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The Hepaticae of the
British Isles

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THE
HEPATICÆ
OF THE
BRITISH ISLES

VOL. I. -TEXT



THE
HEPATICÆ
OF THE
BRITISH ISLES

BEING
FIGURES AND DESCRIPTIONS OF ALL
KNOWN BRITISH SPECIES

BY
WILLIAM HENRY PEARSON
CORR. MEM. LINN. SOC. N.S.W., R.S. TASM., VIDENSK. SELSK. CHRISTIANIA

VOL. I.—TEXT

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PREFACE.

THE object I have had in view whilst preparing this work has been to make the study of the British Hepaticæ somewhat easier for the growing number of students who are taking an interest in this, hitherto, neglected order. Although much has been written on the structure and arrangement of the genera and species, no attempt has been made, since the appearance of Sir Wm. J. Hooker's "British Jungermanniæ" in 1816, to delineate the various organs of each particular species, without which it is most difficult to identify those closely related. A very brief introduction is followed by a full description, with figures of each species, with their organs magnified.

I have followed the arrangement proposed by the late Dr. Spruce, to whom I am indebted for the description of most of the genera.

I have also made free use of the labours of others which I have or may not have duly acknowledged, but all the species have been critically examined and studied by me, and as the work has been great, I trust criticism may be disarmed on this point.

About twenty-five years ago I attended a botanical class taught by the late Dr. Carrington, and so made the friendship of one of the most accurate botanists of our time, who then was bringing out his "British Hepaticæ," of which only four parts were issued. It was then my ambition to assist him, and with him I had prepared a further part, but it never appeared

owing to difficulties arising as to its publication and the doctor's failing health.

After his lamented death I began to arrange my notes and drawings, and with the kindly encouragement of the late Dr. Spruce and the help of many good friends, I have been able to bring to a conclusion a work which has occupied the scanty leisure of a busy commercial life.

My thanks are due to Messrs. James Cash, Richard Crawshaw, George Ely, Symers M. Macvicar, and other friends for help during the progress of the work.

No one can be more conscious than I am of its many imperfections, yet I venture to hope that students will find it of value in the study of these interesting plants.

WM. HY. PEARSON.

PARK CRESCENT, VICTORIA PARK,
MANCHESTER.

CONTENTS.

	PAGE
PREFACE	v
CONTENTS	vii
INTRODUCTION	1
GLOSSARY OF TERMS USED	7
CONSPECTUS HEPATICARUM	11
JUNGERMANIACEE	11
JUBULEE	23
JUNGERMANIEE	66
RADULEE	66
PORELLEE	79
PTILIDEE	93
TRIGONANTHEE	116
SCAPANIOIDEE	207
EPIGONIANTHEE	245
FOSSOMBRONIEE	416
METZGERIEE	449
MARCHANTIACEE	466
RICCIACEE	483
ANTHOCEROTACEE	498
BIBLIOGRAPHY	501
INDEX	511

HEPATICÆ.

INTRODUCTION.

HABIT.—Frequently growing in matted tufts, sometimes straggling amongst mosses, or creeping over rocks, stones, or trees. (With the description of each species particulars are given of their varied habit.)

FLAGELLA are the whip-like processes some genera bear; they are either furnished with rootlets and minute rudimentary leaves or are destitute of them.

SIZE.—The stems of the British Hepaticæ vary from about 2 mm. to 5 or 6 inches in length. The following is an explanation of the terms used to indicate their size :

“Very long,” 3 to 6 inches.

“Large,” about 3 inches.

“Largish,” about 2 inches.

“Medium,” about 1 to $1\frac{1}{2}$ inch.

“Small,” $\frac{1}{4}$ to 1 inch.

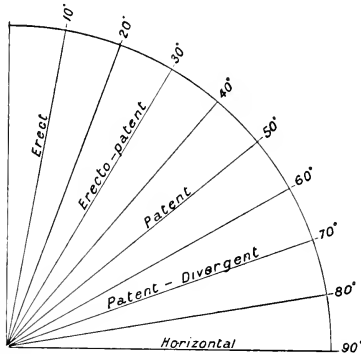
“Minute,” $\frac{1}{8}$ of an inch to 2 mm. to 3 mm.

COLOUR.—Commonly pale or yellowish to dark green, but some varying from silvery white to black, others red or purple.

STEM.—The Hepaticæ may be grouped in two divisions, the frondose and the foliose; but in certain genera both occur, which show that this division is more or less artificial; yet in the study of our British species it is a useful distinction.

The frondose group comprise those genera which have a flattened frond without any distinct stem, stem confused with the lamina, or stem with wings or lamina on either side; they are usually prostrate.

The foliose species have a distinct stem with leaves; these stems are either cylindrical, frontally or laterally compressed, and various in texture, some being almost ligneous, others loosely cellulose. In position they are either erect, depressed, procumbent, or pendant; they are either simple or slightly branched, pinnate or bipinnate; their ramification either lateral or postical; a cross-section of the stem discloses great variety in the size, arrangement,



and texture of the cells, which affords good characters in the determination of species.

ROOTLETS.—Some species are almost destitute of these; in others they are often very abundant, proceeding from the postical side of the stem, from the base of the stipules, or very rarely from the underside of the postical lobe of some species. They are usually short, simple or rarely forked, unicellular fibres, sparingly dispersed or closely clothing the postical side of the stem.

In one genus only (*Riccia*) they are papillose within; all the others are smooth, semi-transparent or pellucid, sometimes dirty white, claret or purple coloured.

LEAVES.—The insertion, position, and shape of the leaves are fully described with each species.

The above diagram illustrates the terms used with reference to their position on the stem.

Erect, making an angle with the stem of about 10° .

Erecto-patent, making an angle with the stem of about 30° .

Patent, making an angle with the stem of about 50° .

Patent-divergent, making an angle with the stem of about 70° .

Divergent or horizontal, making an angle with the stem of about 90° .

The cells of the leaves vary in shape and size, having walls clear and well-defined, with angles thickened or not, most frequently with smaller cells at their angles, called trigones.

The following table of sizes of cells, suggested by the late Dr. Spruce, has been used in the present work :

COMPARATIVE SIZES OF LEAF-CELLS OF HEPATICÆ.

Large10 mm.
Largish or rather large05 mm.
Moderate or medium size033 mm.
Smallish025 mm.
Small02 mm.
Very small or rather minute017 mm.
Minute014 mm.
Very minute0125 to .01 mm.

TEXTURE OF LEAVES.—In the frondose species the leaves vary from a thin lamina, consisting of a single layer of cells, to thick and fleshy, and numerous cells thick; in the foliose they are always composed of a single layer, in one or two cases a slight thickening at the base has been observed. Unlike many of the true mosses, they are destitute of a midrib. In one species (*Diplophyllum albicans*) there is a pseudo-nerve, consisting of a line of thickened cells.

STIPULES, or, as they have been called by various authors, amphigastria, and underleaves, are postical leaves usually very small and rudimentary; in some genera they are large and equalling the leaves and generally of the same texture, but often absent.

INFLORESCENCE.—The reproductive organs of the Hepaticæ are of two kinds, the male (antheridia) and the female (pistillidia); their position affords valuable characters in the determination of species. The leaves enclosing them are called

BRACTS, which are either slightly or widely different from the leaves, but usually agreeing with them in cell structure.

BRACTEOLES are the floral stipules, and are often a larger modification of the same.

PERIANTH.—This is the term used for the inner involucre, which is surrounded by the female bracts. It consists of one or several layers of cells; in some genera it is absent, or replaced by the

CALYPTRA, which is usually a delicate sac enclosed by the perianth.

PISTILLIDIA, or the female organs, are usually situated at the base and enclosed by the perianth and calyptra; they are oblong in shape and vary considerably in number, one only having been fertilised, developing into the perfect fruit, the others fading away.

The CAPSULE is the seed vessel, enclosing the spores and elaters, supported on a long or short, usually very delicate, hyaline pedicel; it is globose or cylindrical, dividing regularly into 4 valves, either to its base or the lower half, or rupturing irregularly. In the *Anthoceros* it is pod-like, with a rudimentary columella.

SPORES or seeds vary in colour, shape, size, and markings.

ELATERS are spiral threads, enveloped in a hyaline almost invisible sac, and mixed with the spores in the capsule.

ANTHERIDIA, or male organs, are usually oval bodies, with or without a short stipe, imbedded in the fronds or enclosed in modified leaves called bracts.

GEMMÆ are detachable cellular bodies found in some species, which develop into perfect plants.

DISTRIBUTION.

The Hepaticæ are generally distributed throughout the British Isles, from the sand flats and rocks by the sea-shore to the topmost heights of our mountains, and are found in almost every imaginable locality. They are the more abundant

in shady woods, by waterfalls and mountain streams, in bogs or on peaty moors, growing on living and dead trees, on stone walls and rocks or mud-covered walls; some species are peculiar to limestone, others to subalpine and alpine districts. Full particulars are given with each species, and if the student has any doubt as to the determination of any species its habitat will often afford a good clue to its correct name.

CENSUS OF DISTRIBUTION.—I have followed the admirable arrangement adopted in the “London Catalogue of British Mosses and Hepaticæ,” 1881.

“The numbers 1 to 16 and the lettered numerals 17A, 17B, 18A, 18B, and 18C, stand for the twenty-one Watsonian provinces, and show in which of those provinces each species is known to grow. The names of these provinces, with the numbers standing for them in the catalogue, and the counties included in each province, are as follows :

1. *Peninsular* (Cornwall, Devon, Somerset).
2. *Channel* (Wilts, Dorset, Wight, Hants, Sussex).
3. *Thames* (Oxon, Bucks, Berks, Surrey, Middlesex, Herts, Essex, Kent).
4. *Ouse* (North'ton, Beds, Hunts, Cambridge, Norfolk, Suffolk).
5. *Severn* (Monmouth, Glo'ster, Hereford, Worcester, Warwick, Salop, and Stafford).
6. *South Welsh* (Glamorgan, Carmarthen, Brecon, Radnor, Cardigan, and Pembroke).
7. *North Welsh* (Montgom., Merioneth, Anglesea, Carnarvon, Denbigh, Flint).
8. *Trent* (Lincoln, Leicester, Notts, Derby).
9. *Mersey* (Cheshire, Lancashire, *sine* Lake Lanc.).
10. *Humber* (Yorkshire *solus*).
11. *Tyne* (Durham, Northumberland).
12. *Lake* (Lake Lanc., Isle of Man, Westmorland, Cumberland).
13. *West Lowland* (Dumfries, Wigton, Kirkeudbright, Lanark, Ayr, Renfrew).
14. *East Lowland* (Berwick, Roxburgh, Selkirk, Peebles, Haddington, Edinburgh, Linlithgow).

15. *East Highland* (Perth, Stirling, Forfar, Kincardine, Aberdeen, Banff, Elgin, Easternness).

16. *West Highland* (Argyle, Arran, Islay, Mull, Skye, Westernness).

17A. *Upper North Highland* (Sutherland, Caithness).

17B. *Lower North Highland* (Ross-shire).

18A. *Hebridean* (Isles).

18B. *Orkney* (Isles).

18C. *Shetland* (Isles).

I. (Ireland) C. (Channel Islands).

HOW TO EXAMINE THE HEPATICÆ.

To gain an accurate knowledge of the Hepaticæ it is necessary to have both a simple and a compound microscope, the simple one with a good-sized table to deploy and dissect the specimen, and the compound one to study the different organs plainly.

Place your specimen in a white saucer, in water, and carefully disentangle a single plant from the mass with which it is usually associated, making sure that you have the whole plant before you. Ascertain its inflorescence: with the paroicous species it may be necessary to dissect with a sharp scalpel the bracts immediately below the perianth, and (as the late Dr. Spruce once mentioned to me) do not spare your best specimens to make sure about this character, which is of great value in the determination of species.

In taking sections of stems and perianths, dissections of the leaves, stipules, and bracts, and examining spores and elaters, the student will find it convenient to place them on a glass slip, covering them with a cover glass, adding a few drops of water, or glycerine and water, to examine them under the compound microscope, using the 2 or 3 inch for studying the shape of the leaves, stipules, and bracts, the $\frac{1}{2}$ or $\frac{1}{4}$ inch for the cell structure, spores, and elaters.

GLOSSARY OF TERMS USED.

- ACCRESCENT, increasing in size.
- ACROCARPOUS, fruit terminating the stem or axis.
- ACROGENOUS, from the growth of the stem taking place at the summit.
- ACUMINATE, tapering gradually to a point.
- ACUTATE, slightly pointed.
- ACUTE, terminating at once in a point.
- ADNATE, joined together, adhering to the face of anything.
- ADVENTITIOUS, developed in an unusual position.
- ÆRUGINOSE, verdigris-green.
- AGGREGATE, crowded.
- ALBESCENS ALBICANS ALBIDUS, whitish.
- ALTERNATE, one after another, but not opposite.
- ALVEOLATE, studded with cavities, somewhat resembling the cells in a honeycomb.
- AMENTULA, the catkins of ♂ inflorescence.
- AMPLEXICAUL, clasping the stem.
- ANDRECIUM, the male inflorescence.
- ANTHERIDIA, the male reproductive organs.
- ANTICAL, the upper face of a stem, branch or lobe of a leaf.
- APICAL, belonging to the apex or point.
- APICULATE, having an apiculus.
- APICULUS, an abrupt very short point continued from the lamina.
- APPLANATE, flattened out or horizontally expanded.
- APPRESSED, applied closely to the stem.
- APPROXIMATE, close together.
- ARCHEGONIA. *See* PISTILLIDIA.
- ARCUATE, bent like a bow.
- AREOLATION, the network formed by the outline of the cells.
- AROMA, the flavour peculiar to any plant.
- AROMATIC, having a spicy taste or smell.
- ARTICULATE, jointed.
- ASCENDING, directed upwards.
- ASPERULOUS, slightly rough, with little points.
- ASSURGENT, ascending upward.
- ATTENUATE, narrowing gradually.
- AURICLES, earlike appendages.
- AURICULATE, having auricles or small lobes at the base.
- AUTOICOUS, male and female inflorescence on the same plant.
- AXIL, the angle between the axis and any part produced from it.
- AXILLARY, in the basal hollow or axil of a leaf or branch.
- BASAL, at the base or lowest part.
- BIDENTATE, with two teeth.
- BIFARIOUS, two ranks or in two opposite rows.
- BIFID, cleft into two, halfway down.
- BIFURCATE, two-forked.
- BILABATE, two-lipped.
- BILOBED, two-lobed.
- BIPARTITE, divided nearly to base into two parts.

- BIPINNATE, doubly pinnate.
 BIPINNATIFID, doubly pinnatifid.
 BISEPTATE, with two partitions.
 BISERIATE, arranged in two parallel rows.
 BISERRATE, serratures again serrated.
 BRACTEOLE, the floral stipule.
 BRACTS, the leaves enclosing the reproductive organs.
 BYSSACEOUS, divided into fine threads like wool.
 CADUCOUS, soon falling off.
 CÆSIOUS, glaucous-green.
 CÆSPITOSE, forming matted tufts.
 CÆSPITULOSE, in very small tufts.
 CALCARATE, spurred.
 CALCICOLOUS, growing on limestone.
 CALYPTRA, the sac enclosing the young capsule.
 CALYX, the external whorl of floral leaves.
 CANALICULATE, channelled.
 CANESCENT, rather hoary.
 CAPILLARY, hairlike.
 CAPITATE, forming a head.
 CARINATE, keeled.
 CARNOSE, fleshy.
 CATENULATE, chainlike.
 CATKIN, a spike of unisexual flowers.
 CAUDEX, the axis of a plant.
 CAULINE, belonging to the stem.
 CHANNELLED, hollowed out like a gutter.
 CHLOROPHYL, the green colouring matter of leaves.
 CILIA, hairlike processes.
 CILIATE, fringed with cilia.
 CIRCINATE, bent circularly.
 CLADOCARPOUS, the fruit terminating a lateral shoot.
 CLAVATE, club-shaped.
 COCHLEARIFORM, round and concave like a spoon.
 COMPLANATE, pressed flat together.
 COMPLICATE, folded.
 COMPRESSED, flattened laterally.
 CONCOLOROUS, of one uniform colour.
 CONDUPPLICATE, folded face to face.
 CONFERVOID, formed of fine threads.
 CONNATE, joined together (base to base).
 CONNIVENT, meeting in one point.
 CONSTRICTED, suddenly narrowed.
 CONVOLUTE, rolled up.
 CORDATE, shaped like the figure of a heart on cards; the point of attachment being at the broader end.
 CORTICAL, belonging to the bark.
 CRENATE, having convex teeth.
 CRENULATE, minutely crenate.
 CUCULLATE, hooded, the apex curved inward like a slipper.
 CUNEATE, wedge-shaped.
 CUSPIDATE, tapering gradually into a rigid point.
 CUTICLE, outer skin of leaf.
 CYATHIFORM, cup-shaped.
 CYLINDRICAL, having a cylindrical figure like a pipe.
 DECUMBENT, reclining on the ground and rising again at the apex.
 DECURRENT, applied to leaves when the lamina runs down the stem below the point of attachment.
 DEFLEXED, bent downward through the whole length.
 DEHISCENCE, mode of bursting.
 DELTOID, triangular.
 DENTATE, toothed, having sharp teeth with concave edges.
 DENTICULATE, minutely toothed.
 DENUDATE, bared of leaves.
 DEPENDANT, hanging down.
 DEPRESSED, flattened horizontally.
 DICHTOMOUS, forked divisions in pairs.
 DIOICIOUS, male and female inflorescence on separate plants.

- DISCOID, like a flat plate.
- DISTANT, applied to the leaves when far away from each other.
- DISTICHOUS, in two opposite rows.
- DIVARICATE, straggling, spreading widely apart.
- DISCRETE, separated and distinct.
- DIVERGENT, spreading outward from the centre.
- ECHINATE, with rigid bristles.
- EDENTATE, without teeth.
- ELATERS, spiral threads with the spores.
- ELONGATED, when any part or organ is in any way remarkable for its length, in comparison with its breadth.
- EMARGINATE, slightly notched at the summit, as if a piece had been cut out.
- EMERSED, protruding upward.
- ENTIRE, not cloven; *quite entire*, not toothed at the margin.
- EPIDERMIS, the cuticular or outer layer of cells.
- ERECT, when any part or organ stands perpendicularly, or very nearly so, to the surface to which its base is attached.
- EROSE, irregularly notched as if gnawed.
- EXPLANATE, spread out flat.
- EXsertED, elevated above the surrounding parts.
- FALCATE, sickle-shaped.
- FASCIATE, all branches reaching an equal height.
- FERTILE, bearing fruit.
- FILIFORM, threadlike.
- FIMBRIATE, fringed with processes.
- FLACID, flabby.
- FLAGELLIFORM, like the thong of a whip.
- FLAGELLUM, a runner, a small branch.
- FLAVESCENT, becoming yellow.
- FLEXUOSE, bending inward and outward.
- FOVEOLATE, impressed with small holes or depressions.
- FREE, not adhering or adnate.
- FRONDose, foliaceous, or in leafy expansions.
- FUGACIOUS, disappearing quickly.
- GALEATE, helmet shaped.
- GEMME, budlike bodies capable of becoming plants.
- GEMMPAROUS, bearing gemme.
- GENICULATE, where any part is bent abruptly, so as to form a decided angle.
- GIBBOUS, very convex or tumid.
- GLABROUS, smooth.
- GLAUcesCENT, faintly glaucous.
- GLAUcous, covered with bluish-white bloom.
- GLOBOSE, nearly spherical.
- GRANULAR, rough on the surface.
- HABIT, general aspect of the plant.
- HABITAT, situation where the plant grows.
- HAMATE, hamulose, curved like a hook.
- HETEROPHYLLOUS, having leaves of more than one form.
- HORIZONTAL, standing off at right angles.
- HYALINE, more or less transparent or translucent.
- HYPOGYNOUS, below the female.
- IMMERSED, covered by the surrounding parts.
- INCISED, cut irregularly and sharply.
- INCLUDED, not extending beyond the surrounding organs.
- INCRASSATE, thickened by internal deposits.

