, in its much smaller leaf-cells which scarcely vary in size throughout the lobe, in its basal ocelli, in its more sharply pointed lobules and in its relatively larger underleaves.

Another West Indian species closely related to *C. versifolia* is *C. emarginuliflora* Schiffn.,* a Cuban plant likewise collected and distributed by Wright. According to its author this species has a more graceful habit than *C. versifolia*, its branches are less numerous and are never flagelliform, its leaves are more distant and their lobules are less conspicuously toothed at the apex, its basal ocelli are either wanting or very inconspicuous, its underleaves are smaller, more distant and with a broader sinus, and its female plants are repeatedly floriferous. The fragmentary material distributed in *Hepaticae Cubenses* shows that these slight differences certainly exist, but it would require the examination of many more specimens before it could be decided whether they were constant enough to be considered specific. In fact Schiffner himself throws doubt on the validity of the species.

12. *Cheilolejeunea pililoba* (Spruce)

Lejeunea (*Eulejeunea*) *pililoba* Spruce, Jour. Linn. Soc. Bot. 30 : 346. pl. 23. f. 6-8. 1894.

Pale to dark green, caespitose : stems prostrate, 0.07 mm. in diameter, irregularly branched : rhizoids few : leaves contiguous to imbricated, the lobe obliquely spreading, plane, broadly ovate to orbicular, 0.4 mm. long, 0.35 mm. wide, rounded to very obtuse at apex, margin crenulate from projecting cells or subentire, antical margin arching across or just beyond axis, rounded or sometimes abruptly contracted at base ; lobule filiform from a minute, triangular base, 0.17 mm. long, 0.01 mm. wide, consisting of two to twelve cells in a single row, rarely two or three cells wide at or near base ; cells of lobe slightly convex, thin-walled, trigones minute, often scarcely evident, intermediate thickenings wanting, cells averaging 14μ at edge of lobe, 21μ in the middle and at base : underleaves distant or contiguous, ovate or narrowly ovate, 0.25 mm. long, 0.13 mm. wide, narrowed toward base, bifid to or beyond the middle with erect, lanceolate, acuminate lobes and obtuse to lunulate sinus, margin as in leaves : inflorescence autoicous : ♀ inflorescence borne on a short branch or on a leading branch,

* Engler's Bot. Jahrb. 23 : 585. 1897.

innovating on one side, the innovation simple and sterile ; bracts complicate, unequally bifid, the lobe widely spreading, ovate to obovate, rounded at apex, 0.55 mm. long, 0.3 mm. wide, lobule with a narrowly rhomboidal base connate with lobe, running out into a subulate, acuminate point ending in a row of three or more cells, 0.25 mm. long, base 0.05 mm. wide ; bracteole oblong to obovate from a narrow base, 0.35 mm. long, 0.17 mm. wide, bifid one third or less with triangular, acute, contiguous lobes and narrow sinus, perianth about half exerted, obovoid, somewhat compressed, 0.5 mm. long, 0.35 mm. wide, narrowed toward base, broad and truncate above and with a very short, broad beak, antical face plane or with a very indistinct, low keel near apex, postical keel about half as long as perianth, broad, obtusely two-angled, lateral keels blunt, keels more or less roughened from projecting cells : ♂ spike occupying a short branch, globose, bracts in about two pairs, inflated, keel strongly arched, shortly and subequally bifid with rounded divisions ; bracteole at base of spike small, shortly bifid with acute divisions and narrow sinus.

Type-locality, Dominica (Elliott).

On bark or on the ground. Indian River and Cedar Keys, Florida (Herb. Austin). Also known from Cuba (Underwood).

C. pililoba presents so remarkable a character in its filiform lobule that there is little danger of confusing it with any of our other Lejeuneae. Among tropical species *Lejeunea* (*Eu-Lejeunea*) *setiloba* Spruce* is said to have a similar but shorter lobule. Through the kindness of M. B. Slater, the writer has had the privilege of examining the type-material of this species from the Spruce herbarium. These specimens show that the filiform condition of the lobule is by no means a constant feature. On some of the stems one occasionally finds a small, broadly ovate, inflated lobule of the ordinary type with the apex consisting of one or two projecting cells, and there are all gradations between such a lobule and the form described by Spruce. These specimens in fact give one the impression that the filiform lobule of *L. setiloba* is really an abnormal character. Aside from these differences in the lobule, the underleaves of *L. setiloba* are broader and usually less deeply cleft than in *C. pililoba* and are occasionally angular-unidentate on the sides. The perianth also is obovoid and scarcely compressed, and its sharp antical keel indicates that the species is a true *Lejeunea*.

* Hep. Amaz. et And. 281. 1884.

According to Spruce *C. pililoba* should also be placed in his subgenus *Eulejeunea*, but it seems best to transfer it to *Cheilolejeunea* on account of its compressed perianth with obsolete antical keel.

According to the original description, the type-specimens of *C. pililoba* were entirely sterile, and yet on this negative evidence the species was said to be dioicous. The specimens in the British Museum, from which the published figures were drawn, show, however, flowers of both sexes on the same stem. None of the archeogonia are fertilized, and the plants look as if they had grown in an unfavorable locality, where they were unable to develop normally. The specimens are not quite so large as those described by Spruce, and the filiform lobule is usually less than twelve cells long, although this length is given as one of the specific characters. The specimens from Florida and also those from Cuba (Matanzas, mixed with Hep. Amer. 145) agree closely with the British Museum specimens. Both are distinctly autoicous and the Cuban plants show well-developed perianths.

13. LEJEUNEA PATENS Lindb.

Jungermannia serpyllifolia Dicks. Fasc. Pl. Crypt. Brit. 4: 19. 1801.

Pandulphinius serpyllifolius S. F. Gray, Nat. Arr. Brit. Plants, 1: 689. 1821.

Lejeunea patens Lindb. Acta Soc. Sci. Fenn. 10: 482. 1875.

Pale or sometimes darker green, slightly glossy when dry, caespitose: stems prostrate or slightly ascending, 0.08 mm. in diameter, copiously and irregularly branched: rhizoids few: leaves imbricated, the lobe ovate, widely spreading, falcate, strongly convex, 0.5 mm. long, 0.35 mm. wide, rounded and decurved at apex, margin distinctly crenulate from projecting cells, antical margin rounded or sometimes contracted at base, arching across or a little beyond axis, postical margin forming an angle of 90° or less with keel, angle in poorly developed leaves often obtuse; lobule strongly inflated, ovate, 0.17 mm. long, 0.1 mm. wide, keel arched, mostly crenulate, free margin curved and involute to beyond apex, then lunately truncate to end of keel, apex tipped with a single blunt, projecting cell; cells of lobe convex, thin-walled, but usually with conspicuous trigones and intermediate thickenings, walls sometimes thin throughout, cells averaging at edge of lobe 14 μ in diameter, in the middle 19 μ , at the base

$28 \times 23 \mu$: underleaves distant, about the size of the lobules or a little smaller, orbicular, 0.15 mm. long, strongly convex postically, gradually narrowed toward base, bifid about one half with obtuse to acute lobes separated by a sinus varying from narrow and acute to broader and obtuse, margin crenulate from projecting cells: inflorescence autoicous: ♀ inflorescence sometimes on a leading branch, sometimes on a short branch, innovating on one side, the innovation often but not always floriferous and branched; bracts complicate, unequally bifid, the lobe somewhat spreading, oblong, rounded at the apex, 0.5 mm. long, 0.3 mm. wide, margin crenulate, lobule narrowly oblong, rounded to obtuse at apex, 0.25 mm. long, 0.12 mm. wide; bracteole free or nearly so, ovate-oblong, 0.4 mm. long, 0.25 mm. wide, bifid about one fourth with acute lobes and sinus, margin crenulate; perianth about half exserted, oblong-obovoid, 0.9 mm. long, 0.5 mm. wide, gradually narrowed toward base, rounded above and with a short beak, terete below, sharply five-keeled in upper half or third, the keels crenulate from projecting cells, becoming blunter with age: ♂ spike occupying a short branch, bracts in two to four pairs, strongly inflated and with strongly arched keel, subequally bifid about one fifth with rounded lobes, cells plane; bracteoles limited to base of spike, similar to the underleaves, but smaller: antheridia in pairs.

Type-locality, Ireland (Lindberg).

On rocks. Newfoundland (Waghorne); Nova Scotia (Macoun). The species is also known from Great Britain and from Norway.

Lejeunea patens and the two species which follow are so nearly allied to one another that they have given rise to much confusion. The elucidation of their synonymy is due largely to Lindberg, who was the first to distinguish clearly between *L. serpyllifolia* Lib. and *L. patens*. Although he described the latter as a distinct species, he threw doubts on its validity, recognizing the close relationship which exists between the two species. At the time *L. patens* was published, it was taken for granted that *L. serpyllifolia* Lib. was the same as *Jungermannia serpyllifolia* Dicks.; but in 1879 Lindberg* discovered that the type-specimen of Dickson's species was identical with his *Lejeunea patens*. The name "*Lejeunea serpyllifolia*," however, cannot now be taken up for *L. patens*, on account of the older *L. serpyllifolia* of Libert. At the same time

* Musc. Scand. 2, footnote. 1879.

we can avoid any confusion which might arise from the use of Libert's name by restoring to Libert's species the still older name "*cavifolia*," of Ehrhart, a course which Lindberg and others have already adopted.