- INCUBOUS, base with the lowest angle on the underside of the stem.
- INCUMBENT, lying upon.
- INCURVED, gradually bending from without inwards.
- INDEHISCENT, without dehiscence, or regular line of suture.
- INFLEXED, bent inward.
- INFLORESCENCE, the general arrangement or disposition of the flowers in a plant.
- INFRA-AXILLARY, originating below the axil of a leaf.
- INNOVATIONS, new growths, or supplementary extensions of the stem.
- INSERTIONS, mode of attachment.
- INTERRUPTEDLY-PINNATE, where the pairs of leaflets in a pinnate leaf are alternately larger and smaller.
- INVOLUCRE, a whorl of bracts free or united, seated below or surrounding the flower or flowers.
- INVOLUTE, rolled inward.
- IRREGULAR, exhibiting a want of symmetry.
- JULACEOUS, smooth, slender, and cylindrical.
- KEEL, a central postical ridge like the keel of a boat.
- LACERATE, irregular, cleft as if torn or lacerated.
- LACINIÆ, small shreds.
- LACINIATE, cut or slashed.
- LACUNÆ, hollows.
- LÆTE-VIRENS, bright green.
- LÆVIGATE, smooth as if polished.
- LAMELLÆ, small plates.
- LAMINA, the expansion of a leaf exclusive of nerve.
- LANCEOLATE, narrowly elliptic and tapering to each end.
- LATERAL, attached to the side (the sides right and left of the axis).
- LENTICULAR, compressed like a double convex lens.
- LEPTODERMOUS, thin-coated.
- LIGNEOUS, woody.
- LIGULATE, strap-shaped.
- LINEAR, a narrow leaf with parallel sides.
- LINGULATE, tongue-shaped.
- LOBATE, or LOBED, divided into or bearing lobes.
- LOBE, any division of an organ; or especially a rounded division or projection.
- LOBULATE, divided into small lobes or lobules.
- LORICATE, equally narrow throughout.
- LUMEN, the internal space or cavity of a cell.
- LUNULATE, crescent-shaped.
- LURIDUS, dirty brown.
- LUTESCENT, pale yellow.
- MALE, a plant or flower which bears antheridia and no pistillidia.
- MAMMILLAR, hemispherical with a projecting papilla.
- MARGINAL, at the edge.
- MARGINATUS, having a border of cells different in form or colour.
- MEMBRANACEOUS, or MEMBRANOUS, thin and semi-transparent.
- MONILIFORM, like a necklace of beads.
- MONOICOUS, male and female inflorescence separate but on the same plant.
- MULTIFID, cleft into many lobes or segments.
- MURICATE, rough, with sharp prominences.
- MURICULATE, minutely muricate.

- NAKED, where any part is exposed or uncovered by other surrounding parts or organs.
- NAVICULAR, boat-shaped.
- NERVE, the mid-rib of leaf.
- NITIDUS, smooth and polished.
- NUCLEATE, with a central substance of greater density.
- OB—, in comparison inversely, as
- OBVATE, inversely ovate.
- OBLONG ELLIPTIC, obtuse at each end, with the longitudinal diameter 3-4 times the transverse.
- OBSOLETE, scarcely apparent.
- OBTUSE, terminating gradually in a rounded end.
- OBTUSIUSCULUS, rather obtuse.
- OCHREACEOUS, brownish-yellow.
- OLIVACEOUS, a dusky-green; of an olive colour.
- OPAQUE, when the surface is dull, or not at all shining.
- OPPOSITE, when similar organs are arranged in pairs over against each other.
- ORBICULAR, circular.
- OVAL, elliptic, and about twice as long as broad.
- OVATE, elliptic with the lower end broader.
- PAGINA, the expanded surface of the leaf.
- PALLID, pale.
- PALMATE, 5-lobed from a centre.
- PAPILLE, small rounded prominences.
- PAPPULOSE, covered with papillæ.
- PARAPHYSES, succulent pointed threads growing with the reproductive organs.
- PAROICOUS, ♂ and ♀ in the same inflorescence, ♂ naked in the axils of the lower bracts.
- PARTITE, divided almost to the very base.
- PATENT, spreading at an angle of 26 - 45 .
- PATENTISSIMA, spreading at right angles or nearly so.
- PATULOUS, spreading at an angle of 46 -90 .
- PECTINATE, comblike.
- PEDICEL, or PEDUNCLE, the fruit stalk.
- PEDICELLATE, having pedicels.
- PEDUNCLE, or PEDICEL, the fruit stalk.
- PENDULOUS, hanging down.
- PERIANTH, the innermost bracts united.
- PERIGONIAL BRACTS, the leaves surrounding or enclosing the pistillidia.
- PERIGONIUM, the involucre of male inflorescence.
- PERIGYNIUM, the involucre of female inflorescence.
- PERSISTENT, remaining a long time.
- PILIFEROUS, ending in a fine weak point or hair.
- PINNATE, having branches on two opposite sides.
- PINNATIFID, divided half-way to the mid-rib in segments in a feathery manner.
- PISTILLIDIA, the male organs.
- PLICATE, plaited.
- PLUMOSE, feathery.
- POLYMORPHOUS, of many forms.
- PORE, a small aperture.
- POSTICAL, the under or rooting face of a stem or branch, or lobe of leaf.
- PROCESSES, divisions.
- PROCUMBENT, spreading on the ground.
- PROLIFEROUS, bearing an excessive development of parts.
- PULVINATE, like a cushion.
- PUNCTATE, with opaque dots.
- PYRIFORM, pear-shaped.

- QUADRATE, square.
 QUADRIFID, cut into four segments.
 QUADRIpartITE, cloven almost to the very base into fours.
 RADICLES, small rooting fibres.
 RADICULOSE, with small rootlets.
 RECURVED, curved back.
 REFLEXED, suddenly bent back.
 REGULAR, symmetrical.
 REPAND, slightly sinuous.
 RETICULATE, having the appearance of network.
 RETUSE, round at the end.
 REVOLUTE, rolled back.
 RHIZOME, a creeping subterranean stem.
 ROSULATE, arranged like a rosette.
 ROTUND, round.
 ROTUNDATE, roundish.
 ROUNDISH, approaching a round form, or merely rounded off at the extremities.
 RUFESCENT, reddish-brown.
 RUPTURING, irregularly bursting.
 SCABROUS, rough with minute warts.
 SCABRULOUS, slightly scabrous.
 SCARIOSE, dry, thin, and semi-transparent.
 SECUND, turned to one side.
 SEGMENT, one of the subdivisions of any part or organ.
 SEMIAMPLEXICAUL, half clasping the stem.
 SEPTATE, having partitions.
 SERRATE, with sharp straight-edged teeth pointing forward.
 SERRULATE, with small serrations.
 SESSILE, without evident pedicle.
 SINUATE, having the margin with alternate concavities and convexities.
 SINUS, the re-entering angle or depression between two projections or prominences.
 SPICATE, where the male flowers are disposed in a spike.
 SPIKE, an inflorescence of male flowers on a stem or branch.
 SPINULOSE, with minute prickles.
 SPORANGIUM, the sac holding the spores.
 SPORES, seeds.
 SPOROgonIUM, the capsule.
 SQUAMOSE, scaly.
 SQUARROSE, spreading out at right angles.
 STELLATE, radiating like a star.
 STIPULES, a foliaceous appendage on the postical side of stem or branch.
 STIPITATE, attached to a stipe or foot-stalk.
 STOLONIFEROUS, producing stolons.
 STOLONS, horizontal or descending shoots from the base of stem with minute leaves.
 STOMATA, air-pores in the epidermis of leaves.
 STRIATE, marked with striæ or slight furrows.
 SUB—, in composition somewhat, as subacute, rather pointed.
 SUBULATE, awl-shaped; WIDELY-SUBULATE, narrowly triangular.
 SUCCUBOUS, base with the lowest angle on the upper side of the stem.
 SULCATE, furrowed, with longitudinal channel.
 SUTURE, line of junction of two parts.
 SYNOICOUS, antheridia and pistillidia in one inflorescence.
 TEREte, cylindric and tapering.
 TRANSVERSE, in a plane perpendicular to the axis, or longitudinal direction.
 TRIDENTATE, having three toothlike divisions.
 TRIFARIOUS, ranged in three rows.
 TRIFID, three cleft midway to the base.

- TRIGONOUS**, having three faces.
- TRILOBATE**, three-lobed.
- TRIPARTITE**, parted nearly to the base in three divisions.
- TRIQUETROUS**, triangular.
- TRISTICHOUS**, disposed in three rows.
- TRUNCATE**, cut off abruptly.
- TUBERCULATE**, covered with minute knobs.
- TUBULAR**, hollow and cylindrical.
- TURBINATE**, top-shaped.
- TURGID**, slightly swollen.
- UMBRACULIFORM**, umbrella-shaped.
- UNCINATE**, hooked, curved back at point.
- UNDULATE**, with an alternately convex and concave margin.
- UNEQUAL**, the two sides not symmetrical.
- UNGUICULATE**, ending in a point like a claw.
- UNISERIATE**, disposed in a single row.
- URCEOLATE**, pitcher shaped.
- VAGUELY**, without any definite direction.
- VALVES**, distinct portions of the capsule which become detached by dehiscence in a definite manner.
- VENTRICOSE**, unequally swelling on one side, or swelling in the middle.
- VERRUCOSE**, covered with wartlike prominences.
- VERRUCULOSE**, when the warts are small and abundant.
- VERTICAL**, standing quite erect.
- VESICULAR**, inflated like bladders.
- WHITISH**, not pure white.

CONSPECTUS HEPATICARUM

(*Spruce*).

Suborder I. JUNGERMANIACEÆ.

Vegetation foliose, in a very few species frondose. Fruit solitary, pedicellate, capsule quadrivalvate, very rarely irregularly rupturing. Elaters mixed with the spores. Androëcia spicate, often amentiform; antheridia enclosed in leafy bracts, in a few frondose species only either scattered or seriate upon the stem and ebractate.

Tribe I. JUBULEÆ.

Ramification always lateral, *i.e.* having distichous, for the most part infra-axillary branches arising from among the lateral leaves only, never from the stipules. Leaves always alternate, incubous, complicato-bilobate, the smaller inferior lobule generally inflated or saccate. Stipules present in nearly all species, radiculose; in a few species absent, in which case the radicles are in two rows along the stem, in a very few species they are duplicate (that is, in two rows). Flowers ♂ most frequently diandrous, in a few species monandrous. Flowers ♀ monogynous or 1-4-gynous. Perianth always present, free, more or less frontally compressed, 2-12-angled, constricted at the apex, shortly tubular. Calyptra constantly free both from the perianth and the pistillidia. Capsule on a short pedicel, globose, quadrivalvate for only two-thirds of its length from the apex, the lower third being undivided and forming a neck or apophysis, which is really the dilated apex of the pedicel. Elaters monospiral, truncate, persistent.

Tribe II. JUNGERMANIÆ.

Ramification various, lateral or partly postical (floral branches principally); rarely all postical, very rarely antical. Leaves incubous, transverse or succubous, alternate or opposite; very various in form, subexplanate or concave, entire or very often divided, but very rarely complicato-bilobate. Stipules in some genera constantly present, in others very rare or absent. Flowers ♀ in some always monandrous, in others oligandrous, in very few polyandrous. Flowers ♂ oligo-polygynous; pistillidia 5-80, free, or when in fruit more or less adnate to the calyptra. Perianth very variable; complanate, trigonous or polygonous, rarely perfectly terete, mouth wide or constricted; sometimes really or apparently absent, in a few species forming a fleshy pendulous pouch. Calyptra usually free, in some species adnate to the perianth or involucre. Capsule globose, oblong or cylindrical, quadrivalvate to the base, dehiscing irregularly in very few species. Elaters in almost all cases dispiral, rarely monospiral or 3-4-spiral, deciduous; sometimes a few heteromorphous elaters persist a little longer than the rest either at the base or the apex of the capsule, but finally fall away in the same manner as the normal ones.

A. Elaters normally dispiral.

a. Radicles arising from the lobule of the leaves.

Subtribe I. RADULÆ.

Plants rather large, prostrate, dichotomous or laxly pinnate. Branches all lateral, infra-axillary. Leaves incubous, complicato-bilobate, the inferior lobule smaller, radiculose. Stipules none. Flowers ♂ 1-3-androus. Perianth almost always frontally compressed, sometimes complanate, with a wide truncate mouth. Capsule in almost every instance oblongo-cylindrical.

b. Radicles arising from the stem or from the postical stipules.

Subtribe II. PORELLEÆ.

Plants large, handsome. Stems springing from a creeping radiculose caudex, plumæformi-pinnate or bipinnate, somewhat radiculose, all the branches lateral and infra-axillary. Leaves incubous, complicato-bilobate, the inferior lobule decidedly smaller and ligulate. Stipules of equal size with the lobules, now and then radiculose. Inflorescence dioicous. Flowers ♂ constantly monandrous. Flowers ♀ terminal on an extremely short lateral branch (*i.e.* cladogenous.) Perianth compressed a little at the front, trigonous, the third angle postical, 3–10 plicate, the laciniolate mouth at first contracted, finally gaping or bilabiate. Calyptra free. Capsule large, globose, quadrivalvate to the base; the valves often imperfectly separated at the base and irregularly lacerate.

Subtribe III. PTILIDÆ.

Plants usually large, often beautifully coloured, whitish, yellowish, or rosy, sometimes blood-red. Stems in most cases arising from a creeping radiculose, often also flagelliferous caudex, pinnately or indefinitely ramose, sub-radiculose, branches either all lateral or some postical, but the female flower always terminal on the stem or on a longer or shorter lateral (never on a postical) branch. Leaves incubous, transverse or succubous, nearly of the same size and of the same shape as the stipules which are always present, canaliculate, but very rarely complicate, bi-multifid, often elegantly ciliate or torn into capillary laciniae. Inflorescence dioicous in every species (with the sole exception of *Anthelia Juratzkana*?). Flowers ♂ in species with succubous leaves, monandrous; in those with incubous leaves, generally diandrous. Female bracts in several pairs, either all free or the inner ones adnate to the perianth, sometimes to the calyptra. Perianth (when present) very slightly, frontally compressed, traversed by 3–10 keels or folds, rarely ecarinate, constricted or truncate at the mouth, free from the inner bracts or, in some genera, adnate to and covered up by them; sometimes absent. Calyptra

free, or in some species which are without perianth covered with the inner bracts. Capsule either globose, thick with many cell-rows, straight-valved, or cylindrical of two cell-rows, with contorted valves, the valves being sometimes bifid. Elaters slender, dispiral.

Subtribe IV. TRIGONANTHÆ.

Plants minute or rather large, from green becoming pale, rarely dull purple or subroseate. Stems most frequently prostrate or procumbent, indefinitely or pinnately ramose, or dichotomous, postical flagella almost bare of leaves, being often superadded. Foliaceous branches lateral or in some occasionally all postical; those bearing female flowers postical in almost every species, only terminal in a few *Cephalozia*. Leaves alternate, rarely opposite, succubous or incubous, varying in form, more or less deeply divided from the frequently broad truncate apex into 2-4 or rarely into 6 teeth or lobes, seldom quite simple; in very few species are they complicate with the postical lobe; margin generally quite entire, flat or incurved, never recurved. Stipules either wanting or small; in a few instances not much less in size than the leaves and nearly similar in shape to them.

Flowers ♀ standing on a postical branch, very rarely on a lateral branch or terminal on the stem itself; ♂ monandrous, very rarely diandrous. Female bracts trijugate and tristichous, in a few species distichous. Perianth nearly always long and narrow, trigonous, the third angle postical, rarely 4-6-angled by reason of the other angles being intercalated, all the latter wingless and without teeth; free both from calyptra and involucre (except that of *Kantia*, which instead of a perianth has a pouch grown together on the insides to the calyptra). Calyptra generally small, free, except in *Kantia*. Capsule most frequently oblong or cylindrical of a double series of cells (in a few genera there are 4-5 strata of cells), valves straight, twisted in *Kantia* only. Elaters slender, dispiral.

Subtribe V. SCAPANIOIDEÆ.

Plants handsome and large leaved, often remarkable for their colour, which is roseate, whitish, or yellowish. Stems arising from a creeping caudex, erect or inclined downwards, sub-radiculose, producing only a few lateral branches. Leaves alternate, transverse complicato-bilobate with the antical lobule the smaller, in most cases beautifully denticulate or ciliated at the margin, sometimes even lobulate, naked, or in some species lamellose or pilose on the upper surface. Stipules absent in most species but present in a few, somewhat large bilobate and incised. Flowers terminal on the stem, dioicous, rarely paroicous; males di-polyandrous. Female bracts in most species somewhat similar in shape to the leaves but more equally lobed. Perianth in typical species emersed, free, frontally compressed, often complanate and decurved with a truncate mouth; in a few others less compressed and 5 to many-folded. Capsule robust, oblong, sometimes very long. Elaters dispiral. Perhaps it might be better to regard this subtribe as a section of the following; but it may easily be recognised by its peculiar habit and complicate leaves, having the antical lobe the smaller (and not the postical as in *Radula*, &c.).

Subtribe VI. EPIGONIANTHEÆ.

Plants very rarely small, often large and robust, varying in colour from green to whitish or yellowish, sometimes purplish, less frequently rosy. Stems either arising from a creeping caudex and almost all rootless, or prostrate and more abundantly radiculose, irregularly branched or dichotomously, rarely pinnate. Branches almost always lateral, springing from the middle or from the postical angle of the axil, very rarely truly postical, that is, axillary with the stipules. Leaves succubous or transverse (never incubous), alternate or opposite, somewhat large, simple, bifid or 3-5-fid; the margin in the small species quite entire as a rule, in the larger ones very often ciliate or with spiny teeth, often much recurved at the antical portion of the base.

Stipules generally absent or small, rarely of a moderate size; in some species with opposite leaves (e.g. *Lophocolea*, *Chiloscypha*, and *Leioscypha*) connate at each side with the adjacent leaf, and there forming a three-leaved whorl; in the opposite leaved *Plagiochilæ*, however, they are wanting. Inflorescence dioicous or monoicous, acrogenous, very rarely hypogenous. Male bracts 1-10-androus. Female bracts 1-5-jugate, generally more incised than the leaves, free, or in a few species adnate to the perianth for a longer or shorter distance, or finally performing the functions of an imperfectly monophyllous perianth or where the same is evidently deficient. In genera which have a pouch instead of a perianth the inner bracts are very often minute and surround the mouth of the pouch. Perianth perfect and normally compressed at the side; in some it is complanate (at least in the upper part) and two-edged with a very broad truncate or bilabiate apex, the sutures (both antical and postical) being frequently winged; but in those species which have rather large stipules it is often trigonous with the third angle in front; again, in some it is more inflated trigonous, seldom terete, small-mouthed. Capsule very often more or less oblong, of many series of cells. Elaters dispiral, very rarely monospiral.

Subtribe VII. FOSSOMBRONIEÆ.

Plants foliose or very often frondose, prostrate as a rule, radiculose, but in *Scalia* fixed to the matrix by a branched rhizomatous base, absolutely rootless; sub-dichotomous, the frondose species being very rarely postically sub-ramose. Stem generally sub-plane-convex, quite distinct from the lamina of the frond; or very broad and merging into the lamina on each side. Leaves (when any) succubous, rather broad, often slightly fleshy, turning flaccid in drying. Stipules absent, except in *Scalia*. Fronds linear or obovate, quite entire or serrulate, sometimes pinnatifid, in *Petalophyllum* lamellose on the upper side. Male flowers submarginal along the whole length of the stem; antheridia binate to quinate, scarcely covered with the leaves; in some

species both foliose and frondose hidden in twos and threes, in small cavities of the epidermis arranged on both sides of the stem; or in others contained in open monandrous cavities supplied with a minute incurved bract. Perianth incompletely tubular (perfectly so in *Pallavicinia* only); in many species, however, none is present. Calyptra not often small, generally long and fleshy, free from the involucre and perianth, but often more or less deeply concrete with the receptacle. Sterile pistillidia either more or less deeply adnate to the calyptra (sometimes only at the apex), or always arranged along the stem, naked. Capsule in typical plants subglobose, formed of 2-5 series of cells, dehiscing more or less irregularly.

B. Elaters monospiral, very acute at each end; but a few short apical ones persisting longer.

Subtribe VIII. METZGERIÆ.

Plants frondose, dichotomous or pinnately branched, the laciniaë linear; branches in the genus *Aneura* all lateral, the nerve broad laxly cellulose, radiculose beneath, lamina none or very narrow, rarely of moderate breadth; in the other genus, *Metzgeria*, branches extremely seldom lateral and pinnate, all the floriferous ones (sometimes even those that do not bear flowers) postical, radicles springing from the nerve and the margin, now and then from the whole surface. Reproductive organs of both sexes distichous on the nerve of a shortened branch; pistillidia 2-20 pairs, styleless; antheridia very frequently more numerous, very rarely tetrastichous. Perianth none. Calyptra large, obovate, fleshy, in *Aneura* very often papillose, in *Metzgeria* hairy with radicles. Capsule elongate, quadrivalvate to the base, of two series of cells. Apical elaters fixed and interwoven with others that are free, stretched out in four pencils above the open capsules.

Suborder II. MARCHANTIACEÆ.

Fronds more or less fleshy, prostrate, broadly and indistinctly nerved, venoso-areolate on the upper surface, areolæ as a rule with one pore, with a cavernous stratum below the pores; dichotomous, sometimes putting out postical frondules, villous beneath with very long radicles. Very long hair-like fasciculated water-carrying ductules fill up the canal beneath the nerve, which afterwards ascend into the capitulum through the little canals in the peduncles. Inflorescence in almost all species dioicous, acrogenous, or epigenous. Andrœcia either peltate and stipitate or discoid and half immersed; antheridia solitary in the cavities. Female capitula supported on a stout peduncle continuous with the nerve of the frond, from 2 to many-flowered, orbiculate, hemispherical or conical, generally lobate, paleaceous beneath, chambered within the locali looking downwards. Involucre of each loculus one or many-flowered or none. Perianth arcuate, delicate, split into equal segments, rarely absent. Pistillidia from two to twelve set in two rows on a short receptacle. Calyptra thin, often persistent only at the base. Capsule with a short pedicel, globose, of one row of cells, either splitting all round or 4-8-fid from the vertex. Elaters 1-5-spiral, deciduous.

Suborder III. RICCIACEÆ.

Fronds cellulose, fleshy, furnished with a stratum of air-cavities beneath the epidermis, in most instances dichotomous. Fruit valveless, generally immersed in the frond. Involucre most frequently and perianth always absent. Capsule either free or connate and confused with the calyptra, globose, bursting irregularly. Elaters none. Antheridia immersed in the frond.

Suborder IV. ANTHOCEROTACEÆ.

Fronds tender, slightly fleshy or thin, becoming flaccid by drying, radiculose beneath but without paleæ; orbicular, lobate at the circumference, nerve very broad, confused with the lamina.

Epidermis without pores, sometimes marked with dark gonidia bearing cells. Inflorescence monoicous or dioicous, antical (*i.e.* epigenous). Antheridia immersed in cavities scattered over the frond, covered, solitary or few, rarely numerous. Involucre shaped like a horn with an oblique scarious mouth. Perianth and calyptra none. Oogonia solitary, naked, nestling in the substance of the nerve. Fruit pedunculate, siliquoid, two-valved, traversed by a columella or dissepiment. Elaters either mono-spiral or containing only a flexuose (not spiral) fibre.

ORDER **HEPATICÆ.**

Suborder I. *JUNGERMANIACEÆ.*

Tribe I. *JUBULÆ.*

Genus I. **FRULLANIA**, *Raddi.*

Frullania, Raddi, Jung. Etr. in Act. Soc. Modena, xviii. p. 20 (1820).

Salviatus, Gray and Bennett, Nat. Arr. Br. Pl. ii. p. 687 (1821).

Jubula, Dum. Comm. Bot. p. 112 (p.p.) (1822).

Plants usually large, rarely small, depresso-cæspitose and stratified, often pendulous, somewhat firm, colour rarely green, often reddish brown, sometimes almost black, in a few species rosy, rarely shining. Stems firm, terete, opaque, cells small, pinnately branched; branches exactly axillary, more contiguous to the lobe than to the lobule; true subloral innovations wanting. Leaves standing on a very small base, rarely half-embracing the stem, almost exactly transverse complicato-bilobed; antical lobe larger, obliquely ovate or suborbiculate, convex, incubous, often at the antical base semicordate, quite entire, very rarely denticulate near the apex; lobule cucullate, galeiform or saccate (campanulate or digitiform), rarely evolute ovato-lanceolate, bipartite interior segment, the one nearest the stem small or minute, triangular, subulate or styliiform. Cells usually small, in others minute, in a few medium, almost subequal, globose-hexagonal; walls thickened, trigones and angles conspicuous. Stipules constantly present, large, but smaller than the leaves, orbicular, oblong or cuneate, base often cordate or crispato-auriculate, rarely subdecurrent, apex bifid (in a few species entire). Rootlets where present produced

from the hilum at the middle base of the stipule, usually short, dark-coloured and stellately spreading. Inflorescence dioicous or monoicous (rarely paroiicous). Andrœcia usually situated on abbreviated branches, globose oblong or cylindrical, bracts crowded 2- (rarely 3-4-) androus. Gynœcia always terminal, acrogynous or cladogynous. Bracts 2-5-pairs, larger than the leaves, lobule larger and evolute, often dentate or laciniate. Perianth almost always projecting, oval or obovate, trigonous, third angle postical or tetragonous, with postical angles two in number, usually smooth, a few species tuberculate, apex constricted, rostellate. Pistillidia 2-4. Calyptra pyriform or obovate, fleshy, below often 6-8 cells thick. Pedicel short, 8 or 9 cells in diameter, 32 cells in circumference. Capsule globose, inner layer papilloso spongy, dividing nearly to the base into 4 valves. Elaters 1 rarely 2-4 spiral. Spores moderately large, reddish, tuberculate, verruculose or rough.

1. *Frullania Tamarisci* (L.), Dum.

Lichenastrum imbricatum, *Tamarisci narbonensis facie*, Dill. Hist. musc. p. 499, t. 72, fig. 31 (1741).

Jungermania Tamarisci, Linn. Sp. pl. 1600 (1753); Hook. Brit. Jung. n. 6 (1816).

Frullania Tamarisci, Dum. Recueil Jung. p. 13 (1835).

Monoicous, densely or loosely stratified, large, reddish-brown or blackish in colour, rarely dark green. Stems prostrate, imbricate, pinnate, branches patent, alternate, unequal in length, beset with still shorter branchlets; radiculose, rootlets reddish-brown, in dense bunches proceeding from the base of the stipules. Leaves distichous, alternate, closely imbricate, horizontal or patent-divergent, unequally bilobed, antical lobe convex, slightly involute, subrotund or ovate-rotund, apex obtuse or acute, postical lobe about 4 times smaller than the antical, much smaller than the stipules, parallel with the stem, cylindrical or obovate, saccate, sometimes evolute, then oblong-ovate, convex on the under surface. Epidermis polished, cells very small to small, roundish-quadrate, walls thick, angles thickened, moniliform cells more or less present which are larger and darker than the others. Stipules

large, about twice as broad as the stem, subquadrate, longer than broad, decurrent, hastate, sagittate or calcarate, apex bidentate, sinus acute, segments acute or obtuse, margin revolute. Flowers γ terminal on short branches, proceeding from chief stem or branches. Bracts larger than the leaves, unequally bilobed, antical lobe ovate, lanceolate, acute or acuminate, margin coarsely and irregularly serrate, postical lobe smaller lanceolate acuminate, margin irregularly serrate, remarkably revolute. Bracteole oblong, bifid to about the middle, segments lanceolate, subulate, recurved, margin lacinate. Perianth oval or obovate, obtusely tricarinate, rostellate, smooth. Calyptra obovate or pyriform, yellowish-white, sub-carnose. Pedicel short. Capsule spherical, pale reddish-brown. Spores brownish. Elaters the same.

Male plant more slender than the female, amentula spherical on short lateral branches, perigonial bracts 3 to 4 pairs, turgid, sub-equally bilobed, lobes oval; perigonial bracteole ovate, bifid, segments and sinus sub-acute, margin plane; antheridia oval, 2 or 3 in each bract.

DIMENSIONS.—Stems 1 to 3 inches long, with leaves 1.25 mm. wide, diameter of stem .2 mm.; leaves, antical lobe 1.1 mm. \times .8 mm., postical .3 mm. \times .2 mm., antical .8 mm. \times .8 mm., postical .2 mm. \times .15 mm., antical .6 mm. \times .5 mm., postical .25 mm. \times .1 mm.; cells .0175 mm., .02 mm. \times .015 mm.; stipules .6 mm. \times .35 mm.; segments .2 mm., .6 mm. \times .6 mm., seg. .1 mm., .45 mm. \times .3 mm., seg. .2 mm.; bracts, antical lobe 1.25 mm. \times .6 mm., postical .9 mm. \times .25 mm.; bracteole .1 mm. \times .6 mm., seg. .5 mm., perianth .2 mm. \times .8 mm.; perigonial bract .5 mm. \times .3 mm., perigonial bracteole .4 mm. \times .25 mm.; seg. .15 mm.; antheridia .175 mm. \times .15 mm.

HAB.—Spreading in large patches, sometimes of great extent, on trees, stone walls, and rocks, in exposed or shaded places. Common, but often sterile.

1-17. I.

OBSERVATIONS.—This, the commonest of the British *Frullania*, is distinguished from *F. dilatata* (L.) by its larger size, proportionately smaller and more cylindrical postical lobes, margin of

stipules entire, antical lobes of bracts serrate, and smooth perianth. From *F. germana* Tayl. and *F. microphylla* (Gott.). See notes with those species.

DESCRIPTION OF PLATE I.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 24$ (C. and P. Hep. Brit. n. 48). 3. Ditto, postical view $\times 24$ (ditto). 4. Leaf $\times 24$ (ditto). 5, 6. Antical lobes of leaf $\times 24$ (ditto). 7. Postical lobe of leaf $\times 85$ (ditto). 8. Leaf and stipules $\times 24$ (Loch Lomond, Gourlie). 9. Portion of leaf $\times 290$ (C. & P. n. 48). 10–12. Stipules $\times 24$ (ditto). 13. 2nd sub-bracts and sub-bracteole $\times 24$ (Loch Lomond, Gourlie). 14. Sub-bracts $\times 24$ (ditto). 15. Bracts $\times 24$ (ditto). 16. Bracteole $\times 24$ (ditto). 17. Perianth $\times 24$ (ditto). 18. Cross-section of perianth $\times 24$ (ditto). 19. Perigonal bracts and bracteole $\times 24$ (Croatia, Klingraff).

2. *Frullania microphylla* (Gottsche), Pears.

Frullania Tamarisci (L.) var. *microphylla*, Gottsche ex Carrington in Trans. Bot. Soc. Edin. vii. 457 (1863).

Frullania microphylla (Gottsche) Pears. in "Journ. of Bot." (1894).

EXSICC. Gottsche & Rabenh. Hep. Eur. n. 209 & 636; Carr. & Pears. Hep. Brit. Fasc. ii. n. 137.

Dioicous, shallowly cæspitose, small, reddish-brown to brownish-black. Stems procumbent, dichotomously branched or pinnate, radiculose; rootlets fasciculate, dirty white, produced from base of stipules. Leaves incubous, closely imbricate, horizontal, unequally bilobed, antical lobe crossing the stem, convex, broadly oval, rotundate, postical lobe about three times smaller, saccate, oval, erect, with apex inclined towards the stem; epidermis slightly polished; cells small, 4-, 5-, and 6-angled; walls thick; leaves crossed obliquely by a line of slightly larger and darker moniliform cells. Stipules approximate, nearly twice as broad as the stem, oval, ovate or obovate, bifid to about the middle; sinus subacute; segments obtuse, subacute or acuminate; margin entire. Bracts about twice as large as the leaves, unequally bilobed; antical lobe oblique, acute; margin serrate-dentate; postical about two-thirds smaller, subrhomboid or broadly lanceolate, acute or

acuminate, irregularly serrate-dentate, sometimes with a large segment on the inner margin near the base; bracteole oval, bifid to nearly the middle; sinus obtuse; segments lanceolate, acuminate; margin serrate-dentate. Perianth projecting about half beyond the bracts; antical side carinate; postical smooth, convex; epidermis smooth; cells similar to leaf-cells, only with the dark ones irregularly dispersed; apex slightly rostellate. Capsule subspherical; valves with seven trumpet-mouthed elaters attached to each, unispiral. Male stems irregularly bipinnate; catkins small, on short lateral branches, globose; perigonial bracts 2-3 pairs, turgid at the base, unequally bilobed; antical lobe broadly oval; postical rather smaller, oval; antheridia with long bearers, subglobose.

DIMENSIONS.—Stem $\frac{1}{2}$ – $\frac{3}{4}$ in. long, with leaves .6 mm. wide; diam. of stem, .075 mm.; leaves, antical lobe, .35 mm. \times .275 mm., postical lobe .175 mm. \times .1 mm., antical .35 mm. \times .25 mm., postical .15 mm. \times .1 mm., antical .45 mm. \times .3 mm., postical .2 mm. \times .15 mm.; cells .02 mm., .0175 mm., .02 mm. \times .0175 mm.; stipules .2 mm. \times .125 mm.; segments .11, .275 mm. \times .175 mm.; seg., .15 mm.; bract, antical lobe .75 mm. \times .4 mm.; postical .5 mm. \times .25 mm.; bracteole .4 mm. \times .25 mm.; seg. .225 mm., .275 mm. \times .15 mm.; seg. 125 mm.; perianth 1.0 mm. \times .5 mm., 1.25 mm. \times .55 mm.; valves of capsule .3 mm. \times .275 mm.; elaters .225 mm. \times .02 mm.; diameter of pedicel .3 mm.; male catkins .4 mm. \times .4 mm.; perigonial bract, antical lobe .4 mm. \times .275 mm.; postical .3 mm. \times .175 mm.; antheridia .125 mm. \times .1 mm.

HAB.—On smooth face of rocks and on trees in exposed or shaded places, mostly near the coast, in shallow patches, closely attached to the rocks or trees. Rare. 1. The Lizard, W. Cornwall, *W. Curnow*, July 1883. St. Mary's, Scilly, *W. Curnow*, July 1872. 7. Barmouth, Merioneth, *W. H. P.*, June 1878. 10. Ingleton, Yorks, *Webster and Pearson*, May 1893. South of Ireland, Old Weir Bridge, Killarney, *Carrington*, 1861. Glengariff, *Carrington*, 1861, *G. E. Hunt*.

Obs.—For several years I have considered *Frullania Tamarisci*

var. *microphylla* Gotts. to have well-marked specific characters, but whilst the late Drs. Carrington and Spruce did not think fit to raise it to specific rank, I refrained from publishing it as such. Dr. Spruce wrote me some time before he died that he considered it had good claims to specific rank, adding that he had Carrington's and Hunt's specimens from Glengariff, &c., and Curnow's from Cornwall, and found them essentially different from *F. Tamarisci*.

Herr Stephani, to whom I have submitted descriptions and specimens, writes: "This is doubtless a good species. The differences between *F. fragilifolia* Tayl. and it are—

<i>F. fragilifolia</i> :	<i>F. microphylla</i> :
stouter.	smaller.
postical lobes cucullate.	postical lobes longer, saccate.
stipules cuneate, segments truncate, $\frac{1}{4}$ only bilobed.	stipules oblong, segments acuminate, $\frac{1}{2}$ bilobed.
bracts ♀ obtuse, mamillately dentate.	bracts ♀ acute, spinosely dentate.
innermost bracteole large, segments ovate, apex acute, on one side connate with leaf.	innermost bracteole small, segments lanceolate, apex subulate, on both sides free.

"There is little difference in the cells, but the dotted line of large brown cells is uninterrupted in *F. microphylla*, and consists of single scattered cells in *F. fragilifolia*."

This is certainly the species which it resembles most in size and habit, from which it also differs in the persistent leaves, which have a broader base at their insertion; the perianth is also smaller and oval. It differs from *F. Tamarisci* in its much smaller size, leaves more oval, with relatively larger postical lobes, stipules oblong, and not at all calcarate; from *F. dilatata* in its smaller size, more oval leaves with dotted moniliform cells, stipules with margin entire, antical lobe of bract serrate, and smooth perianth.

DESCRIPTION OF PLATE II.—Fig 1. Plant natural size. 2. Portion of stem with perianth, antical view $\times 24$. 3. Portion of stem, postical view $\times 64$. 4, 5. Leaves, postical view $\times 24$.

6-8. Ditto, antical view $\times 64$. 9. Portion of leaf $\times 290$.
 10, 11. Stipules $\times 64$. 12. Bract $\times 64$. 13. Bracteole $\times 64$.
 13. Cross-section of perianth $\times 24$. 15. Male catkins $\times 64$.
 16. Perigonial bract $\times 24$. 17. Ditto, explanate $\times 24$. 18.
 Antheridium $\times 64$ (Barmouth, W. H. P.)

3. *Frullania fragilifolia*, Taylor.

Frullania fragilifolia, Tayl. in Ann. and Magaz. of Nat. Hist. p. 172 (1843).