L. patens has not before been recorded for America. Its discovery in Newfoundland and in the neighboring island of Cape Breton shows quite conclusively that its range is northern, and that it does not belong to that group of subtropical hepaticae which are characteristic of the southwestern corner of Ireland.

The species has been illustrated by Moore* and also by Pearson.† Moore's figures bring out clearly the crenulations on the leaves and underleaves, an important character which Pearson's figures do not show.

14. LEJEUNEA CAVIFOLIA (Ehrh.) Lindb.

Jungermannia cavifolia Ehrh. Beitr. 4: 45. 1789.

Jungermannia clavaeflora Nees; Martius, Fl. Crypt. Erl. 137. pl. 3. f. 10. 1817.

Lejeunea serpyllifolia Lib. Ann. Gén. Sc. Phys. 6: 374. pl. 97. f. 2. 1820. G. L. & N. Syn. Hep. 374. 1845.

Lejeunea cavifolia Lindb. Acta Soc. Sci. Fenn. 10: 43. 1871. Not Stephani.‡

Lejeunea serpyllifolia, var. β *cavifolia* Lindb. l. c. 10: 485. 1875.

Lejeunea serpyllifolia, var. γ *Americana* Lindb. p. p., l. c. 10: 486. 1875.

Lejeunea (*Eu-Lejeunea*) *serpyllifolia* Spruce, Hep. Amaz. et And. 262. 1884.

Eulejeunea serpyllifolia Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1³: 122. 1893.

Pale to dark green, dull or glossy when dry, growing in depressed tufts or creeping over other bryophytes: stems prostrate, 0.07 mm. in diameter, irregularly branched, the branches widely spreading, sometimes few but usually abundant: rhizoids scanty: leaves imbricated, the lobes ovate, obliquely preading, plane to convex, 0.6 mm. long, 0.35 mm. wide, rounded to very obtuse at the apex, margin en-

* Proc. Roy. Irish Acad. II. 2: pl. 43. 1877.

† Hep. Brit. Isles, pl. 11. 1899.

‡ Bol. da Soc. Brot. 4: 171. pl. 1. f. 5-7. 1886.

tire or nearly so, antical margin arching across or just beyond axis, slightly rounded at base, postical margin usually forming an angle of 120° or more with keel, angle rarely as small as 90° ; lobule strongly inflated, ovate, 0.2 mm. long, 0.14 mm. wide, keel strongly arched, scarcely or not at all crenulate, free margin more or less curved and involute as far as apex, then passing by a shallow lunulate sinus to end of keel, apex tipped with a single, blunt, projecting cell; cells of lobe almost plane, thin-walled, trigones and scattered intermediate thickenings sometimes distinct, sometimes scarcely evident, cells at edge of leaf averaging $17\ \mu$ in diameter, in the middle $24\ \mu$, at the base $30 \times 21\ \mu$: underleaves distant, as large as or a little larger than lobule, ovate-orbicular, 0.2 mm. long, 0.18 mm. wide, plane or slightly convex postically, gradually narrowed toward base and neither decurrent nor rounded, bifid about one half with rounded to acute lobes and obtuse to acute sinus, margin entire or nearly so: inflorescence autoicous: ♀ inflorescence sometimes on a leading branch, sometimes on a short branch, innovating usually on only one side, the innovation sometimes simple and sterile, sometimes floriferous; bracts complicate, unequally bifid, the lobe somewhat spreading, narrowly to broadly ovate, rounded to obtuse at the apex, entire, 0.5 mm. long, 0.3 mm. wide, lobule oblong to lanceolate, rounded to acuminate at the apex, entire, 0.3 mm. long, 0.1 mm. wide; bracteole free, oval-obovate, 0.4 mm. long, 0.2 mm. wide, bifid one fourth to one third with acute to obtuse lobes and sinus, margin entire; perianth about half exserted, oblong to oval-oblong from a narrowed base, 0.85 mm. long, 0.4 mm. wide, rounded or truncate at the apex with a short, slender beak, terete below, sharply five-keeled in upper part, the keels smooth, becoming blunter with age: ♂ spike as in *L. patens*.

Type-locality, near Upsala, Sweden (Ehrhart).

On rocks and trees. Ontario (Macoun); New Hampshire (Faxon, Evans); Massachusetts (Stone); Connecticut (Eaton, Hall, Evans); New York (Underwood, Cook, Mrs. Britton); Pennsylvania (Barbour); Wisconsin (Cheney); Minnesota (Holzinger). Widely distributed in Europe and recently reported from Japan.

EXSIC.: Hep. Bor.-Amer. 97 p. p. Hep. Amer. 8 (as *Lejeunea serpyllifolia*).

Lejeunea cavifolia is the commonest representative of the Lejeuneae in the northern United States. When well developed, it can readily be distinguished from *L. patens* and from *L. Americana*. Poorly or abnormally developed specimens, however, of these closely allied species do not always show their specific characters and cannot always be determined.

Lejeunea patens is a paler plant than *L. cavifolia*; the lobes of its leaves spread more abruptly from the lobules and are more convex, especially when dry; the underleaves are more nearly orbicular and are smaller than the lobules, while the margins of both leaves and underleaves are distinctly crenulate from projecting cells. The leaf-cells also, as a rule, are more strongly convex and show more conspicuous trigones and intermediate thickenings. Unfortunately the abrupt spreading of the lobe from the lobule is not always evident in *L. patens*, especially on the leaves of the smaller branches. Neither is this character by itself to be wholly relied upon in separating the species, for in *L. cavifolia* the lobe sometimes spreads widely also. The figures recently published by Pearson* show how variable both species are in this respect. It is only when the spreading lobe is found in connection with the other peculiarities of *L. patens* that it becomes of value as a differential character.

Lindberg's variety *planiuscula* of *L. cavifolia*, first distinguished simply as a form, hardly seems worthy of varietal rank.† According to the description, the plants of this variety are more elongated, less branched and broader than in the type, the leaves are less imbricated and less decurved, the lobules are relatively smaller and the cells have thinner walls and scarcely evident trigones. Faxon's specimens from Crawford Notch, New Hampshire, and Underwood's from Manlius, New York, agree with this description and also with the specimens which Lindberg quotes, but they are connected with typical *L. cavifolia* by intermediate conditions. Apparently their peculiarities are due to a moister habitat, which would naturally produce a laxer growth and lead to a diminution in the development of the lobules and of the cell-walls.

Two specimens of *Lejeunea* distributed in *Hepaticae Americanae* should perhaps be noted here. One of them is the curious submerged "*Kantia aquatica*" Underw., distributed as no. 107. As Underwood‡ himself has shown, this plant is a true *Lejeunea*, apparently related to *L. cavifolia*. As a result of its submerged

* Hep. Brit. Isles, pl. 10, 11. 1899.

† *Lejeunea serpyllifolia*, forma *a planiuscula* Lindb. Acta Soc. Sci. Fenn. 10: 484. 1875. *Lejeunea cavifolia*, var. *β planiuscula* Lindb. Musc. Scand. 2. 1879.

‡ Bull. Torrey Club, 23: 383. 1896 (footnote).

habit it has lost its lobules, and, as the specimens have failed to develop perianths, it is impossible to refer them definitely. The other specimen was distributed under no. 178, as *Lejeunea* (*Eu-Lej.*) *serpyllifolia*. The plants seem to be perfectly sterile, the lobes are crenulate on the margins and both lobules and underleaves are very small, the latter being bifid beyond the middle with broad, obtuse lobes and sinus. Evidently the plant is not *L. cavifolia*, but it is in too poor a condition to be determined. Both of these specimens were collected in Florida.

15. *Lejeunea Americana* (Lindb.)

PLATE 20, FIGS. 14-26

Jungermannia serpyllifolia Wils. & Hook. *p. p.*; Drummond, *Musc. Amer. St. Merid.* 172. 1841. Not Dickson.

Lejeunea serpyllifolia Sull. *Musc. Alleg.* 272. 1845. Not Libert.

Lejeunea cavifolia Aust. *p. p.* *Hep. Bor.-Amer.* 97. 1873. Not Lindb.

Lejeunea serpyllifolia, var. γ *Americana* Lindb. *p. p.* *Acta. Soc. Sci. Fenn.* 10: 486. 1875.

Lejeunea (*Eu-Lejeunea*) *flava*, subsp. *albida* Spruce, *Hep. Amaz. et And.* 269. 1884.