Dioicous, creeping, shallowly caespitose or substratified, small, dark reddish-brown in colour. Stems procumbent, irregularly pinnate or sub-bipinnate, branches alternate; radiculose, rootlets fasciculate, hyaline, proceeding from the base of the stipules. Leaves imbricate or approximate, horizontally and obliquely inserted, from a narrowed base, fragile, caducous, unequally bilobed, antical lobe convex, subrotund or suborbicular, entire, postical lobe about 3 times smaller, cucullate, oval or oblong, sometimes pendant below the antical lobe; epidermis not polished, cells unequal in size, small to smallish, few largish, the large ones, which are darker and contain oil-granules, are irregularly disposed over the leaf or rarely monoliniate, walls firm, trigones small. Stipules 2 to 3 times as wide as the stem, persistent, obovate or broadly obovate, sometimes cuneate, plane, adpressed to the stem, bifid to $\frac{1}{4}$ or $\frac{1}{3}$, sinus acute or obtuse, segments acute or obtuse. Flowers φ terminal; bracts much larger than the leaves, 2-4 pairs, closely imbricate, subequally bilobed, antical lobe broadly oval or spatulate rotundate, irregularly and obtusely dentate, postical lobe rather smaller, oval or oval-oblong, rotundate or obtuse, irregularly dentate. Bracteole oblong-quadrangle, bifid to the middle or below, segments oblong or ovate, acute or obtuse, connate with leaf on one side, 2nd sub-bract with antical and postical lobes dentate, 3rd and 4th sub-bracts with antical lobes entire or slightly irregularly dentate. Perianth projecting about half beyond the bracts, broadly obovate, unicarinate anticallly, concave postically, epidermis smooth. Male stems more regularly pinnate, catkins subrotund, broader than long, or

globose, on short lateral branches, proceeding from the main stem. Perigonial bracts 2, 3 pairs, larger than the stem leaves, unequally bifid, turgid, antical lobe oval-orbicular, postical lobe smaller, oval; perigonial bracteole oblong-quadrata, bidentate. Antheridia oval-orbicular.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, with leaves .75 mm. wide, diameter of stem .1 mm., leaves, antical lobe .5 mm. \times .3 mm., postical .175 mm. \times .11 mm., antical lobe .375 mm. \times .3 mm., postical .175 mm. \times .125 mm., antical .3 mm. \times .3 mm., antical .4 mm. \times .3 mm.; cells .025 mm. \times .0175 mm., .02 mm. \times .02 mm., .03 mm. \times .03 mm., .035 mm. \times .035 mm.; stipules .275 mm. \times .215 mm.; segments .075 mm., .25 mm. \times .2 mm., segments .0175 mm.; 3rd sub-bract, antical lobe .275 mm. \times .175 mm., postical lobe .175 mm. \times .05 mm., 2nd sub-bract, antical lobe .35 mm. \times .2 mm., postical .3 mm. \times .15 mm.; bract, antical lobe .375 mm. \times .25 mm., postical .35 mm. \times .15 mm.; bracteole .375 mm. \times .3 mm.; segments .225 mm., .35 mm. \times .275 mm., seg. .2 mm.; perianth 1.5 mm. \times .1 mm.; perigonial bract, antical lobe .6 mm. \times .5 mm.; postical .5 mm. \times .3 mm.; perigonial bracteole .3 mm. \times .1 mm.; antheridia .15 mm. \times .125 mm.

HAB.—On exposed or shaded rocks, more rarely on trees. Rare. 1. Culval Carn, Penzance, *W. Curnow*. Carn near West Trevallo, *W. Curnow*. Coast near Gurnard's Head, Cornwall, *Curnow and Marquand*. St. Mary's, Scilly, *W. Curnow*. 7. Barmouth, Merionethshire, *Dr. Carrington, G. A. Holt, C. J. Wild, and W. H. P.* Tyn-y-Groes, Merionethshire, *G. A. Holt*. Snowdon, Carnarvon, *Dr. Carrington*. Pass of Llanberis, Carnarvon, *W. H. P.* 10. Near Sedbergh, Yorks, *M. B. Slater*. 12. Windermere, Westmorland, *G. Stabler*. Kentmere, Westmorland, *G. Stabler*. 15. Trossachs, Perthshire, *Dr. Carrington*. Feugh Rocks, Strachan, Aberdeenshire, *J. Sim*. 16. Invermoidart, West Inverness, *S. M. Macvicar*. Killarney, *Dr. Taylor, Dr. Carrington*, and others.

Found on the Continent.

OBS.—Remarkable for its caducous leaves; having a very narrow base at insertion, they fall off when dry on pressure,

leaving the stem more or less naked whilst the stipules remain attached.

Distinguished from *Frullania microphylla* (Gott.), which it resembles most in size, by its fragile leaves, the antical lobes of bracts being rotundate at the apex, with margin irregularly dentate.

From *Frullania Tamarisci* (L.), by its smaller size, fragile leaves, with irregularly dotted cells, stipules, bracts and perianth different.

From *Frullania dilatata* (L.), by its smaller size, reddish tinge, fragile leaves, irregular dotted cells, different shape of stipules, bracts, and smooth perianth, not tuberculate.

DESCRIPTION OF PLATE III.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 24$ (Stockholm, S. O. Lindberg), 3. Leaf $\times 64$ (Barmouth, Holt). 4–6. Antical lobes of leaves $\times 64$ (Barmouth, W. H. P.). 7. Postical lobe $\times 64$ (ditto). 8, 9. Portions of leaf $\times 290$ (ditto). 10, 11. Stipules $\times 64$ (Barmouth, Holt). 12. Ditto, $\times 64$ (Kentmere, Stabler). 13, 14. Bracts $\times 24$ (ditto). 15. Bracteole $\times 64$ (ditto). 16. Ditto, $\times 64$ (Stockholm, Lindberg). 17. 2nd sub-bract $\times 64$ (Kentmere, Stabler). 18. 3rd sub-bract $\times 64$ (ditto). 19. Perianth $\times 24$ (ditto). 20. Male catkin $\times 31$ (Barmouth, Holt). 21. Perigonal bract $\times 24$ (ditto). 22. Perigonal bracteole $\times 24$ (ditto). 23. Antheridium $\times 64$ (ditto).

4. *Frullania germana*, Taylor.

Frullania germana, Tayl. Trans. Bot. Soc. Edin. ii. p. 45; Ann. Nat. Hist. p. 173 (1843).

Frullania Tamarisci (L.). var. *germana*, Carr. Trans. Bot. Soc. Edin. (1863).

Dioicous, loosely and shallowly caespitose, largish, olive to reddish-brown in colour. Stems procumbent, bipinnate, branches complanate, patent, short. Leaves imbricate, horizontal, unequally bilobed, antical lobe crossing the stem, ovate to subreniform, acute or rotundate, entire, apex inflexed, postical lobe 4 to 6 times smaller, galeate or cylindrical, oblong-ovate, ventricose, or when evolute oblong, concave; texture somewhat thin, epi-

dermis dull, not polished; cells small, roundish, walls very thick, basal cells larger, oblong or almost rectangular, moniliform cells wanting. Stipules distant or approximate, two to three times as broad as the stem, subrotund, bifid to about $\frac{1}{3}$, segments acute, sinus obtuse or subacute, margin entire, recurved. Bracts unequally bilobed, antical lobe oval-acuminate, margin entire, postical lobe 3 to 4 times smaller, lanceolate-acute or narrowly triangular-acuminate, margin entire, recurved. Bracteole oblong-oval, bifid to about the middle, sinus obtuse, segments lanceolate-acute, margin entire, slightly recurved. Perianth oblong-ovate, tricarinate, epidermis smooth, slightly rostellate. Capsule subspherical; spores brown, elaters pale brown. Male plant narrower than the female, catkins linear; perigonal bracts 15 to 25 pairs, closely imbricate, subequally bilobed, antical lobe oval, acute; postical slightly smaller, unidentate; ventricose; antheridia subglobose.

DIMENSIONS.—Stem 1 to 3 inches long, with leaves .2 mm. broad, diameter of stem .15 mm.; leaves, antical lobe 1.4 mm. \times .8 mm., postical (evolute) .6 mm. \times .2 mm., antical 1.2 mm. \times .85 mm., postical .35 mm. \times .2 mm.; cells .02 mm., .025 mm. \times .02 mm., .02 mm. \times .015 mm.; stipules .6 mm. \times .6 mm.; segments .125 mm.; bract, antical lobe 1.65 mm. \times .8 mm., postical 1.2 mm. \times .3 mm.; bracteole 1.3 mm. \times .55 mm.; segments .7 mm.; perianth 2.2 mm. \times 1.2 mm.; male spike .4 mm. \times .75 mm.; perigonal bract, antical lobe .75 mm. \times .5 mm., postical .6 mm. \times .4 mm.

HAB.—In extensive patches on trees and rocks. Rare. 1. Mullion Cove, Cornwall, *W. Curnow*. 7. (?) 12. Glen Helen, Isle of Man, *George Stabler*. 16. Loch Skene. Invermoidart, West Inverness, *S. M. Macvicar*. South of Ireland, somewhat abundant, *Dr. Taylor*. Glengariff and Killarney, *Dr. Carrington*. Glena, *S. O. Lindberg*. O'Sullivan's Cascade, *Holt and Stewart*. Rathlin Island, *S. A. Stewart*.

Obs.—Very distinct species, distinguished from *F. Tamarisci* (L.), of which it has been considered a variety by some authorities, by its paler colour, more delicate texture, epidermis dull, not polished, absence of the moniliform cells, margin of bracts entire;

male catkins linear, not globose, postical lobes of perigonial bracts unidentate.

DESCRIPTION OF PLATE IV.— Fig 1. Plant natural size. 2. Portion of stem, antical view $\times 16$ (Original, herb. Taylor). 3. Ditto, postical view $\times 24$ (ditto). 4-6. Leaves $\times 24$ (ditto). 7. Portion of leaf $\times 290$ (ditto). 8. Stipule $\times 24$ (ditto). 9. Sub-bracteole $\times 24$ (ditto). 10. Bract $\times 24$ (ditto). 11. Bracteole $\times 24$ (ditto). 12. Perianth $\times 16$ (ditto). 13. Male spike $\times 11$ (Killarney, Holt & Stewart). 14. Perigonial bract $\times 24$ (ditto).

5. **Frullania dilatata** (L.) Dum.

Lichenastrum imbricatum minus, Dill. Hist. Musc., p. 497, t. 72, n. 27 (1741).

Jungermania dilatata, Linn. Sp. Pl., p. 1600 (1753); Hook. Brit. Jung. n. 5 (1815).

Frullania dilatata, Dum. Recueil Jung. p. 13 (1835).

Dioicous, closely creeping, often forming roundish patches or substratified, small to largish in size, deep purple colour, often tinged with brown, to olive-green. Stems prostrate, loosely and vaguely pinnate, 8 to 10 cells in diam., cortical cells about 30, walls brown, inner white, equal in size to the cortical; radiculose, rootlets few, dirty white, proceeding from the stipules. Leaves imbricate, below smaller and then approximate, incubous, distichous, unequally bilobed, antical lobe crossing the stem, horizontal, concave, postical lobe about 3 times smaller, contiguous with the stem, cucullate, saccate, oval-orbicular, sometimes near the bracts widely subulate, plane or recurved; epidermis dull, not polished: cells smallish, subquadrate or subquadrate-oblong, irregular in outline, lumen brown, walls and trigones hyaline. Stipules much wider than the stem, distant, cuneate or obovate, bifid to $\frac{1}{4}$ or $\frac{1}{3}$, sinus acute, segments acute, outer margin slightly notched near their base, margin plane. Stylus small, between the postical lobe and stem, subulate or triangular-subulate. Flowers σ terminal on main stem or branches, no innovant branches immediately below them. Bracts larger than the stem leaves, unequally bilobed, antical lobe subrotund, rotundate, margin quite entire, undulate, often reflexed, postical lobe half the size or less obliquely

ovate acute, irregularly dentate, reflexed. Bracteole oblong-cuneate, divided to below the middle, sinus acute, segments lanceolate-acute, outer margin furnished with one or two large teeth; sub-bract, antical lobe subrotund, postical lobe oblong-acute, with large segment near the base; sub-bracteole ovate-acute, bifid to near the middle, sinus acute, segments acuminate. Perianth projecting two-thirds beyond the bracts, ovate or obcordate, composed of one layer of cells, complanate below, above triangular, antically plane or with a slight elevation, postically carinate, rostellate, beak short, sometimes slightly uncinatè; epidermis tuberculate. Calyptra oblong-obovate, rather fleshy. Capsule spherical, pale yellowish-brown, bursting into 4 oval-acute or obtuse valves. Spores spherical, minutely tuberculate, 2 to 3 times broader than the unispiral, pale golden-brown elaters, also of a darker colour.

Male flowers on short lateral branches, catkins roundish or elongate; perigonial bracts 4-8 pairs, turgid, unequally bilobed, antical lobe oval, postical lobe rather smaller oval-quadrate, perigonial bracteole oval-acute, bifid to about $\frac{1}{3}$, sinus acute, segments acute; antheridia globose.

DIMENSIONS.—Stems $\frac{1}{2}$ to 2 inches long, with leaves .75 mm. to .1 mm. wide, diam. of stem .05 mm. to .075 mm.; leaves, antical lobe .9 mm. \times .8 mm., postical .4 mm. \times .3 mm., antical .6 mm. \times .5 mm., postical .3 mm. \times .25 mm.; cells .03 mm. \times .015 mm., .03 mm. \times .02 mm., .03 mm. \times .025 mm.; stylus .125 mm. \times .04 mm. wide at the base; stipules .225 mm. \times .175 mm.; segments .1 mm., .5 mm. \times .4 mm., seg. .15 mm., .25 mm. \times .175 mm., seg. .075 mm.; sub-bract, antical lobe 1.25 mm. \times .75 mm., postical .9 mm. \times .3 mm.; sub-bracteole .75 mm. \times .5 mm.; segments .35 mm.; bract, antical lobe .9 mm. \times .5 mm., postical .5 mm. \times .35 mm.; bracteole .1 mm. \times .75 mm.; segments .6 mm.; perianth 1.4 mm. \times .1 mm., 1.5 mm. \times 1.2 mm.; capsule .75 mm. \times .7 mm.; valves .6 mm. \times .5 mm.; pedicel .25 mm. diam.; spores .05 mm. diam.; elaters .6 mm. \times .02 mm.; perigonial bracts, antical lobe .45 mm. \times .3 mm., postical .35 mm. \times .25 mm.; perigonial bracteole .25 mm. \times .175 mm.; antheridia .15 mm. \times .1 mm.

HAB.—On trees and rocks, often in large patches, closely attached. Common.

1 to 16. 1.

Found on the Continent.

Obs.—Distinguished from other British *Frullaniæ* by its proportionately large postical lobes, when fertile by its tuberculate perianth.

DESCRIPTION OF PLATE V.—Fig. 1. Plant natural size. 2. Portion of fertile branch, antical view $\times 16$ (Dolgelly, W. H. P.). 3. Portion of stem, antical view $\times 13$ (ditto). 4. Leaf, postical view $\times 31$ (Constance, Jack). 5-7. Leaves, postical view $\times 31$ (Dolgelly, W. H. P.). 8. Portion of leaf $\times 290$ (ditto). 9, 10. Styli $\times 64$ (ditto) 11, 12. Stipules $\times 46$ (ditto). 13. Stipules $\times 31$ (Constance, Jack). 14. Bract, postical view $\times 31$ (Dolgelly, W. H. P.). 15. Ditto, explanate $\times 16$ (ditto). 16. Sub-bract $\times 16$ (ditto). 17. Bracteole $\times 16$ (Ditto). 18. Sub-bracteole $\times 16$ (ditto). 19. Perianth $\times 16$ (ditto). 20. Cross-section of perianth $\times 16$. 21. Portion of male stem, postical view $\times 16$ (ditto). 22. Perigonial bracts and bracteole $\times 13$ (ditto).

Genus 2. JUBULA, Dum.

Jubula, sp. Dum. Comm., p. 112 (1822).

Lejeuniae, sp. Corda in Opiz Nat. p. 652 (1829).

Jubula, Dum. Recueil, p. 12 (1835).

Frullaniæ, sp. Nees Nat. Eur. Leb. 111, p. 240 (1838).

Plants conspicuous, somewhat large, dark green, prostrate, substratified, dichotomous, or pinnately branched. Stem 8 cells in diameter, about 32 in circumference. Leaves large, incubous, bipartite; antical lobe plane, dentato-spinose or ciliate; lobule minute, saccate, rarely evolute lanceolate acuminate; cells small or medium, subequal, walls delicate. Antical elobulate leaf axillary at the insertion of every branch, seated partly on the stem and partly on the branch. Stipules half the size of leaf, plane, subrotund, bifid, sparsely spinose or quite entire. Inflorescence monoicous. ♀ innovations two opposite, rarely only one. Bracts 1 pair, unequally complicate; bracteole bipartite, free.

Pistillidia delicate, 1 or 2, rarely 3 or 4. Perianth trigonous, obpyramidal, slightly rostellate, smooth. Calyptra lower half broadly tubular, 2 or 3 cells thick, upper half abruptly subglobose, delicate. Pedicel about twice as long as the perianth, thick. Capsule globose, dividing into 4 valves which are composed of two layers. Elaters long. Spores minutely tuberculate. Andrœcia spicate on branches; bracts diandrous.

1. **Jubula Hutchinsiae** (*Hook.*), *Dum.*

Jungermania Hutchinsiae, Hooker, Brit. Jung. t. 1 (1816).

Jubula Hutchinsiae, Dum. Comm. Bot. p. 212 (1822).

Fruillania Hutchinsiae, Nees Nat. Eur. Leb. 111, p. 240 (1838).

Monoicous, in spreading or dense imbricated patches, rarely substratified, medium to large in size, pale to blackish-green in colour. Stems prostrate, laxly and subflabellately branched, sometimes pinnate, sometimes dichotomous, subgeniculate, branches proceeding from below the ♀ flowers furcately, rarely with unilateral innovations, 8 × 6 cells in diameter, frontally compressed, cortical cells about 30, pale brown, much smaller than the inner which are very large and pellucid; radiculose, rootlets few, whitish. Leaves incubous, horizontal, subimbricate, antical distichous, bifarious, unequally bilobed, antical lobe plane, broadly obliquely ovate, apiculate-acute or cuspidate, except at the base acutely spinose-dentate, principally at the antical margin, spines 2-12, triangular-acuminate, sometimes longer and ciliaform, lower leaves less, upper leaves more dentate, branch leaves with few, rarely without, antical base dilated but not cordate, covering the stem, sometimes unidentate, postical lobe 4 to 5 cells distant from the stem, subparallel to it, saccate, ovate, 5 or 6 times shorter than the antical lobe or evolute, subulate or lanceolate acuminate; cells smallish, 5- and 6-angled, near base subelongate, walls thin, no trigones or thickened angles, subpellucid or with numerous chlorophyllose granules which crowd round the cell walls, making them appear thickened; at the insertion of every branch is present an antical elobulate leaf seated partly on the stem and partly on the branch, broadly subcordate-ovate, acuminate, quite

entire or subspinose, no lobule. Stipules subrotund subplane, acutely decurrent at the base, to about the middle bifid, segments cuspidate-acuminate, connivent, margin with few long spines or entire. Flowers ♀ on terminal branches. Bracts adnate at their base, longer than the leaves, deeply bilobed, complicate, lobes obliquely lanceolate acuminate spinose or laciniate, postical half the size or smaller. Bracteole oblong, almost bipartite, carinate, lobes unequal, slenderly acuminate spinose. Perianth verruculose, composed of a single layer of cells, about 200 round, near the middle, twice as long as the leaves, projecting about half beyond the bracts, pyriform or narrowly obpyramidal, deeply tricarinate, flattened antically, postically ridged, angles rounded, at the base terete, apex rotundate-truncate, obscurely rostellate. Pistillidia slender, 1 or 2, very rarely 3 or 4. Calyptra below 2 or 3 cells thick, above abruptly subglobose, delicate. Capsule globose, outer layer of cells dark brown, inner pale yellow, margin of valves when open reflexed, base (apex of pedicel) cruciate, hyaline. Spores brown, elaters pale brown.