Pale, whitish-green or yellowish, closely appressed to substratum or growing in wide, depressed mats: stems prostrate, 0.08 mm. in diameter, irregularly pinnately branched: rhizoids often abundant: leaves imbricated, the lobe ovate, widely spreading, plane or slightly convex, 0.5 mm. long, 0.35 mm. wide, rounded to obtuse at apex, margin entire or subcrenulate from projecting cells, antical margin arching across or just beyond axis, slightly rounded at base, postical margin forming an obtuse angle with keel; lobule inflated, ovate, 0.2 mm. long, 0.15 mm. wide, keel strongly arched, scarcely or not at all crenulate, free margin slightly curved, more or less involute, apex tipped with a single projecting cell, sinus between apex and end of keel shallow and oblique; cells of lobe plane or nearly so, thin-walled, but usually with distinct trigones and occasional intermediate thickenings, averaging $15\ \mu$ in diameter at edge of leaf, $23\ \mu$ in the middle and $29 \times 23\ \mu$ at the base: underleaves contiguous or subimbricated, a little larger than lobule, orbicular, 0.2 mm. long, plane or nearly so, rounded or subcordate at base, bifid about one half, segments

usually acute or apiculate, occasionally obtuse, rarely rounded, sinus acute to obtuse, margin entire or irregularly sinuate, rarely with an indistinct, blunt tooth at about the middle of one or both sides: inflorescence autoicous: ♀ inflorescence sometimes on a leading branch, sometimes on a short branch, innovating on one or rarely on both sides, the innovations often floriferous, bracts complicate, unequally bifid, the lobe obliquely spreading, varying from oblong to obovate, rounded to subacute at the apex, 0.6 mm. long, 0.3 mm. wide, lobule mostly oblong and rounded or truncate at the apex, rarely indistinctly toothed or lobed with rounded divisions, 0.35 mm. long, 0.18 mm. wide; bracteole free, ovate, 0.55 mm. long, 0.35 mm. wide, somewhat narrowed at base, bifid about one half with erect, obtuse to acute divisions and narrow sinus; perianth obovoid, often distinctly dilated above middle, 0.7 mm. long, 0.35 mm. wide, gradually narrowed toward base, broad and truncate above, and with a short beak, terete below, sharply five-keeled in upper part, the keels smooth sometimes showing vague traces of wings: ♂ inflorescence usually occupying a short branch, rarely borne on a longer branch, bracts in two to eight pairs, similar to those of *L. patens*: spores greenish, angular, thick-walled, minutely verruculose, averaging 14 μ in short diameter.

Type-locality, Southern States (Austin)?

On trees. North Carolina (Johnson); South Carolina (Sullivan, Miss DuBois); Georgia (Small); Florida (Farlow, J. D. Smith, Underwood, Straub); Alabama (Underwood); Mississippi (Langlois, Lloyd and Tracy); Louisiana (Drummond, Langlois); Texas (Hall). Also known from various parts of tropical America.

EXSIC.: Musc. Amer. St. Merid. 171 p. p. (as *Jungermannia serpyllifolia*). Musc. Alleg. 272 (as *Lejeunea serpyllifolia*). Hep. Bor.-Amer. 97 p. p. (as *Lejeunea cavifolia*). Hep. Amer. 98 (as *Lejeunea* (*Micro-Lej.*) *Austin*). Hep. Amer. 137 (as *Lejeunea* (*Micro-Lej.*) *lucens*).

In proposing the present species as a variety of *Lejeunea serpyllifolia* Lib., Lindberg referred to it all the American specimens in his herbarium which presumably belonged to that species. His dictum has been followed, almost without exception, by subsequent writers on American hepaticae, who have apparently taken it for granted that typical *L. serpyllifolia* Lib. did not occur in America. Judging, however, from the specimens which Lindberg quotes, his variety was an aggregate, made up of *L. Americana*, as

described above, and *L. cavifolia*. He quotes three exsiccatae, Hep. Bor.-Amer. 97, Musc. Amer. St. Merid. 171 *p. p.* (caespites pallidi) and Musc. Alleg. 272; he also quotes two plants not distributed in exsiccatae, Cleve's specimens from Catskill, New York, and Macoun's from Belleville, Canada. Of the first-mentioned specimen, Austin gives as a habitat, "on rocks and roots of trees; chiefly on mountains." He does not tell, therefore, in what part of the country they were collected. The writer has examined this number in two sets of Hep. Bor.-Amer., and finds in both cases pale tufts, which are clearly *L. Americana*, and darker tufts, which agree perfectly with the European specimens of *L. cavifolia* quoted by Lindberg, as, for example, Hep. Eur. 435. Sullivant's specimens from Charleston, South Carolina, are a poorly developed form of *L. Americana*. They show characteristic perianths, but their leaves and underleaves indicate that they grew in a moist locality, and their thin-walled leaf-cells, with small and often scarcely evident trigones, point to the same conclusion. Drummond's Louisiana specimens are also a poorly developed *L. Americana*. Cleve's specimens have not been examined by the writer, but specimens in the Underwood herbarium from Belleville, collected by Macoun, are typical *L. cavifolia*. It is a little difficult to say what should be considered the type of Lindberg's variety, and consequently of the present species. The writer would suggest, however, that the pale tufts in Hep. Bor.-Amer. 72 be so regarded. Austin's plants are the first ones quoted by Lindberg, and these pale specimens, except for certain characters drawn from the leaf-cells, agree closely with the original description.

Few of our species have been the cause of quite so much confusion as *L. Americana*. It has been referred to *L. cavifolia*, to *Euosmolejeunea duriuscula* and also to *Microlejeunea lucens* and is to be found under one or more of these various names (or their equivalents) in most of our large herbaria.

The characters which separate it from *L. cavifolia*, although slight, are sufficiently distinct when well developed specimens are examined. *L. Americana* is a paler plant than the northern species, the lobes of its leaves spread more widely from the axis, the lobules are relatively smaller, and the underleaves are broader, more or less sinuous on their margin and tending to be rounded or subcordate

at the base. The perianth, however, offers the best points of difference; in the new species this is much broader in the upper part than at the base and frequently flares out abruptly above the middle, its keels also are sharper than in *L. cavifolia* and sometimes shows rudimentary wings. In the United States *L. Americana* seems to be confined to the bark of trees, while *L. cavifolia* is more at home on rocks, at the roots of trees, and creeping over other hepatics.

L. Americana is a much paler and more delicate plant than *Euosmolejeunea duriuscula*. Its leaves spread more widely from the axis, and its lobules are relatively larger with their free margins more involute, so that the apical teeth cannot usually be seen without dissection; its underleaves also are larger and not cuneate at the base. In *L. Americana*, moreover, on account of its autoicous inflorescence, perianths are frequently developed, whereas in the other species they are extremely rare.

L. Americana should hardly be confused with *Microlejeunea lucens*. It is in the first place a much larger plant and has an autoicous inflorescence. It differs markedly also in the more conspicuous thickenings of its cell-walls and in its larger and broader underleaves, which are never sharply unidentate on their lateral margins.

Spruce's *L. flava*, subsp. *albida* should apparently be referred to the present species, although his specimens are a little larger and were found on living leaves instead of on bark. Spruce afterwards recognized that the plant was specifically distinct from *L. flava* and distributed it in Hep. Spruceanae as a manuscript species. The writer has carefully compared these specimens with typical plants of *L. Americana* and finds no essential differences between them.

16. *Microlejeunea lucens* (Tayl.)

PLATE 21, FIGS. 1-10

Lejeunea cucullata Sull. Musc. Alleg. No. 274. 1845. Not Nees.

Lejeunea lucens Tayl. Lond. Jour. Bot. 5: 399. 1846. G. L. & N. Syn. Hep. 764. 1847.

Lejeunea (*Micro-Lejeunea*) *lucens* Spruce, Hep. Amaz. et And. 288. 1884.

Lejeunea (*Eu-Lejeunea*) *lucens* Steph. Hedwigia, 29: 84. 1890.

Pale green, scattered or growing in depressed tufts: stems prostrate, 0.05 mm. in diameter, sparingly and irregularly branched, the branches sometimes microphyllous: rhizoids scanty: leaves distant to imbricated, the lobe obliquely spreading, ovate, on well-developed axes 0.25 mm. long, 0.17 mm. wide, plane, rounded at the apex or sometimes varying to obtuse, margin entire or subcrenulate from projecting cells, antical margin arching partially across axis, slightly rounded or almost straight at base, postical margin forming a continuous line or a very obtuse angle with keel; lobule on well-developed axes about half as long as lobe, on microphyllous branches sometimes as long as lobe, strongly inflated, ovoid, 0.01 mm. long, 0.09 mm. wide, keel strongly arched, free margin involute to apex, then passing by an obliquely truncate or lunulate sinus to end of keel, apex tipped with a single slightly projecting, almost straight cell; lobule often poorly developed; cells of lobe thin-walled throughout or sometimes with minute trigones and scattered intermediate thickenings, averaging $14\ \mu$ in diameter at edge of lobe, $20\ \mu$ in the middle and at the base: underleaves distant, ovate, 0.14 mm. long, 0.1 mm. wide, plane, narrowed toward base and not decurrent, bifid to about the middle, with subulate, acute or acuminate divisions ending in a single cell or in a row of two cells and separated by a narrow, obtuse sinus, lateral margins variable, sometimes rounded, sometimes angular, sometimes unidentate, especially on slender branches, the tooth consisting of a single projecting, rounded to acute cell, margin otherwise entire or nearly so: inflorescence dioicous: ♀ inflorescence on a short branch, innovating on one or on both sides, the innovations short and simple, inflorescence very rarely without innovation; bracts complicate, subequally or somewhat unequally bifid, the lobe suberect, oblong-obovate, rounded or very obtuse at the apex, margin entire or subcrenulate, 0.4 mm. long, 0.2 mm. wide, lobule rounded to acuminate at the apex, 0.4 mm. long, 0.2 mm. wide, sometimes narrower; bracteole free or nearly so, ovate, 0.45 mm. long, 0.25 mm. wide, bifid about one third with acute lobes and obtuse sinus, margin subentire, sometimes bearing a blunt lobe-like tooth on one side near the base; perianth scarcely exerted, broadly pyriform, 0.5 mm. long, 0.3 mm. wide, slightly compressed, five-keeled, the keels smooth, beak short: ♂ spike julaceous, occupying the base of an elongated branch; bracts in five or six pairs, as large as the leaves, turgid, the lobule half as large as lobe.

Type-locality uncertain.