Male spikelets on short lateral branches; perigonial bracts about 6 pairs, more than twice smaller than the leaves, broadly emarginate-bilobed, turgid below, lobes subaeuminate, connivent, lower smaller quite entire, rarely denticulate; perigonial bracteole ovate-acute, bifid to below the middle, segments subulate, margin entire or unidentate; antheridia 2, oval.

DIMENSIONS.—Stems 1 to 2 inches long, with leaves 2 mm. to 2.5 mm. wide, diam. of stem .1 mm. to .2 mm., leaves, antical lobe 1.25 mm. × .75 mm., postical .25 mm. × .175 mm., antical 1.5 mm. × .75 mm., postical .15 mm. × .2 mm., antical 1 mm. × .6 mm., postical .3 mm. × .2 mm., cells .03 mm., .025 mm., .03 mm. × .02 mm.; stipules .75 mm. × .6 mm.; segments .35 mm., .6 mm. × .5 mm., seg. .25 mm., .65 mm. × .6 mm., seg. .25 mm.; sub-bract, antical lobe 1.25 mm. × .5 mm., postical .75 mm. × .25 mm.; bract, antical lobe 1.5 mm. × .75 mm., postical 1 mm. × .35 mm.; bracteole 1.25 mm. × .75 mm.; segments .75 mm., perianth 1.9 mm. × .95 mm.; valves of capsule .4 mm. × .25 mm.; apex of pedicel .3 mm. diam.; spores .015 mm.; elaters .25 mm. × .015 mm.;

male spikes 1·25 mm. \times ·5 mm.; perigonial bracts, antical lobe ·6 mm. \times ·4 mm., postical lobe ·45 mm. \times ·3 mm.; perigonial bract-eole ·4 mm. \times ·3 mm., seg. ·2 mm.; antheridia ·15 mm. \times ·125 mm.

HAB.—In spreading patches on shaded damp rocks. Rare. 1. Norvah, Cornwall, *J. Ralfs*. 7. Dolgelly, Merioneth, *J. Ralfs*, *W. Wilson*. Arthog, Merioneth, *Dr. Carrington*, *John Whitehead*, *W. H. P.* 10. Near Hebden Bridge, West Yorkshire, *James Needham*. Ravengill, Pateley Bridge, *L. J. Cocks*. 12. Isle of Man, *G. A. Holt*. Lodore, Cumberland, *Rev. C. H. Binstead*, *W. H. P.* 16. Dunoon, *Gourlie*, *Lyon*. South of Ireland, *Miss Hutchins*, *Dr. Taylor*, *Dr. Spruce*, *Dr. Carrington*, &c.

Found in North and South America, Pacific Islands.

Obs.—This is a very beautiful and distinct species and not likely to be confounded with any other of the British Hepaticæ. By several authorities it has been placed with the *Frullaniæ* but Dr. Spruce has kept it distinct, retaining for it Dumortier's genus *Jubula*; in colour, texture and habit it differs from any of the *Frullaniæ* and, as Dr. Spruce points out, "Hep. Am. et An." p. 60, occupies a position intermediate between this genus and *Lejeuneæ*, agreeing with the latter in the bracts of the female flower being adnate to subfloral ramuli (or innovations) and other characters.

The plant was discovered in the South of Ireland by Miss Hutchins and named after her by Dr. Hooker.

Var. *integrifolia*, Nees, is a more slender form with antical lobes less spinose, sometimes, but rarely, entire, postical lobe evolute; I do not attach much importance to these characters as plants from different localities vary from type to this form according to dampness or shade.

The description is taken from Dr. Spruce's "Hep. Am. et An." where further valuable notes are given.

DESCRIPTION OF PLATE VI.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 16 (Isle of Man, G. A. Holt). 3. Leaf, postical view \times 24 (ditto). 4, 5. Leaves, postical view \times 24 (Killarney, Dr. Carrington). 6. Portion of leaf \times 290 (Isle of Man, G. A. Holt). 7, 8. Stipules \times 24 (ditto). 9, 10.

Ditto (Killarney, Dr. Carrington). 11. Sub-bract $\times 16$ (Isle of Man, G. A. Holt). 12, 13. Bracts $\times 16$ (ditto). 14. Bracteole $\times 16$ (ditto). 15. Perianth $\times 16$ (ditto). 16. Cross-section of perianth $\times 16$ (ditto). 17. Portion of branch with male catkin, postical view $\times 16$ (ditto). 18. Perigonial bract $\times 24$ (ditto). 19. Perigonial bracteole $\times 24$ (ditto).

Genus 3. **LEJEUNEA**, *Libert.*

Lejeunea, Lib. in Ann. gen. sc. phys. t. 5, p. 372 (1820).

Pseudulphinus, Gray & Bennett, Nat. Arr. Br. Pl. 1, p. 688 (1821).

Lejeuneeæ sect. Lejeuneotypus Dum. Syll. Jung. p. 32 (1831).

Plants usually delicate, small, a few very minute, some robust, creeping amongst mosses or other hepatics, stratified or caespitose or pendulous, pallid, whitish or yellowish-green, sometimes dark brown. Stems terete, slender, rarely firm, pinnately branched, rarely plumæform or dichotomous, all branches contiguous to the outer base of the leaves, *i.e.* infra-axillary. Leaves oblique or almost longitudinally inserted, alternate, complicato-bilobed, margin entire, serrulate, denticulate, dentate, spinose or ciliate, rarely lacinate, antical lobe larger, broad or narrow, incubous, postical lobe (lobule) usually rhomboidal or ovate, incurved and ventricose rarely plane; epidermis smooth, papulose muriculate rarely echinate. Cells subequal, small or medium in size, sometimes minute, leptodermous; trigones and angles rarely conspicuous. Stipules in nearly all species present, in a few wanting bifid or rarely entire. Inflorescence dioicous or monoicous (very rarely paroicous). Androecia on amentiform branches, rarely on the chief stem; bracts subequal, diandrous, very rarely triandrous in a few species monandrous. Female flowers monogynous. Sub-floral innovations where present solitary or binate and opposite, in most species adnate to the bracts. Bracts ♀ 1 pair, rarely several, planilobed. Perianth free from the bracts, oval oblong or pyriform, terete or angular, variously winged, cristate or ciliate at the angles, leptodermous. Calyptra about half the length of the perianth, obovate or pyriform, thin. Pedicel cruciate on the section 4 cells across, quasi-articulate when dry and mostly

geniculate at the joints. Capsule globose hyaline or pale brown-membranous, dividing to about two-thirds into 4 valves, composed of two layers, inner spongy. Elaters persistent at the apex of the valves, usually unispiral.

1. **Lejeunea Mackaii** (*Hook.*), *Spreng.*

Jungermania Mackaii, Hook. Brit. Jung. t. 53 (1816).

Phragmicoma Mackaii, Dum. Comm. Bot. (1822).

Lejeunea Mackaii, Spreng. Syst. Veg. 4, p. 233 (1825-7).

Monoicous, densely but shallowly cæspitose, small, reddish-brown to blackish olive-green. Stems creeping, imbricate, firm, more or less dichotomous, sometimes with only one innovation proceeding from below the ♀ flower; cortical cells larger than the inner, walls brown, 30-35, inner with pellucid walls 10 × 12. Leaves imbricate, often densely, distichous, horizontal or patent-divergent, unequally bilobed, antical lobe slightly convex, sub-semicordate, ovato-rotund, all very obtuse, postical lobe 3 to 4 times smaller than the antical, subquadrate or ovate, free margin involute, bidentate, ventricose; cells smallish, 4-, 5- and 6-angled, walls thick, angles slightly thickened. Stipules twice shorter than leaves, much wider than the stem, rotundo-cuneate, entire or retuse, never cordate or decurrent. Bracts unequally bilobed, antical lobe ovato-obtuse, margin entire, postical from half to one-third the size, oblong-obovate, margin entire. Bracteole oval, apex retuse. Perianth projecting about half beyond the bracts, obcordato-obovate, gibbous below, compressed, slightly convex, mouth contracted, dentate, composed of a single layer of cells, about 150 round the middle. Capsule spherical, delicate, whitish, dividing down to the base into 4 valves. Elaters bispiral.

Andrœcia on long lateral branches not produced from the axil of the leaves; perigonal bracts closely imbricate, smaller than the stem leaves, subequally bilobed, antical lobe oblong, postical similar but slightly smaller, turgid; antheridia two, large, globose.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, with leaves 1.5 mm. to

2' mm. wide, diameter of stem '15 mm. to '2 mm., leaves, antical lobe 1'2 mm. \times '9 mm., postical lobe '4 mm. \times '3 mm., antical 1'2 mm. \times 1' mm., postical '3 mm. \times '25 mm., antical '9 mm. \times '7 mm., postical '3 mm. \times '2 mm.; cells '03 mm. \times '02 mm., '025 mm. \times '02 mm., '025 mm. \times '025 mm., '035 mm. \times '02 mm.; stipules '6 mm. \times '5 mm., '5 mm. \times '45 mm.; sub-bract, antical lobe 1'25 mm. \times 1' mm., postical lobe '3 mm. \times '1 mm.; sub-bracteole '7 mm. \times '7 mm.; bract, antical lobe 1'5 mm. \times 1' mm., postical lobe 1' mm. \times '45 mm.; bracteole 1' mm. \times '8 mm.; perianth 1'3 mm. \times 1'2 mm.; male branches 2 mm. to 6 mm. long, 1' mm. wide; perigonal bract, antical lobe 1' mm. \times '6 mm., postical lobe '8 mm. \times '4 mm.; antheridia '2 mm. \times '175 mm.

HAB.—On shaded limestone and other rocks, in large or small patches. Moderately rare.

1. Gulval Carn, Cornwall, *J. Rulfs*. Rocks west of the Lizard, Cornwall, *W. Curnow*. "Common in Devon," *Hooker*. 7. Barmouth, *Dr. Carrington and W. H. P. Arthog*, Merionethshire, *W. H. P.* 10. Ingleboro, Yorks, *Dr. Carrington*. 12. Levens, Westmorland, *G. Stabler*. Witherslack, Westmorland, *G. Stabler*. Lodore, Cumberland, *W. H. P.* 13. River Dee, Tongland, New Galloway, *J. McAndrew*. 16. Invermoidart, West Inverness, *S. M. Macvicar*. I. Very common on the Sear Limestone, Killarney, *Dr. Carrington*. South of Ireland, *Mackay, Dr. Taylor, &c.*

Obs.—Unlike other British *Lejeuneæ* in size and colour; distinguished from *Radolæ* by presence of stipules and from any of the British *Frullaniæ* by the entire stipules.

DESCRIPTION OF PLATE VII.—Fig. 1. Plant natural size. 2. Portion of stem, antical view \times 16. 3. Ditto, postical view \times 24. 4, 5. Leaves, postical view \times 24. 6. Portion of leaf \times 290. 7. Sub-bract \times 16. 8. Sub-bracteole \times 16. 9. Bract \times 16. 10. Bracteole \times 16. 11. Perianth \times 16. 12. Cross-section of perianth \times 16. 13. Portion of male stem, postical view \times 24. 14. Perigonal bract \times 24 (*Arthog, W. H. P.*).

2. *Lejeunea ovata*, *Tayl.*

Jungermania serpyllifolia, var. *B. ovata* Hook. Brit. Jung. t. 42 (1816).

Lejeunea ovata, Tayl. Mss; G. L. N. Syn. Hep. p. 376 (1845).

Lejeunea Mollerii, Steph. "Hedwigia" (1887).

Dioicous, depresso-cæspitose, small, pale to dark green, turning brown when dry and old. Stems creeping, sparingly and irregularly branched, pellucid. Leaves subimbricate or contiguous, patent to erecto-patent, unequally bilobed, antical lobe convex, somewhat swollen at the base, hamate, falcato-lanceolate, rarely ovato-lanceolate, gradually acutate, branch leaves acuminate, margin quite entire, postical lobe 2 to 3 times smaller than the antical lobe, ovoid, turgid, free margin involute, quite entire or rarely with an obtuse short segment near the apex, involute or plane, inner margin reaching to the stem, but slightly overlapping it. Cells small, 4-, 5- and 6-angles, subopaque, chlorophyllose, walls thick, angles thickened, trigones minute. Stipules smaller than the postical lobe of leaf, about twice as wide as the stem, subplane, broadly obcordate-triangular, emarginate, sinus broad, segments rotundato-obtuse, widely divergent. Female flowers terminal on short lateral branches, one or two innovations being produced from below the bracts. Bracts unequally bilobed, antical lobe plane oval-acute, postical 2 to 3 times smaller, oval-lanceolate apex obtuse. Bracteole obovate-cuneate, almost to $\frac{1}{4}$ emarginate-bifid, segments rotundate. Perianth obovate-clavate, upper portion acutely 5-angled. Andrœcia on very short lateral branches; perigonial bracts 1 or 2 pairs, closely imbricate, erect, unequally bilobed, antical lobe oval-obtuse, postical somewhat similar but smaller; antheridia oval-globose.

DIMENSIONS.—Stem $\frac{1}{4}$ to $\frac{1}{2}$ inch long, with leaves .5 mm. to .75 mm. wide, diam. of stem .05 mm., leaves, antical lobe .325 mm. \times .175 mm., postical .175 mm. \times .1 mm., antical .375 mm. \times .2 mm., postical .2 mm. \times .1 mm., antical .3 mm. \times .175 mm., postical .15 mm. \times .1 mm.; cells .02 mm. \times .025 mm., .02 mm. \times .02 mm., .015 mm. \times .02 mm.; stipules .1 mm. \times .15 mm., .1 mm. \times .125

mm., $\cdot 1$ mm. \times $\cdot 1$ mm.; bract, antical lobe $\cdot 7$ mm. \times $\cdot 4$ mm., postical lobe $\cdot 4$ mm. \times $\cdot 2$ mm.; bracteole $\cdot 6$ mm. \times $\cdot 4$ mm.; segments $\cdot 125$ mm.; male catkin $\cdot 4$ mm. \times $\cdot 175$ mm.

HAB.—On shaded rocks in hilly districts. Rare.

7. Barmouth, Merionethshire, *Dr. Carrington*. Tyn-y-Groes, Merionethshire, *W. H. P.* Llanberis, Carnarvonshire, *E. M. Holmes, W. H. P.* 10. Whernside, *Lees and West*. 12. Lodore, Cumberland, *Dr. Carrington and W. H. P.* Rosthwaite, Cumberland, *Dr. Carrington and W. H. P.* 16. Invermoidart, West Inverness, *S. M. Macvicar*. I. Tore Waterfall, Bantry, Dunkerron, *Dr. Taylor*. Killarney, *Dr. Carrington* and others.

Found on the Continent, Portugal (*Moller*), Norway (*B. Kaalaas*).

Obs.—Distinguished from *L. hamatifolia* (Hook.) by the quite entire margins of the antical lobes of the leaves, from *Lej. calcarca* Lib. and *Lej. Rossettiana* Mass. by the smooth epidermis, and from all other British species by the acute or acuminate antical lobes of the leaves.

I have never met with perianth of this species, nor had Dr. Spruce; the description of it is taken from the "Syn. Hep."

DESCRIPTION OF PLATE VIII.—Fig. 1. Plants natural size. 2. Stem, antical view $\times 24$ (Llanberis, E. M. Holmes). 3. Ditto, postical view $\times 64$ (Original, herb. Taylor). 4. Leaves, antical view $\times 85$ (Llanberis, E. M. Holmes). 5, 6. Ditto, postical view with stipules $\times 64$ (ditto). 7. Portion of leaf $\times 290$ (ditto). 8-10. Stipules $\times 85$ (ditto). 11, 12. Ditto $\times 64$ (Tyn-y-Groes, W. H. P.). 13. Bract $\times 24$ (Borrowdale, Dr. Carrington and W. H. P.). 14. Bracteole $\times 24$ (ditto). 15. Male catkin $\times 64$ (Llanberis, E. M. Holmes).

3. *Lejeunea hamatifolia* (Hook.), Dum.

Jungermania hamatifolia, Hook. Brit. Jung. t. 54 (1816).

Lejeunea hamatifolia, Dum. Comm. p. 111 (1822).

Monoicous, densely, intricately but shallowly caespitose, small, green in colour. Stems procumbent, very slender but firm.

flexuose, when fertile regularly pinnate, when sterile sparingly branched or almost simple. Leaves approximate, bifarious, alternate, erecto-patent, unequally bilobed, antical lobe convex, ovate or oval-acuminate, apex incurved, margin coarsely and irregularly serrate, postical lobe about half the size of the antical, oval, free margin involute, furnished with a large tooth near the apex, below entire or slightly denticulate (1 or 2 minute teeth). Cells smallish to small, 4-, 5- and 6-angled, walls firm, no thickened angles or trigones. Stipules obtriangular, bifid, sinus broadly sublunulate, segments subulate or triangular, very divergent, 3, rarely 2 cells wide at the base. Female inflorescence on short branches; bracts smaller than the leaves but somewhat similar, only both the antical and postical lobes more serrate, the postical not being involute. Perianth pyriform, brevi-rostrate, acutely 5-angled, keels above setose-spinose-winged, mouth when open with few teeth. Androecia terminal on long branches; perigonial bracts 3 to 4 pairs, erect or erecto-patent, closely imbricate, turgid at the base, antical lobe serrate, postical almost equal in size; antheridia oval to globose, pale, stipe of equal length, arcuate-curved; perigonial bracteoles similar to the stipules, only with segments less divergent.

DIMENSIONS.—Stem $\frac{1}{4}$ inch long, .05 mm in diameter, with leaves .3 mm. to .4 mm. wide; leaves, antical lobe .325 mm. \times .175 mm., postical .2 mm. \times .125 mm., antical .25 mm. \times .1 mm., postical .15 mm. \times .075 mm., antical .25 mm. \times .125 mm., postical .175 mm. \times .1 mm.; cells .02 mm., .02 mm. \times .025 mm., .02 mm. \times .03 mm.; stipules .1 mm. \times .1 mm.; segments .05 mm., .075 \times .1 mm., seg. .05 mm.; bract, antical lobe .275 mm. \times .125 mm., postical .2 mm. \times .1 mm.; perianth .6 mm. \times .4 mm., beak .01 mm. long; perigonial bract, antical lobe .25 mm. \times .15 mm., postical .175 mm. \times .125 mm.; perigonial bracteole .1 mm. \times .08 mm., seg. .05 mm.; antheridia .08 mm. \times .06 mm.

HAB.—On shaded rocks, especially gold-bearing quartz, rarely on trees. Rare.