On trees or moist rocks: Virginia (Sullivant); Florida (Miss Biddlecome, J. D. Smith, Underwood); Mississippi (Lloyd and

Tracy), Louisiana (Langlois). Widely distributed in tropical America.*

EXSIC.: Musc. Alleg. 274 (as *Lejeunea cucullata*). Hep. Bor.-Amer. 98 (as *Lejeunea cucullata*).

There has been a great deal of confusion about this little species and many specimens have been referred to it which really belong elsewhere. The writer ventures, therefore, to relate its history in some detail.

The specimens in the Taylor herbarium, which are presumably the type, consist of a few fragmentary stems. In the small envelope which contains them there is written in Wilson's handwriting: "*Jung. cucullata* Nees? Ohio, Sullivant, 147. I have very little of it and all barren. W." On the sheet upon which this envelope is pasted Taylor has written: "*Jungermannia lucens* Tayl. Mss. No. 147. Sullivant, Ohio. *Jung. cucullata* Nees? No. 25 Jan.? 1846. W. Wilson." The specimens are not only fragmentary and sterile but on most of the leaves show poorly developed lobules, indicating that they grew in an unfavorable locality. From the notes it would appear that these specimens were collected somewhere in Ohio, and Taylor, in his original description of *Lejeunea lucens*, states that the species came from the vicinity of Cincinnati. The evidence, however, is against this view, as the following facts will show. The more abundant specimens distributed by Sullivant in Musc. Alleg. agree perfectly with those in the Taylor herbarium, and the same may be said of Austin's specimens in Hep. Bor.-Amer. Sullivant's specimens came from Cheat Mountain, Virginia, and Austin's are labeled, "On moist rocks in the Alleghany Mountains, Sullivant." In the second edition of Gray's Manual, Sullivant limits the range of his "*L. cucullata*" to the Alleghany Mountains and quotes Taylor's *L. lucens* as a synonym. Apparently then no one has collected the species in the northern United States with the exception of Sullivant, and, as all of his specimens came from the Alleghany

* *Lejeunea cucullata* is listed as a Massachusetts plant by Tuckerman and Frost in their "Catalogue of Plants growing without cultivation within thirty miles of Amherst College" (1875, p. 53). Unfortunately the specimens are now inaccessible, so that it is impossible to say whether they represented *Microlejeunea lucens* or merely a small form of *Lejeunea cavifolia*, the latter of course being much more probable.

Mountains, those in the Taylor herbarium could not have come from Ohio.

All of these specimens from the Alleghany Mountains are perfectly sterile and many different conclusions have been drawn from them. As we have already seen they were referred by Sullivant to *L. cucullata* Nees and by Taylor to his *L. lucens*. Spruce thought at first that they were the same as the Mexican *L. diversifolia* Gottsche* and afterwards transferred them to his *L. diversiloba*.† Still later he referred them with some hesitation to *L. lucens*.‡ Carrington suggested that they were probably the same as *L. crenulifolia* Gottsche Ms. from the island of Trinidad.§

If these specimens, which are so doubtful, are to be regarded as the type-specimens, the species is certainly unfortunate. Spruce, however, considered that the type of *Lejeunea lucens* was a specimen which Taylor had deposited in the Kew herbarium.|| This specimen came from Brazil and was labeled: "Pará, in cortice (T. L. R.) in Herb. Hook." In his original description Taylor states that his specimens came from the Hooker herbarium, and this fact would of course support Spruce's view. Spruce was able to identify with this Kew specimen a fertile plant which he himself had collected near Pará and in this way gave the species a firm footing. The specimens from Florida and Louisiana agreeing closely with this South American plant, perhaps it would be wisest to follow Spruce and consider the Pará plant at Kew as the type of *Microlejeunea lucens*. We can then refer tentatively to this species the doubtful Alleghany Mountain specimens, until something more definite is learned about them.

The generic position of the present species is not altogether definite. By Spruce it was first placed in the subgenus *Micro-*

* Mex. Leverm. 227. 1863. Not *L. diversifolia* Mitt. Spruce (Jour. Bot. 5: 198, footnote. 1876) at first referred to this Mexican species not only Sullivant's Alleghany Mountain specimens but also the minute plant from Ireland which later became the type of his *L. diversiloba*. He decided afterwards that all three were distinct and that the Mexican plant was really the same as his *L. erectifolia* from South America.

† Jour. Bot. 5: 235. 1876.

‡ *L. c.* 25: 37, 39. 1887.

§ Trans. Bot. Soc. Edin. 13: 469. 1879. *Microlejeunea crenulifolia* Steph. Hedwigia, 35: 114. 1896.

|| Hep. Amaz. et And. 288. 1884. Jour. Bot. 25: 37. 1887.

Lejeunea, while Stephani* considered it a *Eu-Lejeunea*. Both of these opinions were afterwards reversed, Spruce† placing it in *Eu-Lejeunea* and Stephani‡ in *Micro-Lejeunea*. As a matter of fact it is intermediate between the two genera, and it is here placed in *Microlejeunea* because it seems to have more in common with our other species of this genus than it does with our species of *Lejeunea* proper. Its differential characters will be discussed in connection with the remaining species of *Microlejeunea*.

17. *Microlejeunea Ruthii* sp. nov.

PLATE 21, FIGS. 11-19

Pale or dull green, scattered among other hepatics or loosely depressed-caespitose: stems prostrate, 0.04 mm. in diameter, sparingly and irregularly branched, the branches widely spreading: rhizoids scanty: leaves distant to loosely imbricated, the lobe obliquely spreading to suberect, ovate or broadly ovate, 0.35 mm. long, 0.25 mm. wide, rounded at the apex, margin subentire or slightly angular-sinuate, antical margin extending partially across axis, almost straight or slightly rounded at base, often a little contracted just above insertion, postical margin almost straight, forming a continuous line or sometimes on robust axes a very obtuse angle with keel; lobule about half as long as lobe, strongly inflated, ovoid, 0.17 mm. long, 0.13 mm. wide, keel more or less arched, free margin curved, strongly involute to apex, then passing by an oblique and lunulate sinus to end of keel, apex tipped with a single projecting, sometimes outwardly curved cell; cells of lobe plane or slightly convex, walls somewhat thickened with indistinct trigones and occasional intermediate thickenings, averaging $12\ \mu$ in diameter at the edge of lobe, $18\ \mu$ in the middle and at the base: underleaves distant, orbicular, 0.14 mm. long, narrowed toward base and neither rounded nor decurrent, bifid to about the middle with broad, suberect, triangular lobes and obtuse sinus, lobes subacute or acute, ending in a single cell or in a row of two cells, or robust stems usually four cells long and four cells wide at base, margin entire or subcrenulate from projecting cells, lateral margins rounded, never toothed: inflorescence dioicous: ♀ inflorescence borne on a leading branch, innovating on one side, the innovation usually long and sterile; bracts complicate, deeply and unequally bifid, the lobe obliquely spreading, ovate to oblong, 0.5 mm. long,

* Hedwigia, 29: 84. 1890.

† Jour. Linn. Soc. Bot. 30: 348. 1894.

‡ Bot. Gazette, 17: 171. 1892.

0.25 mm. wide, rounded or very obtuse at the apex, margin as in leaves but usually more sinuate, lobule mostly ligulate, rounded at the apex, varying to subacute, 0.3 mm. long, 0.1 mm. wide, keel wingless or nearly so; bracteole free, ovate from an abruptly contracted base, 0.5 mm. long, 0.35 mm. wide, bifid about one third with sharp, more or less contorted segments and narrow sinus, margin as in bracts: perianth and ♂ inflorescence unknown.

On bark. Big Frog Mountain, Tennessee (A. Ruth), the type-locality.

Microlejeunea Ruthii is closely related to the European *M. ulicina* (Tayl.), agreeing with it in its general habit and dioicous inflorescence. In *M. ulicina*, however, the lobes of the leaves are more convex and tend to be more or less pointed, the leaf-cells have thinner walls, and the underleaves are more deeply divided, the narrower divisions being as a rule only two cells wide at the base. The bracts also are more distinctly winged at the keel, their lobes are more pointed and are often denticulate on the margin, while the bracteole is narrower.

Although firmer in texture than *M. lucens* and darker in color, *M. Ruthii* resembles this species in several respects. It may be distinguished by the less widely spreading lobes of its leaves, by its slightly smaller cells with thicker walls, and by its broader underleaves, which have broader segments and are never unidentate on the sides. The ♀ inflorescence also is borne on a leading branch instead of on a short branch as is usual in *M. lucens*.

18. *Microlejeunea Cardoti* (Steph.)

Lejeunea (*Micro-Lejeunea*) *Cardoti* Steph. Bot. Gazette, 17: 172. 1892.