7. Cwm Bychan, Merionethshire, *Rev. Mr. Salway*. Tyn-y-Groes, Merionethshire, *W. H. P.*, *G. A. Holt*. 10. Dent, Yorks, *G. Stabler*. Ingleton, Yorks, *G. Webster and W. H. P.*

12. Lodore, Cumberland, *G. Stabler, C. J. Wild, W. H. P. Rosthwaite*, Cumberland, *Dr. Carrington and W. H. P.* 15. Glen Tilt, *Mr. Durnford.* 16. Moidart, West Inverness, *S. M. Maericar.* I. Killarney, *Dr. Taylor, Dr. Spruce, W. Wilson, Dr. Carrington.* Brandon, *Dr. Moore.* Cromaglow, *Prof. Lindberg.*

Found on the Continent and in South Africa.

Obs.—Distinguished from all other British *Lejeunea* by the long acuminate distantly serrated antical lobe of leaf. This hepatic has a most curious distribution; it is found in fair abundance on the gold-bearing reefs near the celebrated gold mines at Tyn-y-Groes, in North Wales, also on quartz in Borrowdale, at Ingleton in Yorkshire, not on the limestone which is so abundant in the last-mentioned place, but on eruptive rocks which are exposed near the river. In a collection of hepaticæ made at Kynsna, a gold-bearing district in South Africa, by Hans Iversen in 1883, specimens of this species were found agreeing in every particular with our native one.

DESCRIPTION OF PLATE IX.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 85$ (Africa). 3. Portion of male stem, antical view $\times 85$ (Cromaglow, S. O. Lindberg, and the following). 4. Ditto, postical view $\times 85$. 5–7. Leaves $\times 85$. 8–10. Ditto, explanate. 11. Portion of leaf $\times 290$. 12–14. Stipules $\times 85$. 15. Bract, explanate $\times 85$. 16. Perianth $\times 31$. 17. Perigonial bracts $\times 85$. 18. Perigonial bracteole $\times 85$. 19. Antheridium $\times 85$.

4. *Lejeunea serpyllifolia* (Dicks.), Lib.

Jungermania serpyllifolia, Dicks. Pl. crypt. Brit. fasc. 4 (1801).

Lejeunea serpyllifolia, Lib. Ann. gen. sc. phys. 6, p. 374, n. 2, pp. (1820).

Dioicous, shallowly or densely caespitose, small, pale or rarely dark green or yellowish colour. Stems laxly creeping, irregularly branched, rarely subpinnate, radiculose, rootlets produced from base of stipules, white, few, short. Leaves incubous, slightly imbricate or approximate, patent-divergent to patent, unequally bilobed, antical lobe convex, obliquely ovato-oval, rotundato-obtuse or obtuse, margin entire, rarely slightly repand, when dry plano-adpressed, postical lobe much smaller than the antical,

orbicular or ovate, turgid, margin entire, involute; epidermis shining when dry; cells medium size, 5- and 6-angled, lumen pellucid or chlorophyllose, walls thin, trigones distinct. Stipules distant, larger than the postical lobe of leaf, about twice as wide as the stem, slightly decurrent, oval or subrotund, deeply bifid, sinus broad or narrow, usually obtuse, sometimes acute, segments obtusate or acute. Female flowers on lateral branches. Bracts unequally bilobed, antical lobe obovate, rotundate, or obtuse; postical lobe much smaller, oval-oblong. Bracteole obovato-oval, bifid to $\frac{1}{4}$, sinus and segments obtuse. Perianth projecting about half beyond the bracts, elliptico-clavate, below terete, upper part 5-plicate, angles obtuse, margin smooth, beak short. Calyptra thick, obovate. Capsule ovato-globose. Spores large. Androecia on chief stem or on lateral branches, below the perianth perigonal bracts 2-4 pairs, closely imbricate, unequally bilobed, antical lobe orbicular, postical rather smaller, oval, much swollen; antheridia 2, oval-globose.

Lindberg described two forms as follows:—

Var. *planiuscula*. Elongate, about 1 mm. wide, pale or green, pellucid, when dry shining, less branched, intricate and fragile, planiuscula, leaves more or less remote, antical lobe convexulous, slightly decurved, obliquely ovato-oval, rotundato-obtuse, margin entire, postical lobe 5-7 times smaller, stipules subadpressed, 2 to 3 times larger than the postical lobe, convexiuscula, rotundo-oval, sinus more or less broad and obtuse, segments somewhat obtuse, margin entire, perianth elliptico-clavate, below terete, upper part 5-plicate, angles complanate, margin smooth.

Var. *cavifolia*. Smaller and often yellowish-pale or green, very ramose, intricate and fragile, convex, leaves closely imbricate, antical lobe obliquely broadly ovato-oval, very obtuse, apex distinctly narrower but never acute, entire, postical lobe 3-5 times smaller, cells very chlorophyllose and thickened, trigones distinct, stipules subadpressed, as large or larger than the postical lobe, convex, oval-rotund, perianth narrow at the base, oval-pyriform, upper 4th part 5-plicate.

DIMENSIONS.—Stems $\frac{1}{2}$ to $\frac{3}{4}$ inch long, .085 mm. in diameter,

with leaves .7 mm. to .85 mm. wide; leaves, antical lobe, .45 mm. \times .3 mm., postical 2 mm. \times .15 mm., antical, .45 mm. \times .35 mm., postical .2 mm. \times .1 mm.; cells .03 mm. \times .03 mm., .04 mm. \times .0275 mm., .04 mm. \times .03 mm.; stipules, .25 mm. \times .2 mm.; segments, .075 mm., .2 mm. \times .15 mm., seg. .075 mm.; bract, antical lobe 4 mm. \times .25 mm., postical, .225 mm. \times .125 mm.; bracteole .4 mm. \times .2 mm., segments 1 mm.; perianth, .8 mm. \times .5 mm.; perigonial bract, antical lobe, .25 mm. \times .2 mm., postical .2 mm. \times .15 mm.; spores, .025 mm.

HAB.—On rocks, stones, trees or banks in damp shaded or, more rarely, exposed situations.

Moderately common. 1-18c. I.

Found on the Continent and in North America.

Obs.—This, the most generally distributed of British *Lejeunea*, is abundantly distinct from any of the other British species, with the exception of *Lej. patens*, Lindb., and *Lej. flava* (Sw.), which see for distinguishing characters.

DESCRIPTION OF PLATE X.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 31, var. *planiuscula* (Glena, S. O. Lindberg). 3. Ditto, postical view (ditto). 4. Ditto \times 64 var. *cavifolia* (n. 273 G. & R. Hep. Eur.). 5, 6. Leaves \times 31 (n. 435 G. & R. Hep. Eur.). 7. Portion of leaf \times 290 (ditto). 8. Bract \times 64 (Ingleton, W. H. P.). 9. Bracteole \times 64 (ditto). 10. Perianth \times 31 (n. 435 G. & R. Hep. Eur.). 11. Perigonial bract \times 64 (ditto).

5. *Lejeunea patens*, Lindb.

Lejeunea patens, Lindberg Acta Soc. Sci. Fenn. Hep. Hib. x. p. 482 (1875).

Monoicous, caespitose, small, very pale green or sometimes white. Stems prostrate or sub-erect, irregularly and much branched and interwoven. Leaves more or less closely imbricate, from their base to the height of the postical lobe patent to erecto-patent, then acutely patent-divergent, very much decurved and well overlapping the stem, unequally bilobed, antical lobe remarkably convex, especially when dry, obliquely ovato-elliptical or very bluntly oval; postical lobe 2-4 times smaller than the

antical, oval, very convex, free margin slightly involute or adpressed to the antical lobe. Texture very pellucid, and when dry shining; cells smallish, 4-, 5-, and 6-angled, lumen but slightly chlorophyllose, walls somewhat thick, trigones present. Stipules smaller than the postical lobes of the leaves, 2 to 3 times as wide as the stem, very convex, subrotund, bifid to nearly the middle, sinus more or less broad and obtuse, segments somewhat obtuse. Female flowers on short lateral branches. Bracts unequally bilobed, antical lobe oval, narrow at the base, apex sub-acute or obtuse, postical lobe 4 times smaller than the antical, oval-lanceolate; bracteole oval, bifid to $\frac{1}{4}$, sinus narrow, sub-acute, segments acute. Perianth projecting slightly beyond the bracts, pyriform-clavate, terete below, above 5-plicate, wings prominent, very acute, complanate, upper margin slightly crenulate. Calyptra obovate, large, composed of somewhat large and irregular-shaped cells. Andrœcia on short lateral branches; perigonial bracts few 2-4 pairs, closely imbricate, erect turgid, bifid, antical lobe broadly ovate, postical somewhat similar but rather smaller; antheridia two, oval-globose.

DIMENSIONS.—Stem about $\frac{1}{2}$ an inch long, .075 mm. in diameter, with leaves .8 mm. wide; leaves, antical lobe .5 mm. \times .375 mm., postical .2 mm. \times .15 mm., antical .45 mm. \times .35 mm., postical .225 mm. \times .175 mm.; cells .03 mm. \times .025 mm., .025 mm. \times .025 mm.; stipules .19 mm. \times .16 mm.; segments .075 mm., .2 mm. \times .185 mm., seg. .08 mm.; bracts, antical lobe .4 mm. \times .225 mm., postical .2 mm. \times .1 mm.; bracteole .4 mm. \times .225 mm., seg. .11 mm.; perianth .85 mm. \times .45 mm.; capsule .275 mm. diam.; perigonial bracts, antical lobe .3 mm. \times .2 mm., postical .275 mm. \times .175 mm.; antheridia .1 mm. \times .075 mm.

HAB.—On rocks, stones, and trees in shaded places. Rare. 7. Arthog, Merionethshire, *Dr. Carrington*. 10. Saltersgate, Yorks, *S. Anderson*. 12. Brown Ghyll, *G. Stabler and W. H. P.* 13. New Galloway, *J. McAndrew*. 16. I. Killarney, *W. Wilson*. Glens and Torc Cascade, *Dr. Carrington, Prof. Lindberg, G. A. Holt, &c.* Conner Hill, Dingle Bay, *Prof. Lindberg*, and other stations in the South of Ireland.

Found on the Continent. Norway (*Kaaulas*).

Obs.—Dr. Spruce wrote me some years ago: “Lindberg’s *Lejeunea patens* is an excellent species. There are fine patches of it in Sir Wm. Hooker’s herbarium, gathered by Wilson at Killarney; also in Dickson’s herbarium; and it is probably the true type of his *L. serpyllifolia*. If so we should have to fall back on the name *carifolia* for what we have hitherto considered *serpyllifolia*. I found *L. patens* before Lindberg did, and named it too, but I supposed it the same as a new species (*L. helicophylla*) I had gathered in the Andes. A more rigorous comparison obliges me now to hold them distinct.”

L. patens is distinguished from *L. serpyllifolia* in being a smaller and more slender plant, with branches more intricately interwoven, the remarkable manner in which the leaf diverges from above the postical lobe, the proportionately larger and more turgid postical lobe, and the angles of the perianth being more winged and acute.

With reference to the suggestion of Dr. Spruce I do not wish to make any further alterations in the name, and as Prof. Lindberg was the first to clearly define *L. patens* I prefer to retain the one he gave it.

DESCRIPTION OF PLATE XI.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 31$. 3. Ditto, postical view $\times 31$. 4. Ditto, postical view $\times 64$. 5. Portion of leaf $\times 290$. 6, 7. Bracts $\times 64$. 8. Bracteole $\times 64$. 9. Perianth $\times 31$. 10. Cross section of perianth $\times 31$. 11. Perigonial bracts, postical view $\times 64$. 12. Antheridium $\times 85$ (Killarney, Holt and Stewart).

6. *Lejeunea flava* (Swartz), Nees.

Jungermania flava, Swartz, Prodr. fl. Ind. occ. p. 144 (1788).

Lejeunea flava, Nees Nat. eur. Leb. 3, p. 277 (1838).

Lejeunea serpyllifolia, var. *thymifolia*, Carrington, Irish Crypt. (1863).

Lejeunea Moorei, Lindb. Hep. Hib. p. 187 (1875).

Monoicous, closely caespitose, small to medium in size, yellowish, rarely very dark green in colour. Stems prostrate, sub-simple, vaguely branched or pinnate, but slightly radiculose or rootless.

Leaves incubous, contiguous or subimbricate, to the plica erecto-patent, afterwards patent to patent-divergent, unequally bilobed, antical lobe obliquely oblong or ovato-oblong, rotundate, slightly concave, at the base subdecurrent, complicate, quite entire, plane, postical lobe 3-7 times smaller, subovate or rhomboid-quadrate, saccate, margin inflexed, transverse or subascending, rarely obsolete. Cells smallish, roundish-quadrate, 5- and 6-angled, near base slightly elongate, walls and angles thickened, sometimes trigones distinct. Stipules below smaller and distant, above larger and contiguous, about half the length of the antical lobe of the leaf, about 3 times larger than the postical lobe, ovato-oval or orbicular, bifid to the middle, sinus narrow, obtuse or acute, segments subobtuse or acute, sometimes one lobe acute, the other shorter and obtuse, quite entire, rotundate at the base or cordate, rarely decurrent. Female flowers terminal on the branches or on stem, and subtended by a simple or repeatedly proliferous innovation, or sometimes by a pair of opposite ones. Bracts much longer than the leaves, complicato-bilobed, antical lobe oval-lanceolate, obtuse, margin plane, quite entire, postical lobe about half the size or still smaller, elliptical, obtuse. Bracteole oblong, obovate, narrowly lanceolate or cuneato-lanceolate, cloven to about the middle or deeper, sinus very narrow, segments obtuse. Perianth very slightly emersed, green, pyriform, rounded at the apex, beak short, slightly compressed, 5-carinate, keels small, subobtuse. Andrœcia on short lateral branches or on stem, rotund or oval, perigonal bracts 5-9 pairs, bilobed to the middle, postical lobe rather smaller than the antical, diandrous.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .1 mm. in diameter, with leaves 1 mm. wide; leaves, antical lobe .55 mm. \times .35 mm., postical .15 mm. \times .1 mm., antical .5 mm. \times .35 mm., postical .125 mm. \times .1 mm.; cells, .025 mm. \times .02 mm., .03 mm. \times .03 mm., .02 mm. \times .02 mm., .03 mm. \times .02 mm.; stipules .3 mm. \times .25 mm., segments .15 mm.; bracts, antical lobe 1 mm. \times .5 mm., postical .6 mm. \times .25 mm., antical 1 mm. \times .6 mm., postical .6 mm. \times .3 mm.; bracteole .8 mm. \times .5 mm., seg. .4 mm.

HAB.—On rocks and trees in shady situations. Rare. 12?

South of Ireland, Killarney, *Dr. Carrington*. O'Sullivan's Cascade, *Dr. Moore*. Hunting Tower, *Dr. Moore*, *D. McArdle*. Glena, *Prof. Lindberg*. Killarney, *G. A. Holt*, *M. B. Slater*.

South America, Rio Janeiro, *Glazion*, Cuba. *Wright*.

OBS.—Distinguished from *Lej. serpyllifolia* by the longer and more narrowly ovate antical lobe, and the smaller postical lobe, smaller cells with thicker walls and angles, and larger stipules.

"*Lej. serpyllifolia* is a smaller plant, colour more rarely yellowish, leaves rounder and with a much longer and more turgid postical lobe, sometimes equalling half the antical." (R. Spruce.) *Dr. Carrington* was the first to publish any notice of this species as native to our Isles, when he described it as var. *thymifolia* of *Lej. serpyllifolia* in his "Irish Cryptogams." *Prof. Lindberg* afterwards published it as *Lej. Moorei*, but later considered it along with *Dr. Spruce* identical with *Lej. flava* (Sw.), which has a very wide geographical distribution. Plants with perfect perianths are extremely rare.

DESCRIPTION OF PLATE XII. — Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 25$ (drawn by Tuffen West, Moore, "Irish Hepaticæ"). 3. Leaf, postical view $\times 64$ (Cromaglow, S. O. Lindberg). 4. Ditto and stipules $\times 64$ (ditto). 5. Ditto $\times 64$ (Glenn, S. O. Lindberg). 6. Portion of leaf $\times 290$ (ditto). 7, 8. Bracts $\times 24$ (ditto). 9. Bracteole $\times 24$ (ditto).

7. *Lejeunea Holtii*, Spruce.

Lejeunea Holtii, Spruce, Journ. of Botany, Feb. 1887.

Monoicous, loosely creeping amongst mosses, largish, yellowish or with a reddish tinge. Stems prostrate, fragile, rarely substratified, subpinnate; frequently the flower-bearing branchlets are elegantly pinnulate. Leaves widely patent, distinctly distichous or bent lightly backwards, dissitous or contiguous, rarely subimbricate, suboblique, ovate-oblong or ovate, obtuse, sometimes subacute rarely rotundate, near the base subsinate-complicate; lobule very small, less than $\frac{1}{2}$ the size of the leaf, subovoid, inflated, with the apex either running gradually into

the leaf or rather abruptly incurved, prolonged on to the stem, occasionally obsolete, especially where the flowers are wanting; cells medium size, equilatero-hexagonal, except below the middle where they incline to become oblong, rather smooth, walls thin, under ordinary powers (1 inch or $\frac{2}{3}$) no trigones are observable, but under the $\frac{1}{4}$ inch they are small but distinct; slightly convex which causes the leaf margin to appear subcrenulate. Stipules delicate, rather less than $\frac{1}{3}$ the size of the leaves, distant, orbicular, subobtusely bifid to the middle, the segments acute or subobtuse. Flowers ♀ on exceedingly short branchlets, usually with a single pair of leaves, very rarely longer with 4 pairs, usually simple, with no subfloral innovations; very occasionally there is present a minute microphyllous innovation springing from the base of the flower. Bracts less than $\frac{1}{2}$ the size of the leaves, recurvulopate, bilobed to below the middle, lobes slightly complicate lanceolate, acute or obtuse, the postical a little shorter and only half the width; bracteole lanceolate, narrowly bifid to a $\frac{1}{3}$ or half of its length, segments acute, connate with the other bract, or free. Perianth distinctly emerging from the bracts for more than double of their length, obpyramidato-pyriform, depressed at the apex and having a very short slender mucronulate slightly compressed beak; cells equilatero-hexagonal, pellucid, beautifully reticulated; 5-keeled—the keels having very deep-like wings—occasionally towards the apical margin bordered with a single series of very thin cells. Calyptra half the size, obovate, constricted at the base so as to appear shortly stipitate. Capsule globose (not been seen exerted). Andrœcia very frequently upon short branches; perigonial bracts 2–5 pairs imbricate, turgidly cymbiform, bilobed, postical lobe rather smaller. Antheridia not known.

DIMENSIONS.—Stems $\frac{3}{4}$ – $1\frac{1}{2}$ inch long and .09 mm. in diameter, with leaves 1.1 mm. wide; leaves, antical lobe .7 mm. × .45 mm., lobule .13 mm., antical lobe .65 mm. × .55 mm., lobule .15 mm. × .15 mm., antical lobe .5 mm. × .35 mm., lobule .15 mm. × .125 mm.; cells, near middle, .03 mm., .04 mm., .04 mm. × .03 mm.; stipules .25 mm. × .25 mm., .3 mm. × .3 mm.,

·225 mm. × ·225 mm.; bract, antical lobe ·4 mm. × ·15 mm. to ·2 mm., lobule ·35 mm. × ·1 mm., antical lobe ·6 mm. × ·2 mm., lobule ·4 mm. × ·15 mm.; bracteole ·3 mm. × ·15 mm., ·55 mm. × ·275 mm.; perianth ·9 mm. × ·55 mm., 1 mm. × ·65 mm.; perigonial amentula ·85 mm. × ·4 mm.