Dark green, loosely depressed-caespitose: stems prostrate, 0.03 mm. in diameter, copiously and irregularly branched, the branches widely spreading: rhizoids scanty: leaves distant to loosely imbricated, the lobe obliquely spreading, ovate, 0.25 mm. long, 0.17 mm. wide, plane, apex broad and rounded, margin entire or subcrenulate from projecting cells, antical margin arching across axis and rounded at base, postical margin usually forming a continuous line with keel; lobule inflated, ovoid, 0.14 mm. long, 0.08 mm. wide, keel strongly arched, more or less involute to apex, then passing by a lunulate sinus to end of keel, apex tipped with a single projecting, straight or outwardly curved

cell; lobule often poorly developed; cells of lobe plane or nearly so, thin-walled throughout or with very indistinct trigones, averaging 13μ in diameter, ocelli at base of lobe usually present in robust leaves, consisting of one to three enlarged cells, 25μ in diameter: underleaves distant, ovate, 0.07 mm. long, 0.05 mm. wide, narrowed toward base and neither rounded nor decurrent, bifid beyond middle with narrow, lanceolate divisions and acute sinus, the divisions about two cells broad at base and ending in a row of two to four cells: inflorescence dioicous: ♀ inflorescence borne on a leading branch, innovating on one side, the innovation mostly simple and sterile; bracts complicate, somewhat unequally bifid, the lobe obliquely spreading, oblong to obovate, 0.35 mm. long, 0.15 mm. wide, rounded to very obtuse at apex, margin entire, lobule ovate, obtuse to subacute, 0.3 mm. long, 0.1 mm. wide, keel wingless or with a very narrow and indistinct interrupted wing; bracteole free, ovate, 0.25 mm. long, 0.12 mm. wide, bifid about one third with subacute lobes and sinus; perianth somewhat exserted, pyriform from a narrowed base, inflated, 0.5 mm. long, 0.35 mm. wide, rounded at apex and with a short beak, obtusely five-keeled: ♂ spike occupying a short branch, sometimes proliferating and giving off short branches beyond inflorescence; bracts in about two pairs, inflated, subequally bilobed with obtuse divisions: bracteole at base of spike similar to underleaves: spores greenish, with a thickened minutely verruculose wall, averaging 23μ in short diameter, varying in length.

On bark of willow. Pointe a la Hache, Louisiana (Langlois), the type-locality; also reported from Mexico.

The specimens of *M. Cardoti* at the writer's disposal are so poorly developed that it is impossible to gain from them a clear idea of the species. On this account, no figures are given. The plants from Louisiana, collected by Langlois, are presumably the type specimens, as they are the ones first quoted by Stephani. They are perfectly sterile and all their lobules are apparently rudimentary. They seem to lack also the basal ocelli which are ascribed to the species. In the plants from Mexico (Hep. Amer. 136), a few of the stems bear perianths and some of the lobes show ocelli, but even here a well developed lobule is rare. The original description was probably drawn from the Mexican specimens.

Stephani compares *M. Cardoti* with *M. ulicina*, *M. bullata* and *M. lucens*; it is also related to *M. Ruthii*. It can be distinguished from *M. ulicina* by its relatively smaller lobule, by its slightly smaller leaf-cells, and by the rounded lobes and entire margins of

its perichaetial bracts. The same peculiarities of the bracts will also serve to separate it from *M. bullata*, which is a much smaller plant with more erect lobes and relatively larger lobules. It differs from *M. lucens* in its darker color, in its smaller leaf-cells, and in its smaller and differently shaped underleaves. Its underleaves will also distinguish it from *M. Ruthii*, a larger plant, the leaf-cells of which are also larger and have slightly thickened walls.

19. *Microlejeunea bullata* (Tayl.)

PLATE 21, FIGS. 20-29

Lejeunea bullata Tayl. Lond. Jour. Bot. 5: 398. 1846.

Lejeunea (*Micro-Lejeunea*) *bullata* Spruce, Hep. Amaz. et And. 289. 1846.

Pale or bright green, scattered or loosely depressed-caespitose: stems prostrate, closely appressed to substratum, 0.03 mm. in diameter, sparingly and irregularly branched, the branches widely spreading: rhizoids scanty: leaves distant, the lobe erect or slightly spreading, ovate, 0.17 mm. long, 0.1 mm. wide, rounded to obtuse at the apex, margin entire or subcrenulate from projecting cells, antical margin variable, sometimes arching across axis and rounded at base, sometimes almost straight and reaching just beyond edge, postical margin forming a continuous line with keel; lobule strongly inflated, ovoid, 0.14 mm. long, 0.08 mm. wide, keel strongly arched, free margin entire, plane or usually involute to apex, then obliquely lunulate to end of keel, apex tipped with a single, straight or outwardly curved projecting cell; cells of lobe more or less convex, thin-walled throughout or sometimes with very minute trigones, averaging $12\ \mu$ in diameter: underleaves distant, ovate to orbicular, 0.06 mm. long, 0.05 mm. wide, narrowed toward base and not decurrent, bifid to beyond the middle with obtuse to lunulate sinus and subulate, erect or connivent lobes, three to five cells long, two cells wide at base and ending in a row of two cells, margin entire: inflorescence dioicous: ♀ inflorescence on a leading branch with a single, sterile and simple innovation; bracts complicate, subequally bifid, the keel wingless or with a narrow, crenulate wing, lobe obliquely spreading, oblong, 0.36 mm. long, 0.12 mm. wide, rounded to acute at the apex, crenulate on margins, lobule narrower, 0.33 mm. long, 0.08 mm. wide, usually acute, crenulate on margin or sometimes with a blunt tooth near apex; bracteole slightly connate on both sides, oblong, 0.3 mm. long, 0.15 mm. wide, bifid about two fifths, sinus variable, divisions acute to acuminate, margins crenulate, sometimes denticu-

late in upper part; perianth pyriform, 0.4 mm. long, 0.2 mm. wide, rostellate, sharply five-keeled, smooth: ♂ inflorescence occupying a short branch, often proliferating at the end; bracts in two to four pairs, larger than the leaves, imbricated, strongly inflated, subequally bifid with a very shallow sinus, the lobes rounded at the apex and entire; bracteoles similar to underleaves, present only at base of spike.

Type-locality, St. Vincent (Guilding).

On bark: South Carolina (Sullivant); Florida (J. D. Smith, Mrs. Russell, Underwood, Straub). Found also at various places in tropical America.

EXSIC.: Hep. Amer. 132 p. p. (as *Lejeunea* (Colo-Lej.) *minutissima*).

Microlejeunea bullata is our smallest representative of the Lejeuneae. It has not before been recorded for the United States, but seems to be common in Florida. When growing by itself its minute size makes it almost invisible, but as it often grows in company with other species it has been collected several times. The type-specimens agree closely with those from Florida.

According to Lindberg, *M. ulicina* occurs in Sullivant's Musc. Alleg. 272, mixed with *Lejeunea Americana*. In one example of this exsiccata examined by the writer, there seems to be no admixture whatever; in another example there is a single sterile stem of *M. bullata*, and it is probable that Lindberg confused this species with *M. ulicina*. At all events it seems advisable to omit the latter species from our lists until its presence is more definitely established.

M. ulicina is about twice as large as *M. bullata*, its leaves spread a little more from the axis and tend to be more pointed, the cells of the lobe are considerably larger, averaging 18 μ in diameter, the cell-walls are thicker and usually show minute trigones, while the lobules are relatively smaller. The perichaetial bracts of the two species, except for the difference in size, resemble each other very closely, but the bracteole of *M. ulicina* is entire or nearly so, while that of *M. bullata* is crenulate or denticulate.

M. bullata has also been confused with *Cololejeunea minutissima*, with which it often grows. The presence of underleaves will at once distinguish it from this species, and there is little danger of confusing it with any of our other Lejeuneae.

20. COLOLEJEUNEA MINUTISSIMA (Smith) Schiffn.

Jungermannia minutissima Smith, Eng. Bot. *pl.* 1633. 1806.

Jungermannia inconspicua Raddi, Mem. Mat. e Fis. Soc. Ital. Sci. Mod. 18: 34. *pl.* 5. *f.* 2. 1820.

Lejeunea minutissima Dumort, Comm. Bot. 111. 1822. G. L. & N. Syn. Hep. 387. 1845.

Lejeunea minutissima β *inconspicua* Nees, Naturgesch. Eur. Leberm. 3: 279. 1838.

Jungermannia parvula Wils. & Hook.; Drummond, Musc. Amer. St. Merid. 172. 1841.

Lejeunea Taylora Spruce, Ann. Nat. Hist. II. 4: 116 (foot-note). 1849.

Lejeunea inconspicua De Not. Mem. Acc. Tor. II. 22: 386. *pl.* 5. *f.* 27. 1865.

Lejeunea parvula Aust.; Lindb. Acta Soc. Sci. Fenn. 10: 481. 1875.

Lejeunea (*Colo-Lejeunea*) *minutissima* Spruce, Hep. Amaz. et And. 293. 1884.

Lejeunea (*Colo-Lejeunea*) *parvula* Steph. Bot. Gazette, 17: 171. 1892.

Cololejeunea minutissima Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1³: 122. 1893.

Dark green, varying to yellowish, scattered or loosely depressed-caespitose: stems prostrate, geniculate at nodes, 0.05 mm. in diameter, irregularly branched: rhizoids somewhat abundant: leaves distant to subimbricated, the lobe obliquely to widely spreading, convex, ovate to subrotund, 0.22 mm. long, 0.19 mm. wide, rounded or very obtuse at the apex, margin crenulate from projecting cells, antical margin arching wholly or partially across axis and slightly rounded at the very short base, postical margin forming a continuous line with keel; lobule strongly inflated, ovoid, 0.19 mm. long, 0.12 mm. wide, keel strongly arched, free margin curved, involute about half its length, bearing an obtuse or rounded tooth just beyond middle, then obliquely truncate or lunulate with a tooth composed of two rounded cells midway between the obtuse tooth and end of keel; lobule often imperfectly developed, in such cases sometimes plane or nearly so, with an almost straight keel and one or both of the marginal teeth obsolete; stylus reduced to a single papilla, sometimes borne on the basal marginal cell of the lobule, early obsolete; cells of lobe convex on

both surfaces, thin-walled and without trigones, averaging $18\ \mu$ in diameter: inflorescence autoicous: ♀ inflorescence on a leading branch, rarely on a short branch, with one or rarely two innovations; bracts somewhat complicate, unequally or subequally bifid, the sinus sometimes very shallow, lobe obliquely spreading, narrowly oblong, 0.4 mm. long, 0.17 mm. wide, rounded at the apex, lobule similar to lobe but sometimes obtuse at the apex, 0.35 mm. long, 0.12 mm. wide, margin crenulate from projecting cells: perianth obovoid, well exserted, 0.5 mm. long, 0.3 mm. wide, cuneate toward base, truncate or rounded at the apex and with a short broad beak, sharply five-keeled in upper part, surface papillose from convex cells: ♂ spike sometimes on a short branch, sometimes on a longer branch; bracts in two to eight pairs, imbricated, very concave, subequally bilobed, the lobes rounded or very obtuse, crenulate, postical lobe without marginal teeth; antheridia borne singly or in pairs: spores greenish with a thickened, minutely verruculose wall, angular, averaging $17\ \mu$ in diameter.

Type-locality, England.

On trees. South Carolina (Ravenel); Florida (J. D. Smith, Mrs. Russell, Underwood, Straub); Alabama (Sullivant); Mississippi (Lloyd and Tracy); Louisiana (Drummond, Langlois); Texas (Wright). Widely distributed in southern and western Europe.

EXSIC.: Musc. Amer. St. Merid. 172 (as *Jungermannia parvula*). Musc. Alleg. 276 (as *Lejeunea minutissima*). Hep. Amer. 132 p. p. (as *Lejeunea* (*Colo-Lej.*) *minutissima*).

The complicated synonymy of *Cololejeunea minutissima* is due largely to the fact that for many years it was not clearly distinguished in Europe from *Microlejeunea ulicina*. It is probable indeed that the original *Jungermannia minutissima* was a mixture of these two species, which frequently grow together and bear much superficial resemblance to each other. In this country *C. minutissima* has been similarly confused with *Microlejeunea bullata*. It can of course be readily distinguished from both these species by its autoicous inflorescence, geniculate stems and particularly by the entire absence of underleaves.

The species is variable, and it is not unusual to find specimens in which the lobules are poorly developed. This is even true of fruiting plants, where the stems bearing perianths tend to be crowded together in the middle of a tuft. In such cases the sterile stems around the edges are likely to be more characteristic. Of the published figures of this species, the only one which brings

out clearly the marginal teeth of the lobule is that of Stephani,* illustrating a luxuriant form from Portugal. All the other figures seem to have been drawn from imperfectly developed material.

Although Lindberg recognized *Lejeunea parvula* as a distinct species he failed to give a complete description of it. He stated merely that it agreed with *L. minutissima* in being autoicous and in having no underleaves but that it differed in its spreading, semioval and plane lobules. These slight differences by themselves in so variable an organ as the lobule are hardly sufficient to separate the two species. Lindberg referred to *L. parvula* the specimens distributed by Drummond as *Jungermannia parvula* and those distributed by Sullivant as *L. minutissima*. The writer has examined both and finds that the material is not only fragmentary but badly weather-worn. It is sufficient, however, to indicate that the specimens are the same as that rather common species of the Southern States, which subsequent writers have referred, without question, to *L. minutissima*. There seems to be no reason, therefore, for trying to hold *L. parvula* distinct. It should perhaps be noted that sometimes, in American specimens, the lobe is more narrowed at the apex and less crenulate than in European plants. Both of these very slight differences, however, are inconstant. American specimens in which the lobes are just as blunt and just as crenulate as in normal European forms are also frequent, and intermediate conditions exist between the two extremes.

C. minutissima is our smallest *Cololejeunea*. It can easily be distinguished from our other three species by its relatively larger lobule and extremely rudimentary stylus. From *C. Jooriana*, with which it sometimes grows, it differs also in its autoicous inflorescence, in its total lack of hyaline cells, in the shape and in the distinctly crenulate margin of its leaf-lobes.

21. *Cololejeunea Biddlecomiae* (Aust.)

Lejeunea calcarea Sull. Musc. Alleg. 275. 1845. Not Libert.

Lejeunea echinata Aust. Hep. Bor.-Amer. 99. 1873. Not Taylor.

Lejeunea Biddlecomiae Aust.; Pearson, List of Canadian Hepaticae, 5. pl. 5. 1890.

* Hedwigia, 26: pl. 1. f. 1. 1887.

Pale or bright green, scattered or depressed-caespitose : stems prostrate, 0.04 mm. in diameter, irregularly pinnately branched : rhizoids somewhat abundant : leaves distant to imbricated, the lobe obliquely to widely spreading, plane or usually convex, ovate, 0.35 mm. long, 0.2 mm. wide, apex varying from rounded to acute, usually obtuse, margin crenulate or denticulate from projecting cells, antical margin arching just across axis, slightly rounded at the very short base, postical margin almost straight, forming a continuous line with keel : lobule inflated, at least near keel, ovoid to globose, 0.17 mm. long, 0.15 mm. wide, keel strongly arched, free margin curved, involute about half its length, bearing an obtuse or rounded, sometimes indistinct tooth just beyond the middle, then obliquely truncate to end of keel, with a tooth usually composed of two rounded cells midway between the blunt tooth and the end of keel ; stylus mostly conspicuous, usually composed of two to ten cells in a single row, sometimes two cells broad a part of its length, in rare cases reduced to a single papilla ; cells of lobe thin-walled, usually with minute trigones, averaging $10\ \mu$ in diameter at edge of lobe, $13\ \mu$ in the middle and $21 \times 13\ \mu$ at base, walls on outer surface of lobe convex to conical, sometimes with a distinct thickening or wart in the middle ; cells of lobule plane : inflorescence dioicous or autoicous : ♀ inflorescence borne on a leading branch, innovating on one side ; bracts unequally bifid, the lobe obliquely spreading, broadly ovate, 0.35 mm. long, 0.2 mm. wide, obtuse to acute at the apex, lobule orbicular, 0.17 mm. long, margin denticulate and outer surfaces of both lobe and lobule papillose from projecting cells ; perianth partly exserted, obovoid to oblong, 0.6 mm. long, 0.35 mm. wide, not compressed, rounded to truncate at the apex, with a short beak, sharply five-keeled in upper part, surface roughened from projecting cells except near the base : ♂ spikes usually borne on leading branches ; bracts in two to five pairs, imbricated, similar to the leaves, but with a proportionately larger lobule ; antheridia borne singly or in pairs.

Type-locality, Canada (Macoun).

On trees or rocks : Ontario (Macoun, Dearness) ; Massachusetts (Stone) ; Connecticut (Eaton, Underwood, Evans) ; New York (Underwood) ; New Jersey (Rau) ; District of Columbia (Coville, Maxon) ; Ohio (Miss Biddlecome, Beardslee, Wilcox, Werner) ; Florida (Miss Biddlecome) ; Alabama (Sullivant).

EXSIC.: Musc. Alleg. 275 (as *Lejeunea calcarea*). Hep. Bor.-Amer. 99 (as *Lejeunea echinata*). Hep. Amer. 51 (as *Lejeunea (Colo-Lej.) calcarea*). Can. Hep. 13 (as *Lejeunea calcarea*).

Cololejeunea Biddlecomiae is closely related to the European

C. calcarea (Lib.) Schiffn. In the latter species the lobes of the leaves are narrower than in *C. Biddlecomiae* and much more pointed, varying from acute to acuminate; they spread more widely from the stem and the postical margin is incurved beyond the keel; the lobule is more inflated with its free margin strongly involute, the roughness of the leaves is more pronounced, and the stylus is commonly shorter.

Although Spruce at one time tentatively accepted *C. Biddlecomiae* as a species, he afterwards regarded it as a luxuriant form of *C. calcarea*. This opinion was based on the fact that it is sometimes difficult to distinguish certain specimens of the American species from certain specimens of the European. The forms which resemble each other so closely, however, seem to be always imperfectly or abnormally developed plants in which some of the specific characters fail to show themselves in a satisfactory manner. When robust and well developed specimens are examined, there is little difficulty in distinguishing between them. *C. calcarea* grows preferably on limestone rocks, it seems to be much rarer on siliceous rocks and there are few records of its occurrence on trees. *C. Biddlecomiae*, on the contrary, attains its best development on trees, particularly in cedar-swamps, and although it is not infrequent on siliceous rocks, it is often less robust in such localities. Whether it is abundant on calcareous rocks does not appear from the specimens examined. The poorly developed specimens, growing on rocks, are the ones which can scarcely be distinguished from rudimentary plants of *C. calcarea*, as for example the specimens distributed by Gottsche and Rabenborst in Hep. Eur. 323. Since however no typical specimens of *C. calcarea* have as yet been collected in America, it seems wisest to refer these doubtful rock-forms to *C. Biddlecomiae*.

The presence or absence of a stylus has been used as a distinguishing mark between species of *Cololejeunea*. This practice is not absolutely correct because the stylus is always present, although sometimes reduced to a unicellular papilla which early shrivels up and disappears. Where the stylus is filiform, the papilla can often be detected somewhere near its apex. Regarding the morphological value of the stylus, opinions have varied. Nees von Esenbeck and afterwards Spruce looked upon it as one of the

divisions of a bifid underleaf, the other having become obsolete. Stephani calls attention to the improbability of this view. As a matter of fact the postical segments cut off from the apical cell bear no appendages whatever except the rhizoids. The stylus, on the other hand, arises from a lateral segment which normally bears a leaf, and there seems to be no reason why it should not be considered homologous with the stylus of *Frullania*, which is acknowledged to be a part of the leaf.