HAB.—Extremely rare, the only known station being on shady rocks below Tore Waterfall, Killarney, near enough to the stream to be moistened by its spray, except when the water is very low. It grows chiefly on *Thamnetum alopecurum*, accompanied by *Radula Carringtoni*, *Saccogyne viticulosa*, *Melzgeria conjugata*, and sometimes by *Lejeunea diversiloba* (G. A. Holt, June 1885), R. S.

OBS.—“Differs from every other British *Lejeunea* in the female flowers being borne on exceedingly short branchlets, which normally put forth no subfloral innovation such as constantly exists in all our other species. In size it resembles *L. flava*, or luxuriant *L. serpyllifolia*, but usually differs at sight from both by the pale reddish tinge of the foliage. Even where the leaves are of the yellow-green of almost ripe limes, dried specimens speedily assume a rufous hue when moistened. Another important and unique character is afforded by the large pear-shaped perianths being so very strongly and sharply keeled that at first sight they seem broadly 5-winged. The female flowers often alternate, or are variously mixed up, with male catkins of about the length of the adjacent leaf, and consisting of from two to five pairs of cymbiform bracts. Where inflorescences of both sexes are numerous (as they sometimes are), they render the stem or branch elegantly pinnulate.

The only species which *L. Holtii* might be confounded with is *L. flava* (Sw.), which grows near it and in much greater abundance; but the former, although nearly equal in size, is far more delicate and pellucid, and its slight tinge of red is never seen in the yellow or green foliage of *L. flava*. The latter, besides the essential difference of the perianths being terminal on branches of various lengths or on the main stem, and invariably putting forth from their base a leafy innovation or even a pair of opposite innovations, each of which may in like manner bear an apical

flower subtended by a secondary innovation, differs also in the tufted habit, the imbricated leaves (which, although only slightly different in form, have smaller, more chlorophyllose cells), but, above all, in much smaller obtusely 5-carinate perianths, as compared with the large, deeply plicato-carinate perianths of *L. Holtii*."

The description and observations are taken from Dr. Spruce's communication to the "Journ. of Bot." for Feb. 1887.

DESCRIPTION OF PLATE XIII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 31$. 3. Ditto, postical view $\times 31$. 4. Ditto, $\times 64$. 5. Portion of leaf $\times 290$. 6. Stipule $\times 64$. 7. Bract $\times 31$. 8. Bracteole $\times 31$. 9. Perianth $\times 31$. 10. Cross-section of perianth $\times 31$. 11. Perigonial amentula $\times 31$ (Forc Cascade, G. A. Holt).

S. *Lejeunea ulicina*, Tayl.

Jungermania ulicina, Tayl. in Trans. Bot. Soc. Edinb. p. 115 (1841).

Jungermania minutissima, Hook. Brit. Jung. t. 52, ex parte (nec Smithii) (1816).

Lejeunea ulicina, Tayl. G. L. N. Syn. Hep. p. 387 (1844).

Lejeunea minutissima, Spruce in Ann. Nat. Hist. et Trans. Bot. Soc. Edinb. (1849) (nec *J. minutissima*, Sm.)

Dioicous, loosely spreading, rarely subcæspitose, often creeping upon mosses, minute, green. Stems straight, not geniculate, vaguely branched, subradiculose. Leaves distant or subcontiguous, erect to erecto-patent (10° – 30°), cochleato-concave, rotundo-ovate, at the apex narrower, obtuse or abruptly acute, from the base to $\frac{1}{2}$ or $\frac{3}{4}$ (rarely almost to the apex) obtusely complicato-bilobed, postical lobe more or less shorter and narrower, rarely almost equal, turgid at the keel, margin incurved or often plane, apex apiculato-acute; cells small, slightly chlorophyllose, subpellucid, smooth or slightly convex, obscurely tuberculose, 4-, 5-, and 6-angled, walls firm, no trigones or thickened angles. Stipules distant, about 3 times shorter than the leaves, rather broader than the stem, oval, to about $\frac{1}{3}$ or the middle, or rarely below bifid, segments linear-subulate, 2 cells broad below, at the apex 1 cell broad. Female flowers terminal, innovations produced on one or both sides. Bracts large, 2 to 3 times larger than the

leaves, subdivergent, at an angle of 60° - 90° , almost to the middle bifid, complicate, keel narrow, winged, antical lobe semi-ovate acute, postical lobe shorter, rarely equally as long, semi-lanceolate or obliquely cuneate, margin cellulose-crose, sometimes subdentate. Braeteole a little shorter, erect oblong or oval-lanceolate, to about $\frac{1}{4}$ acutely bifid, segments acute. Perianth (hardly mature) immersed in the bracts, pyriform-oblong or obovate, apex depressed, terete below, towards the apex obtusely 5-angled, cells slightly convex, papillose or almost smooth.

DIMENSIONS.— $\frac{1}{4}$ - $\frac{1}{2}$ inch long, 0.2 mm. to .03 mm. in diameter, with leaves .25 mm. to .35 mm. wide, leaves, antical lobe .2 mm. \times .15 mm., postical 1.14 mm. \times 0.75 mm., antical .24 mm. \times .15 mm., postical .18 mm. \times .1 mm.; cells .025 mm. \times .02 mm., .02 mm., .017 mm., .02 mm. \times .015 mm.; stipules .08 mm. \times .86 mm., segments .02 mm.; .07 mm. \times .05 mm., seg. 0.15 mm., .1 mm. \times .05 mm.; lobe of bract .4 mm. \times .2 mm., .5 mm. \times .3 mm., braeteole 3 mm. \times .15 mm.; perianth .35-4 mm. \times .18 mm.

HAB.—On trees, or more rarely creeping upon mosses. Rare, extremely so, fertile

2. On beech trees, Southwood, Hants, *R. S. Mill.* 7. Tyn-y-Groes, *Wild and Holt.* Torrent Walk, Dolgelly, *G. Stabler, W. H. P.* 10. Bolton Abbey, Wharfedale, *Dr. Spruce.* Dent, *G. Stabler.* Broadwood, Ingleton, *G. Webster and W. H. P.* 12. Levens, Westmorland, *G. Stabler.* Keswick, *C. Lyell.* 13. Burnfoot Hill, New Galloway, *J. McAndrew.* 15, 16. I. Killarney, *Dr. Taylor, Dr. Spruce, Dr. Carrington, G. A. Holt* and others. Near Lake Brittas, King's Co., *D. McArdle.*

Found on the Continent, France, Mortain, *T. Husnot.*

Obs.—Misled by an original specimen from Sowerby of *Jung. minutissima*, Smith, figured in *Eng. Bot.*, Dr. Spruce was under the impression that it was the same as *Jung. ulicina* of Taylor, and therefore reduced *Jung. ulicina*, Tayl. to a synonym of *Jung. minutissima* Sm., and for the fertile *Jung. minutissima* of Smith coined the name *Lejeunea Taylori*, Spruce; many years afterwards he found in comparing with the figure in *Eng. Bot.* of Smith's *Jung. minutissima* that it could never have been drawn from that

specimen, so he reinstated *Lejeunea ulicina*, Tayl., and made *Lej. Taylori* a synonym of *Lej. minutissima*, Sm. Considerable confusion as to these two species has consequently arisen, but if we remember that the monoicous form with geniculate stems, no stipules and often found fertile is the *Lej. minutissima* of Smith, and the dioicous one with somewhat straight stems, stipules present, and flowers extremely rare is *Lej. ulicina*, Tayl., we shall be right.

Shortly before Dr. Spruce died he wrote me: "Lately I came on the specimen given to Mr. Borrer by Sowerby as part of the *Jung. minutissima* figured in Eng. Bot. You will see it is *L. ulicina*, and when even Hooker did not discriminate between the two it was impossible Sowerby should." In my plate of *Lej. ulicina*, fig. 4, is a drawing of this plant; in Hooker's "Brit. Jung." the two plants are given as *Jung. minutissima*, Sm., but as I have never heard of any one collecting *Lej. minutissima*, Sm., in the Lake District, I should infer that the station given by Hooker, Keswick, refers to *Lej. ulicina*. *Lej. ulicina*, Tayl., is quite distinct from any of the other British *Lejeuneæ*.

DESCRIPTION OF PLATE XIV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 64$ (Ingleton, Webster and Pearson). 3. Ditto, postical view $\times 85$ (ditto). 4. Ditto, postical view $\times 85$ (Herb. Sowerby). 5. Ditto, postical view $\times 85$ (Levens, Stabler). 6. Leaves, antical view $\times 85$ (France, Husnot). 7-9. Ditto, postical view $\times 85$ (Ingleton, Webster and Pearson). 10, 11. Portions of leaves $\times 290$ (ditto). 12, 13. Stipules $\times 85$ (ditto).

9. *Lejeunea diversiloba*, Spruce.

Lejeunea diversiloba, Spruce Journ. of Bot. 1876.

Lejeunea minutissima, var. *major*, Carringt. Irish Cryptogams Trans. Edin. Bot. Soc. (1863).

Dioicous, epiphytic on *Frullania* or other corticolous species, small, pale yellowish-green, sometimes nearly white. Stems slightly branched, branches rigid, subfastigiate, distant, filiform; radiculose, rootlets very short, fasciculate. Leaves incubous, approximate, erecto-patent, angle about 30° , to below the middle complicato-bilobed (or none), antical lobe slightly concave,

obliquely obovate-oblong, rotundate, rarely obtuse or subacute, quite entire, postical lobe variable in form and size, nearly equal to the antical lobe or half the size, or very minute or absent altogether, subquadrate, or oval, inflated, the upper border incurved and notched at the outer angle so as to form a rather blunt tooth, at the keel broadly rotundate; texture somewhat firm; cells pellucid, from smallish to rather minute, 5- and 6-angled, subplane, walls firm, no trigones or thickened angles. Stipules about 3 times shorter than the antical lobe of leaf, slightly broader than the stem, subrotund or oval, to about the middle or below bifid, sinus acute or lunate, segments suberect or incurved, subacute; sometimes obsolete. Female flowers lateral sessile; bracts longer than the leaves, suberect, loosely complicate-bilobed to below the middle, antical lobe obliquely obovato-lanceolate, subacute, obtuse or rotundate, postical lobe almost of equal length or shorter, ligulate or oblong; bracteole obovato-lanceolate, bilobed to below the middle, segments narrow, obtuse or acute. Perianth immersed in the bracts, subglobose, slightly compressed, highly 5-carinate, very smooth. Androecia on short lateral branches; perigonal bracts 2 pairs, larger than the leaves, very turgid, lobes subequal, almost hemispherical, diandrous.

DIMENSIONS.—Stems $\frac{1}{2}$ to $\frac{3}{4}$ sometimes 1 inch long, diameter .05 to .06 mm. with leaves from .3 mm. to .45 mm. wide; leaves, antical lobe .35 mm. \times .2 mm., postical .175 mm. \times .1 mm., antical .2 mm. \times .15 mm., postical .15 mm. \times .1 mm., antical .25 mm. \times .1 mm., postical .075 mm. \times .025 mm., antical .275 mm. \times .15 mm., postical .0; cells .02 mm., .025 mm., .015 mm.; stipules .11 mm. \times .07 mm., segments .075 mm., .125 mm. \times .08 mm., seg. .04 mm., .125 mm. \times .1 mm., seg. .04 mm., .1 mm. \times .075 mm., seg. .05 mm., .08 mm. \times .06 mm., seg. .03 mm.; bracts, antical lobe .325 mm. \times .15 mm., postical .3 mm. \times .075 mm., antical .375 mm. \times .15 mm., postical .25 mm. \times .1 mm.; bracteole .3 mm. \times .2 mm., segments .175 mm.

HAB.—Not unfrequent about Killarney, growing on *Frullania germana* and other prostrate mosses and hepatics, *Dr. Taylor*, *Dr. Spruce*, *Dr. Carrington*, *Mr. G. A. Holt*.

The only known station.

Obs.—Distinguished from other native *Lejeunea* by its rigid stems and the variable character of the postical lobes of the leaves, which are sometimes equal in size to the antical lobes, sometimes about half the size or very minute or entirely wanting.

DESCRIPTION OF PLATE XV.—Fig. 1. Plants natural size. 2. Stem, postical view $\times 30$. 3-5. Portions of stem, postical view $\times 64$. 6. Ditto $\times 85$. 7. Portion of leaf $\times 290$. 8, 9. Stipules $\times 85$. 10, 11. Bracts $\times 64$. 12. Bracteole $\times 64$. (All Killarney, Dr. Carrington.)

10. *Lejeunea calcarea*, Lib.

Lejeunea calcarea, Libert in Bory de St. Vinc. Ann. des sc. nat. VI. p. 373, n. 1, t. 96, f. 1 (1820).

Jungermania hamatifolia, var. *echinata*, Hook. Brit. Jung. (1816).

Lejeunea echinata, Taylor MSS. G.L.N. Syn. Hep. p. 345 (1844).

Monoicous, intricately cæspitose, minute, yellowish-green colour. Stems filiform, subdichotomous or subpinnate, rootlets few, pale. Leaves imbricate, unequally bilobed, antical lobe patent or erecto-patent 40° - 30° ovato-acuminate, epidermis echinate, papillæ small, roundish, texture opaque, cells minute, 4-, 5- and 6-angled, walls firm, no trigones or thickened angles; postical lobe about half the size of the antical, gibbous, ovate, free margin incurved, smooth or very slightly serrate, texture more delicate, rather larger cells, slightly elongate, epidermis *smooth*, slightly echinate at the keel. Style or interlobule attached to each leaf right and left of the stem, linear-subulate, 4 or 5 uniseriate cells long. Stipules absent. Female flowers on short branches; bracts much smaller than the leaves, unequally bilobed, antical lobe ovato-acutate, postical about half the size, widely subulate-acutate, plane. Perianth pyriform, obtusely 5-angled, angles distinctly muricate. Andrœcia on short lateral branches, perigonal bracts 3, 4 pairs, closely imbricate, erect, unequally bilobed, swollen at the base, antical lobe oval-acute, postical about one-third smaller, oval; antheridia subspherical.

DIMENSIONS.—Stems about $\frac{1}{4}$ an inch long, diameter .05 mm.

to .075 mm., with leaves .35 mm. to .4 mm. wide; leaves, antical lobe .375 mm. \times .2 mm., postical .225 mm. \times .15 mm., antical .45 mm. \times .175 mm., postical .25 mm. \times .15 mm.; cells .015 mm., papillæ .01 mm. \times .0125 mm. wide at the base, stylus .1 mm. \times .02 mm.; bract, antical lobe .2 mm. \times .135 mm., postical .175 mm. \times .1 mm.; perianth .75 mm. \times .4 mm.; capsule .25 mm. diam.; pedicel .05 mm. diam.; perigonial bract, antical lobe .275 mm. \times .15 mm., postical .2 mm. \times .125 mm.; antheridia .15 mm. \times .125 mm.

HAB.—In crevices and sheltered spots on limestone rocks. Somewhat rare.

7. 8. Ravensdale, Derbyshire, *G. A. Holl*. 10. Hell Cleft, Teesdale, *Dr. Spruce*. High Force, Teesdale, *R. Barnes*. Gordale, *W. West*. Ingleton, *W. West*. Clapdale Cave, Craven, *Dr. Carrington*. Bolton Woods, *Dr. Carrington*. Nr. Litton, *John Whitehead*. 12. Heversham Head, *G. Stabler*. Pasture Beck, Ullswater, *W. H. P.* 15. Banks of the River Burn, *A. Croall*. Cawdor Wood, Forfar, *A. Croall*. Glen Tilt, *A. Croall*. 16. Moidart, West Inverness, *S. M. Maccicar*, peaty side of ravine, not limestone. I. Kerry, *Dr. Taylor*. Killarney, *Dr. Carrington*.

Found on the Continent and in North America.

Obs.—A very distinct species and not likely to be confounded with any other British ones, except the closely allied *Lej. Rossettiana*, Massal., which see.

Lej. hamatifolia (Hook.), which Hooker considered it to be a variety of, differs in the antical lobe of leaf being distantly dentate, epidermis smooth, presence of stipules, and other characters.

DESCRIPTION OF PLATE XVI.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 64. 3, 4. Portions of stems, postical views \times 64. 5-8. Leaves \times 64. 9-11. Ditto, explanate \times 64. 12. Portion of leaf \times 290. 13. Papillæ of antical lobe of leaf \times 290. 14, 15. Styliiform appendages \times 85. 16. Bract \times 64. 17. Perianth \times 31. 18. Portion of male branch \times 64. 19. Perigonial bract \times 85. 20. Antheridium \times 85. (Teesdale, *Dr. Spruce*.)

11. *Lejeunea Rossettiana*, *Massal.*

Lejeunea Rossettiana, Massalongo, Nuovo Giorn. Bot. Ital. vol. xxi. p. 487 (1889).

Dioicous, intricately cæspitose, minute, yellowish-green. Stems subdichotomous or subpinnate, more or less radiculose, rootlets few, fasciculate, pale. Leaves imbricate, patent, 50° – 60° , bilobed, antical lobe somewhat convex, ovate, apices more or less attenuate-acuminate (rarely only acute), usually incurved, upper surface echinate, postical lobe about $\frac{1}{2}$ to $\frac{1}{3}$ the size of the antical, subquadrate to roundish-quadrate, tumid at the keel, upper portion plane, margin not incurved, unequally dentate-spinulose, exterior surface echinate like the antical lobe, texture opaque: cells very minute, 4-, 5-, and 6-sided, walls distinct, no trigones or thickened angles; papillæ conical, one to each cell. Stipules absent. Stylus also wanting. Female flowers on short branches, subtended by an innovation. Bracts similar to the leaves, only larger, postical lobe with margin more finely dentate-spinulose. Bracteole wanting. Perianth projecting more than half beyond the bracts, oval to pyriform, upper portion obtusely 5-angled, epidermis muricate. Androecia unknown.

DIMENSIONS. — Stems about $\frac{1}{4}$ of an inch long, .05 mm. diameter, with leaves .85 mm.–1. mm. wide; leaves, antical lobe .45 mm. \times .25 mm., postical .225 mm. \times .15 mm., antical .45 mm. \times .275 mm., postical .225 mm. \times .15 mm.; cells .0125 mm.; papillæ .0125 mm. long \times .01 mm. wide at the base; bract, antical lobe .5 mm. \times .25 mm., postical .25 mm. \times .15 mm.; perianth .6 mm. \times .45 mm., .55 mm. \times .4 mm.

Obs.—Differs from *Lejeunea calcarea*, Lib., with which it has been confounded by British botanists in its dioicous inflorescence, more opaque texture, slightly larger size, leaves a little more spreading, echinate postical lobe, with margin more dentate-spinulose, and not incurved, as in *L. calcarea* (the margin of which cannot be seen without dissection), and by the entire absence of the styliform appendage, usually found between the stem and the leaf of *L. calcarea*. The above mentioned characters show this

plant to be a distinct species, and was discriminated by the Italian botanist, Prof. Massalongo, from specimens collected in Italy by Dr. Rossetti.

Original specimens from Dr. Taylor of *Lej. echinata* comprise both this species and *Lej. calcarea*, but as Prof. Massalongo was the first to recognise its distinctness, his name justly deserves to be preserved.

From other British *Lejeuneæ* it is at once separated by its echinate leaves.