In a note sent by Spruce to Underwood, it is stated that a few stems of the European *Cololejeunea Rossettiana* (Massal.) Schiffn. occur mixed with Hep. Amer. 51. Apparently on the strength of this statement, Underwood has listed the species as an American plant. In the two sets of Hep. Amer. examined by the writer, no. 51, which grew on trees, is made up entirely of *C. Biddlecomiae*; and since *C. Rossettiana* has not been collected in Europe except on calcareous rocks, perhaps it would be well to omit it from our lists until its presence is more definitely proved. *C. Rossettiana* was first recognized in Italy, but has since been detected on the British Isles and in western France. It often grows in company with *C. calcarea*, with which it was long confused. It differs from this species in its broader and even rougher lobe and in its plane lobule, which is denticulate on the margin and rough on the postical surface. Its stylus also is reduced to a unicellular papilla, which is often difficult to demonstrate.

22. *Cololejeunea Macounii* (Spruce)

PLATE 22, FIGS. 1-8

Lejeunea (*Cololejeunea*) *Macounii* Spruce; Underwood, Bull. Torrey Club, 17: 259. 1890.

Pale green or yellowish, scattered or loosely depressed caespitose: stems prostrate, 0.08 mm. in diameter, irregularly pinnately branched: rhizoids not abundant: leaves imbricated, the lobes suberect to obliquely spreading, straight or slightly falcate, plane, oblong-obovate, on robust plants 0.7 mm. long and 0.45 mm. wide, rounded at the apex, margin entire or subcrenulate from projecting cells, antical margin not arching across axis, almost straight near base, postical margin forming an almost continuous line with keel; lobule inflated at least near keel, ovate in outline, 0.4 mm. long, 0.2 mm. wide, keel arched, free margin usually plane and

appressed to lobe, bearing an acute tooth beyond the middle, then obliquely truncate to end of keel with a tooth composed of two rounded cells midway between the acute tooth and end of keel; stylus inconspicuous and soon obsolete, composed of two or rarely of three cells in a row, sometimes reduced to a one-celled papilla; cells of lobe thin-walled with small but distinct trigones and occasional intermediate thickenings averaging 10μ in diameter at edge of lobe, 20μ in the middle and $25 \times 20\mu$ at the base, walls on outer surface of lobe slightly convex, each cell, except those near the base, bearing a single, large, short-cylindrical, rounded projection, representing a local thickening of the wall: inflorescence dioicous: ♀ inflorescence borne on a leading branch innovating on one side; bracts complicate, unequally bifid, the lobe similar to the leaf-lobes but narrower, 0.6 mm. long, 0.3 mm. wide, lobule ovate, 0.35 mm. long, 0.17 mm. wide, apiculate or subacuminate at apex, margin and cells of lobe as in leaves; perianth exserted, obconic in lower part, rectangular-oblong above, 0.75 mm. long, 0.3 mm. wide, slightly compressed, subtruncate at apex, sharply five-keeled, the entire surface except near the base roughened as in leaves: ♂ inflorescence unknown.

On maple bark. British Columbia (Macoun), the type-locality.

EXSIC.: Hep. Amer. 177 (as *Lejeunea* (Colo-Lej.) *Macounii*).

Spruce's original description of *C. Macounii*, which was published by Underwood, is so complete that very little has been added to it. In fact the characters of the perianth as stated above are taken wholly from this description, the perianths in the specimens examined by the writer being either too young or too old to show these characters clearly.

In its rough leaves *C. Macounii* resembles *C. Biddlecomiae*, but in the latter species the roughness is due mainly to the very convex or conical cell walls, while in *C. Macounii* it is due almost entirely to the globose warts on the cells. In *C. Macounii* also the lobe is rounded at the apex with its broadest part above the middle, while in *C. Biddlecomiae* the lobe is more or less sharply pointed with its broadest part below the middle. There are also differences in the marginal teeth of the lobule.

In an interesting note to Underwood, Spruce compares *C. Macounii* with two autoicous species of tropical America—*C. cardiocarpa* (Mont.) and *C. platyneura* (Spruce). Both of these species differ in their compressed perianth with a low, bluntly two-angled, postical keel, which is almost obliterated at maturity. *C.*

cardiocarpa differs also in the hyaline apex of its lobe and in its muticous lobule, while *C. platyneura* shows a very small lobule and a false nerve of elongated cells in the lobe.

23. *Cololejeunea Jooriana* (Aust.)

PLATE 22, FIGS. 9-20

Lejeunea Jooriana Aust. Bull. Torrey Club, 6: 20. 1875.

Lejeunea (Colo-Lejeunea) Jooriana Steph. Bot. Gazette, 17: 171. 1892.

Yellowish-green or whitish, darkening somewhat with age, scattered or loosely depressed-caespitose: stems prostrate, 0.05 mm. in diameter, irregularly pinnately branched: rhizoids somewhat abundant: leaves imbricated, the lobe widely spreading, plane, ovate, 0.5 mm. long, 0.35 mm. wide, gradually narrowed from just below the middle to the rounded, obtuse or subacute apex, margin entire or subcrenulate from projecting cells, antical margin arching across axis and rounded at the very narrow base, postical margin forming a continuous line with keel, almost straight from end of keel to apex; lobule inflated, ovoid, 0.25 mm. long, 0.15 mm. wide, keel arched, free margin involute about half its length, bearing an obtuse tooth just beyond the middle, then obliquely truncate or lunulate to end of keel, with a tooth composed of two rounded cells midway between the obtuse tooth and the end of keel: stylus inconspicuous and soon obsolete, composed of two cells in a row or reduced to a one-celled papilla; cells of lobe scarcely convex, with slightly thickened walls, very inconspicuous trigones and occasional, minute intermediate thickenings, averaging $14\ \mu$ in diameter at edge of leaf, $18\ \mu$ in the middle and $25 \times 18\ \mu$ at base; hyaline cells at apex one to ten in number, radially elongated, usually in a single row, united at their basal ends but often with rounded, more or less spreading, free extremities, hyaline cells sometimes present also along a part of antical margin, sometimes absent altogether, usually becoming very indistinct with age: inflorescence synoicous and sometimes paroicous: ♀ inflorescence usually borne on a leading branch, more rarely on a short branch, innovating on one side, the innovation sometimes floriferous; bracts similar to the leaves, unequally bifid, with more or less inflated lobule and arched keel, lobe narrowly ovate, 0.5 mm. long, 0.25 mm. wide, margin slightly crenulate from projecting cells, usually with a small group of hyaline cells at apex and occasionally on antical margin, lobule ovate, 0.35 mm. long, 0.2 mm. wide, crenulate or denticulate in upper part from projecting cells and sometimes bearing one to three hyaline cells at apex, stylus sometimes three

or four cells long; perianth about half exserted, broadly ovoid to obovoid, 0.55 mm. long, 0.4 mm. wide, rounded at the base and rounded, truncate or very slightly retuse at apex, with an extremely short and indistinct beak, somewhat flattened, antical face plane or with a broad low keel, lateral keels sharp to blunt, postical keel broad, obtusely two-angled, cells of perianth with thicker walls than the leaf-cells, slightly convex, especially along keels: antheridia borne singly or in pairs in the axils of the ♀ bracts and sometimes in the unmodified leaf below the innovation: spores more or less elongated, angular, greenish, with a thickened, minutely verruculose wall, averaging 14μ in short diameter.

Type-locality, Louisiana (Joor).

On bark and on reeds. North Carolina (Johnson); Florida (J. D. Smith, Underwood). Also known from Bermuda (Howe).

Austin's original description of this interesting species is incomplete and omits several of its most essential characters. For this reason the species has not been understood, and although specimens of it have been collected several times and at various localities, they have most of them been referred to *C. minutissima*, with which they really have less in common than with either of our other species. Apparently no one except Austin studied the type-material. Underwood's description, the only one since published, is simply a translation of the original description, and Stephani states distinctly that the species is unknown to him. The original specimens were collected on reeds, but the plant grows preferably on bark.

The most remarkable feature of *C. Jooriana* is its synoicous inflorescence. A paroicous inflorescence occurs in the European *C. microscopica* (Tayl.) Schiffn. and in a few of the larger Lejeuneae and Frullaniae, but a synoicous inflorescence has not before been recorded for any member of the Jubuloideae. In fact the only genera of the leafy hepaticae in which it has been observed are the widely removed *Marsupella* and *Gymnomitrium*, belonging to the Epigoniantheae. In order to see the antheridia of *C. Jooriana*, an unfertilized flower must be examined or one in which the perianth is still very immature. As the perianth develops the antheridia, having carried out their function, shrivel up and are soon difficult to demonstrate. In most flowers antheridia occur only in the axils of the perichaetial bracts, their occurrence in the axil of the subbracteal leaf below the innovation being somewhat unusual.

It is interesting to note that the bracts or at any rate those without innovations exhibit inflated lobules, an indication of their perigonal character.

The hyaline leaf-cells of *C. Jooriana* are also a unique character among our Lejeuneae. On old leaves these cells soon become indistinct, and on poorly developed leaves they may be scanty or wanting, but it is rare to find a plant from which they are altogether absent. Hyaline marginal cells are known in a number of tropical Lejeuneae,* the majority of them being species of *Cololejeunea*. The one most closely allied to *C. Jooriana* is perhaps the autoicous *C. cardiocarpa*, in which the ♂ spike bears six to eight pairs of bracts. In this species also, according to Spruce, the lobule is plane, sublinguiform in shape, obtuse at the apex and almost parallel with the axis.

Of our own species, *C. Jooriana* bears some resemblance to *C. Biddlecomiae* and *C. Macounii*. Aside from its inflorescence and hyaline cells, it differs from both these species in its ordinary leaf-cells which are plane or very slightly convex. It differs also from *C. Biddlecomiae* in its much shorter stylus and from *C. Macounii* in the very different shape of its leaf-lobes.

EXCLUDED SPECIES

The species in the following list have all been recorded from the United States. They are now excluded either because they are imperfectly known or because there is insufficient evidence that they occur within our limits. All of these species are referred to more fully in the preceding text.

1. *Neurolejeunea catenulata* (Nees) Schiffn.
2. *Platylejeunea transversalis* (Swartz) Schiffn.
3. *Archilejeunea Auberiana* (Mont.) Steph.
4. *A. xanthocarpa* (Lehm. & Lindenb.) Steph.
5. *Lopholejeunea Sagraeana* (Mont.) Schiffn.
6. *Acrolejeunea torulosa* (Lehm. & Lindenb.) Schiffn.
7. *Euosmolejeunea trifaria* (Nees) Schiffn.
8. *Pycnolejeunea macroloba* (Mont.) Schiffn.
9. *Lejeunea Caroliniana* Aust.

* Cf. Stephani, *Hedwigia*, 27: 288. 1888.

10. *L. diversiloba* Spruce.
11. *L. flava* Swartz.
12. *L. lacte-fusca* Aust.
13. *L. lacte-virens* Mont.
14. *L. Ravenelii* Aust.
15. *L. Wrightii* Gottsche.
16. *Microlejeunea crenulifolia* Steph.
17. *M. cucullata* (R. Bl. & N.) Jack & Steph.
18. *M. erectifolia* (Spruce) Steph.
19. *M. ulicina* (Tayl.) Evans.
20. *Cololejeunea calcarea* (Lib.) Schiffn.
21. *C. Rossettiana* (Massal.) Schiffn.

YALE UNIVERSITY.

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Explanation of Plates

PLATE 16

Archilejeunea clypeata (Schwein.) Schiffn. 1. Stem with perianth, postical view, $\times 27$. 2. Sterile stem, postical view, $\times 27$. 3. Leaf, antical view, $\times 27$. 4. Cells from middle of lobe, $\times 350$. 5. Cells from antical margin of lobe, $\times 250$. 6, 7. Apices of lobules, $\times 250$. 8, 9. Bracts, $\times 40$. 10. Bracteole, $\times 40$. 11. Transverse section of perianth in upper third, $\times 40$. The figures are all drawn from specimens collected by the writer at Woodbridge, Connecticut.

Archilejeunea Sellowiana Steph. 12. Stem with two perianths and δ inflorescence, postical view, $\times 16$. 13. Leaf, antical view, $\times 16$. 14. Cells from middle of lobe, $\times 350$. 15. Cells from antical margin of lobe, $\times 250$. 16. Apex of lobule, $\times 250$. 17, 18. Bracts, $\times 40$. 19. Bracteole, $\times 40$. 20. Transverse section of perianth at about the middle, $\times 40$. The figures are all drawn from specimens collected by A. Commons, at Laurel, Delaware (no. 19).

PLATE 17

Archilejeunea conchifolia Evans. 1. Stem with perianth, postical view, $\times 27$. 2. Leaf, antical view, $\times 27$. 3. Cells from middle of lobe, $\times 350$. 4. Cells from antical margin of lobe, $\times 250$. 5. Apex of lobule, $\times 250$. 6, 7. Bracts, $\times 40$. 8. Bracteole, $\times 40$. 9. Transverse section of perianth at about the middle, $\times 40$. The drawings are all made from the type specimens.

Mastigolejeunea auriculata (Wils. & Hook.) Schiffn. 10. Stem with perianth, postical view, $\times 27$. 11. Small branch, postical view, $\times 27$. 12. Leaf, antical view, $\times 40$. 13. Cells from middle of lobe, $\times 350$. 14. Cells from antical margin of lobe, $\times 350$. 15. Apex of lobule, $\times 50$. 16, 17. Bracts, $\times 40$. 18. Bracteole, $\times 40$. 19. Transverse section of perianth at about the middle, $\times 40$. The figures are all drawn from specimens collected by L. M. Underwood in Florida; 11 and 15 came from Orange Bend (no. 1583) and the remainder from Blandton (no. 1988).

PLATE 18

Brachiolejeunea corticalis (Lehm. & Lindenb.) Schiffn. 1. Stem with perianth, postical view, $\times 31$. 2. Leaf, postical view, $\times 35$. 3. Cells from middle of lobe, $\times 310$. 4. Cells from antical margin of lobe, $\times 220$. 5. Free margin of lobule, inner portion, $\times 220$. 6. Free margin of lobule, outer portion, $\times 220$; both from leaf 2. 7, 8. Bracts, $\times 35$. 9. Bracteole, $\times 35$. 10, 11. Transverse sections of perianth, 10 from upper third, 11 from about the middle, $\times 35$. The figures are all drawn from specimens collected at Lake Worth, Florida, by L. M. Underwood (no. 293).

Euosmolejeunea duriuscula (Nees) Evans. 12. Stem with ♀ inflorescence, postical view, $\times 35$. 13, 14. Sterile stems, postical view, $\times 35$. 15, 16. Cells from middle of lobe, $\times 310$. 17. Apex of lobule, $\times 220$. 18, 19. Bracts, $\times 35$. 20. Bracteole from same involucre, $\times 35$. 21-23. Bracts and bracteole from another involucre, $\times 35$. 12, 13, 15, and 17-20 are drawn from Hep. Bor.-Amer. no. 96; 14, 16, and 21-23, from Hep. Amer. no. 97.

PLATE 19

Euosmolejeunea opaca (Gottsche) Steph. 1. Sterile stem, postical view, $\times 40$. 2. Branch with perianth, postical view, $\times 40$. 3. Cells from middle of lobe, $\times 350$. 4. Cells from antical margin of lobe, $\times 250$. 5. Apex of lobule, $\times 250$. 6. Apex of underleaf, $\times 250$. 7. Apex of underleaf-segment, $\times 250$. 8, 9. Bracts, $\times 40$. 10. Bracteole, $\times 40$. 11. Transverse section of perianth in upper third, $\times 40$. The figures are all drawn from specimens collected at Enterprise, Florida, by E. Faxon.

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PLATE 20

Cheilolejeunea phyllobola (Nees & Mont.) Schiffn. 1. Stem with perianth and ♂ inflorescence, $\times 40$. 2. Cells from middle of lobe, $\times 350$. 3. Cells from antical margin of lobe, $\times 250$. 4. Apex of lobule, $\times 250$. 5. Underleaf, $\times 60$. 6-8. Details of preceding figure 6 representing one side of base, 7 and 8 apices of segments, $\times 250$. 9, 10. Bracts, $\times 40$. 11, 12. Bracteoles, $\times 40$. 13. Transverse section of perianth at about the middle, $\times 40$. The figures are all drawn from specimens collected at Lake Worth, Florida, by L. M. Underwood (no. 301 p.p.).

Lejeunea Americana (Lindb.) Evans. 14. Stem with perianth and ♂ inflorescence, postical view, $\times 40$. 15. Sterile stem (a slender form), postical view, $\times 40$. 16. Cells from middle of lobe, $\times 350$. 17. Apex of lobule, $\times 250$. 18. Base of underleaf (one side), $\times 250$. 19-22. Apices of underleaf-segments, $\times 250$. 23, 24. Bracts, $\times 40$. 25. Bracteole, $\times 40$. 26. Transverse section of perianth in upper third, $\times 40$. 2 is drawn from specimens collected by A. B. Langlois near St. Martinsville; the other figures, from specimens collected at Eustis, Florida, by L. M. Underwood (no. 11).

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Microlejeunea lucens (Tayl.) Evans. 1. Stem with ♀ inflorescence, postical view, $\times 35$. 2. Sterile stem, postical view, $\times 35$. 3. Cells from middle of lobe, $\times 310$. 4. Antical base of lobe, $\times 220$. 5. Apex of lobe, $\times 220$. 6. Apex of

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Microlejeunea Ruthii Evans. 11. Stem with $\varnothing$ inflorescence, postical view, $\times 35$. 12. Sterile stem, antical view, $\times 35$. 13. Cells from middle of lobe, $\times 310$. 14. Apex of lobe, $\times 220$. 15. Apex of lobule, $\times 220$. 16. Underleaf, $\times 220$. 17, 18. Bracts, $\times 50$. 19. Bracteole, $\times 50$. The figures are all drawn from the type-specimens.

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PLATE 22

Cololejeunea Macounii (Spruce) Evans. 1. Stem with very young perianth, postical view, $\times 40$. 2. Sterile stem, postical view, $\times 40$. 3. Cells from middle of lobe, $\times 350$. 4. Similar cells in cross-section, $\times 350$. 5. Cells from margin of lobe, $\times 250$. 6. Apex of lobule, $\times 250$. 7, 8. Bracts, $\times 40$. The figures are all drawn from specimens collected in British Columbia by J. Macoun.

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