HAB.—On limestone rocks, amongst mosses, and often intermingled with *L. calcarea*, Lib. Rare.

8. Millers Dale, Winnats, Ravensdale, Derbyshire, *G. A. Holt*.

10. Limestone Cave, Gordale, Yorks, *Dr. Carrington*. I. Near Dublin, 1830, *Dr. Taylor*. Mucross Desmesne, Killarney, *Dr. Carrington*, 1861.

Found on the Continent (Italy, *Dr. Rossetti*).

DESCRIPTION OF PLATE XVII. — Fig. 1. Plants natural size. 2. Stem, antical view $\times 24$. 3. Portion of stem, postical view $\times 64$. 4–7. Leaves $\times 64$. 8. Leaf $\times 85$. 9. Portion of leaf $\times 290$. 10. Papillæ $\times 290$. 11. Bract $\times 64$. 12. Perianth $\times 31$. 13. Cross-section of perianth $\times 31$. 14. Apex of perianth $\times 31$ (Winnats, Derbyshire, *G. A. Holt*).

12. *Lejeunea minutissima* (Sm.).

Jungermania minutissima, Smith, Eng. Bot. t. 1633 (1806), Hook. Brit. Jung. t. 52 (1816).

Jungermania inconspicua, Raddi in Act. soc. Modena (1818).

Lejeunea Taylori, Spruce, in Trans. Bot. Soc. Edinb. vol. iii. p. 12 (1849).

Lejeunea inconspicua, de Not. in G. and R. Hep. eur. n. 45, Dum. Hep. Eur. p. 18 (1874).

Lejeunea minutissima (Sm.), Spruce Journ. of Bot. p. 36 (1881).

Monoicous, closely but shallowly or loosely caespitose, minute, pale green to whitish. Stems filiform, geniculate, flexuose, creeping, irregularly branched. Leaves bifarious, alternate, distant or approximate, erecto-patent to erect, subrotund, almost all the length complicate, very concave or turgid, postical lobe very little

narrower than the antical; epidermis subpapillose, texture delicate, cells smallish, 4-, 5-, or 6-angled, walls thin, no trigones or thickened angles. Stipules absent. Female flowers terminal on short lateral branches; bracts about twice as long as the leaves, broadly oblong, slightly complicate, very shortly bilobed, postical lobe about twice as narrow as the antical. Perianth emersed, turbinate or pyriform, slightly compressed, acutely 5-angled, keel almost smooth, sometimes furnished with a single series of pellucid cells. Calyptra pyriform, texture similar to the leaves. Capsule subspherical, hyaline, cleft halfway to the base. Androecia on short lateral branches, roundish or spicate; perigonal bracts 3, 4 pairs, cymbiform, turgid. Antheridia single, oval.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, and .05 mm. in diameter, with leaves .35 mm. to .4 mm. wide; leaves, antical lobe .225 mm. \times .175 mm., postical .2 mm. \times .1 mm., antical .225 mm. \times .175 mm., postical .2 mm. \times .175 mm., antical .25 mm. \times .1 mm., postical .225 mm. \times .1 mm.; cells .025 mm. \times .02 mm., .02 mm. \times .02 mm., .03 mm. \times .02 mm., .025 mm. \times .025 mm.; bracts, antical lobe, .35 mm. \times .12 mm., postical .3 mm. \times .1 mm., antical .275 mm. \times .15 mm., postical .225 mm. \times .1 mm.; perianth .5 mm. \times .275 mm.; male catkin .4 mm. \times .3 mm.; perigonal bract .2 mm. \times .15 mm.; antheridia .1 mm. \times .075.

HAB.—On stems of trees. Very rare.

1. Trevello Wood, Penzance, Cornwall, *W. Curnow* and others.
2. Henfield, Sussex, *C. Lyell*. New Forest, Hampshire, *C. Lyell*. Langley, Sussex, *F. C. Roper*.
3. Shiere, Surrey, *E. M. Holmes*. South of Ireland.

Found on the Continent.

OBS.—Being destitute of stipules this plant is at once distinguished from those British species which have them.

Lej. calcarea, Libert, and *Lej. Rossettiana*, Massal. have echinate leaves.

Lej. microscopica, Tayl. has more spreading, narrower leaves, and is rarely found fertile.

See notes under *Lej. ulicina*, Tayl.

DESCRIPTION OF PLATE XVIII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 64 (*Langley, Roper*). 3.

Ditto, postical view $\times 64$ (ditto). 4. Ditto $\times 64$ (Herb. Taylor). 5, 6. Leaves $\times 64$ (New Forest, C. Lyell). 7, 8. Portions of leaf $\times 290$ (ditto). 9, 10. Bracts $\times 64$ (ditto). 11, 12. Ditto $\times 64$ (Langley, Roper). 13. Perianth $\times 64$ (New Forest, C. Lyell). 14. Male catkin $\times 64$ (Coimbra, Portugal, Henriques). 15. Antheridium $\times 85$ (ditto).

13. *Lejeunea microscopica*, Taylor.

Jungermania microscopica, Tayl. in Mackay Fl. hib. 2 p. 59 (1836). Taylor in Hook. Journ. of Bot. 4, p. 97, t. 29. Nees, Nat. eur. Leb. 111, suppl. p. 566 (1838).

Lejeunea microscopica, Tayl. G. L. N. Syn. Hep. p. 345 (1844).

Paroicous, loosely cæspitose, minute, very pale green to white. Stems creeping, very slender, flexuose, pellucid, subramose; radiculose, rootlets few, distant, short, single, pellucid. Leaves often unilateral, distant, patent, ovoideo-fusiform or ovate-lanceolate, somewhat flattened, slightly unequally bilobed, antical lobe a little larger than the postical, apex subacute, triangular or shortly linguaform; epidermis papillose, in some specimens almost smooth, texture pellucid; cells smallish, 4-, 5-, and 6-angled, walls thin, no trigones or thickened angles, near the base in the middle elongate. Stipules absent. Female flowers on short branches, bracts unequally bilobed, antical lobe narrower and longer than the leaves, ovate-lanceolate, postical lobe much smaller, lanceolate acute. Perianth pellucid, obovate or obconical, papillose, ecarinate or obtusely angled, apex flat, no beak, mouth contracted. Andrœcia on short lateral branches, perigonal bracts bilobed, more obtuse at the apex than in the leaves. Antheridia oval.

DIMENSIONS.—Stems $\frac{1}{4}$ inch long, $\cdot 03$ mm. in diameter, with leaves $\cdot 35$ mm. wide; leaves, antical lobe $\cdot 2$ mm. \times $\cdot 12$ mm., postical $\cdot 175$ mm. \times $\cdot 12$ mm., antical $\cdot 175$ mm. \times $\cdot 1$ mm., postical $\cdot 16$ mm. \times $\cdot 1$ mm.; cells $\cdot 03$ mm. \times $\cdot 025$ mm., $\cdot 03$ mm. \times $\cdot 03$ mm., near base of leaf $\cdot 04$ mm. \times $\cdot 02$ mm.; bract, antical lobe $\cdot 25$ mm. \times $\cdot 15$ mm., postical $\cdot 15$ mm. \times $\cdot 05$ mm.; perianth $\cdot 35$ mm. \times $\cdot 225$ mm. near the apex.

HAB.—On *Frullania*, bark of trees or on damp rocks, in shaded or exposed situations. Extremely rare.

7. Rocks below Llyn Ogwen, Carnarvonshire, *Dr. Carrington and W. H. P.* 12. Rosthwaite, Cumberland, *Dr. Carrington and W. H. P.* Seathwaite, Cumberland, *J. R. Byrom and W. H. P.* 16. Moidart, West Inverness, *S. M. Macvicar.* I. Cromaglow, *Dr. Taylor, Dr. Spruce, Dr. Carrington, Dr. Moore, Prof. Lindberg,* and others. Glenariff, Co. Antrim, *Revs. Lett and Waddell.*

Obs.—This is one of the smallest and most beautiful of the British Hepaticæ; single plants being scarcely visible to the naked eye. From *Lej. minutissima* (Sm.), which is also without stipules, it is distinguished by its more distant, spreading, narrower leaves, which are also more papillose and pellucid.

Lej. calcarea, Libert, and *Lej. Rossettiana*, Massal., are larger, coarser species, with more erect leaves, which are distinctly echinate.

From all other British *Lejeuneæ* it is distinguished by the absence of stipules.

DESCRIPTION OF PLATE XIX.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 85$ (Rocks, Ogwen, W. H. P.) 3. Ditto, postical view $\times 64$ (ditto). 4, 5. Leaves, postical view $\times 85$ (ditto). 6. Leaf (ditto) $\times 64$ (Herb. Tayl.). 7, 8. Leaves, antical view $\times 64$ (ditto). 9. Keel of leaf $\times 290$ (Seathwaite, W. H. P.) 10, 11. Portions of leaf $\times 290$ (ditto). 12. Bract $\times 64$ (Glenariff, Lett & Waddell). 13. Perianth $\times 64$ (ditto).

14. *Lejeunea calyptrifolia* (*Hook.*), *Dum.*

Jungermania calyptrifolia, Hook. Brit. Jung. t. 43 (1816).

Lejeunea calyptrifolia, Dum: Comm. p. 111 (1822).

Cohura calyptrifolia, Dum. Recueil, p. 12 (1835).

Dioicous (?), cæspitulose, minute, pale yellowish-green. Stems creeping, slightly and irregularly branched, branches procumbent or suberect; filiform, flexuose; radiculose, rootlets extremely minute, pellucid. Leaves closely placed, bifarious, horizontal, patent or erect, largest at the base of the plant, gradually lessening to the apex, unequally bilobed, antical lobe calyptriform, rostrate corniculate, apex incurved and acute, narrowed at the base, but with a semi-orbicular or broadly oval convolute

wing, above which the margin is slightly incurved, the fold gradually increasing in size until near the apex, where another erect horseshoe-shaped lobe is observed, which is of an extremely delicate texture and is enclosed in the tubular portion of the antical lobe; postical lobe about three times smaller than the antical, oval or subquadrate with rounded corners, convolute; texture delicate, cells smallish, elongate, 4-, 5-, and 6-angled, walls thin, very slightly thickened, trigones absent. Stipules at the base of each leaf, plane, appressed to the stem or a little patent, oblong-cuneate, bipartite or deeply (to two-thirds) bifid, segments patulous, linear-subulate, 3 to 4 cells wide at their base. Female flowers lateral; bracts 2, 3 pairs, minute, erect and closely appressed to the perianth, subquadrate or oval, apex retuse, emarginate, entire or irregular. Perianth relatively large, almost as long as the leaves, projecting three-fourths beyond the bracts, oblong, attenuated at the base, widening towards the apex, obtusely 5-angled, angles furnished with one or two horns; similar horns are found on other parts of the upper portion of the perianth, apex depressed or flat, mouth closed at first, afterwards slightly opened, contracted, margin irregular. Calyptra pyriform, composed of thicker and smaller cells than the perianth. Capsule oval. Spores minute. Andrœcia not known.

DIMENSIONS.—Stems $\frac{1}{4}$ inch long; leaves, antical lobe 1·25 mm. \times ·35 mm., postical ·5 mm. \times ·2 mm., antical 1·5 mm. \times ·45 mm., postical ·5 mm. \times ·25 mm., upper inner lobe ·3 mm. \times ·15 mm., basal lobe ·3 mm. \times ·225 mm., ·3 mm. \times ·25 mm.; cells ·025 mm. \times ·025 mm., ·02 mm. \times ·035 mm., ·02 mm. \times ·04 mm.; stipules ·25 mm. \times ·15 mm. at the middle, segments ·175 mm.; bracts ·45 mm. \times ·35 mm., ·45 mm. \times ·3 mm., ·45 mm. \times ·25 mm.; perianth 1· mm. \times ·4 mm., ·9 mm. \times ·4 mm.; calyptra ·6 mm. \times ·35 mm.; capsule ·375 mm. \times ·2 mm.; spores ·01 mm.

HAB.—In minute, pale yellowish-green tufts, on rocks, trees, or furze bushes. Extremely rare. 1. Trevaylor, Cornwall, *J. Ralfs, W. Curnow.* 7. Tyn-y-Groes, Merionethshire, *Holt and Wild.* 12. Lodore, Cumberland, *C. Lyell and W. H. P.* Stone-thwaite, Cumberland, *J. R. Byrom and W. H. P.* 16. Moidart,

West Inverness, *S. M. Macvicar*. South of Ireland, *Miss Hutchins, Dr. Taylor, Dr. Spruce, W. Wilson, Dr. Carrington, &c.*

Found on the Continent (France).

OBS.—The most curious character about this plant is the inner upper enclosed horseshoe-shaped lobe which Dr. Gottsche was the first to observe, and who seemed to think it had some function which we do not understand, for in an allied *Lejeunea* from the Straits of Magellan, the inner structure of which was very similar to our species, he found in the pouch-like lobe the chitinous remains of many small animals which had been unable to find their way out of this trap-like arrangement.

A closer investigation of this species will reward the student with particulars which are hardly to be expected in a work of mere descriptive botany.

As will be seen from the description and drawings, it is a species which cannot be confounded with any other British one.

DESCRIPTION OF PLATE XX.—Fig. 1. Plants natural size. 2. Plant $\times 31$ (Borrowdale, W. H. P.). 3–7. Leaves $\times 31$ (ditto). 8. Leaf $\times 31$ (Cherbourg, France, Corbière). 9. Basal lobe of leaf $\times 64$ (ditto). 10. Upper lobe of leaf $\times 64$ (ditto). 11. Portion of leaf $\times 290$ (Borrowdale, W. H. P.). 12–14. Stipules $\times 64$ (ditto). 15, 16. Bracts $\times 31$ (Cherbourg, Corbière). 17. Bract $\times 31$ (Borrowdale, W. H. P.). 18, 19. Perianths $\times 31$ (Cherbourg, Corbière). 20. Apex of perianth, showing mouth $\times 31$ (ditto).

Tribe II. JUNGERMANIÆ.

Subtribe I. RADULÆ.

Genus 4. **RADULA**, *Dum.*

Candolleæ, sp. Raddi Jung. Etr. in Mem. Moden. xviii. p. 22 (1820).

Martinellii, Gr. & B. Nat. Arr. Br. Pl. i. p. 690 (1821).

Radula, sp. Dum. Comm. p. 112 (1822).

Radula, sect. *Radulotypus*, Dum. Syll. Jung. p. 38 (1831).

Radula, Dum. Recueil, p. 14 (1835); Nees, Nat. Eur. Leb. 111, p. 145 (1838).

Stems laxly pinnate or dichotomous; branches lateral, arising from the outer base of the leaves. Leaves incubous, complicate,

bilobed, postical lobe smaller than the antical, inflexed, producing rootlets. Stipules absent. ♀ flowers polygonous, fruit terminal on short branches or at the base of the fork. Perianth campanulate, compressed or subterete, truncate, mouth dilated. Bracts entire, 1-pair, somewhat similar to the leaves, deeply bilobed. Calyptra pyriform, persistent, free, opening below the apex. Pedicel stout, composed of 6 to 8 concentric layers of alternate cells. Capsule oval-cylindrical, dividing to the base into 4 valves. Elaters numerous, long, slender, attenuate at both ends, bispiral, deciduous. Spores large, globose. Andrœcia spicate; perigonia bracts 3–15 pairs, small; antheridia 1 or 2 (rarely 3) in the ventricose base of the bracts.

1. *Radula voluta*, Taylor.

Radula voluta, Tayl. MS. G.L.N. Syn. Hep. (1844).

Dioicous, shallowly caespitose, medium size, pale yellow to yellowish-brown. Stems procumbent, pinnately branched. Leaves laxly imbricated, incubous, divergent to patent-divergent, unequally bilobed, antical lobe broader than high, subrotund, obtuse, quite entire, slightly undulate, crossing the stem, decurrent at its postical base, postical lobe about one-third its size, broader than high, subrotund-cordate, plane, undulate or with margin slightly recurved, crossing the stem, auriculate at the base; texture somewhat flaccid; cells small, 4-, 5-, or 6-angled, walls moderately thick, without trigones. Andrœcia on short lateral catkin-like branches, perigonial bracts 3, 4 pairs, closely imbricate, erect, turgid, bilobed, lobes oval, postical rather shorter.

Female plant not known.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inches long with leaves 2· to 3· mm. wide, diameter ·2 mm. to ·3 mm.; leaves, antical lobe 1·6 mm. × 1·9 mm., postical lobe ·9 mm. × 1· mm., antical 1·5 mm. × 1·5 mm., postical ·5 mm. × ·6 mm., antical 1·1 mm. × 1·2 mm., postical ·5 mm. × ·7 mm.; cells ·02 mm. × ·02 mm., ·02 mm. × ·025 mm.; male catkin 3· mm. × 1·5 mm., 2·5 mm. × 1·25 mm.; perigonial bracts, antical lobe 1·2 mm. × ·6 mm., postical

1· mm. × ·6 mm., antical 1· mm. × ·5 mm., postical ·8 mm. × ·4 mm.

HAB.—On damp or wet rocks, or on earth-encrusting rocks, near streams. Rare.

7. Torrent Walk, Dolgelly, *Dr. Carrington and W. H. P.* Tyn-y-Groes, Merioneth, *W. H. P.* 12. Lodore Falls, Cumberland, *Dr. Carrington and W. H. P.* Rosthwaite, Cumberland, *Dr. Carrington and W. H. P.* 13. Ness Glen, Dalmellington, Ayrshire, *J. McAndrew.* I. Dunkerron, *Dr. Taylor.* Torc Waterfall, *Dr. Spruce, Dr. Carrington.* Rocks below Eagle's Nest, Cromaglow, *G. E. Hunt.* Glena, ♂ *Stewart and Holt.*

Not found on the Continent or in North America, the specimens from Tallulah Falls, Georgia, belonging to a different species.

Obs.—Distinguished from other dioicous British *Radulæ* by its pale yellow colour, broad antical lobes, and subrotund-cordate auriculate postical lobes of the leaves, which are more or less undulate and of a flaccid texture. *Radula walapensis*, Mont., from Bolivia, according to the opinions of Dr. Spruce and Stephani, who have seen original specimens, is a different species, which I fully agree with, having myself examined them.

DESCRIPTION OF PLATE XXI. — Fig. 1. Plant natural size. 2. Portion of stem, postical view × 24 (C. & P., n. 44). 3, 4. Leaves, antical lobes × 24 (Torc Waterfall, R. Spruce). 5. (Ditto) × (Herb. Taylor). 6, 7. (Ditto) × 24 (Torc, Dr. Spruce). 8. Portion of leaf × 290 (Glena, Holt and Stewart). 9. Male catkin, postical view × 16 (ditto).

2. *Radula Lindbergii*, *Gottsche.*

Radula complanata (L.), var. *propagulifera*, Nees, Nat. Eur. Leb. iii. p. 148 (1838).

Radula Lindenberghiana, Gottsche, Hartmann's Handb. Scand. Fl. 9, Aufl. p. 98 (1864), in error, should be *R. Lindbergiana*.

Radula commutata, Gottsche, Jack, "Flora," n. 23 & 25 (1881).

Dioicous, widely and shallowly cæspitose, medium to largish in size, from dull greenish-brown to dark sordid brown. Stems prostrate, subpinnate, irregularly or regularly bipinnate, branches

ascending. Leaves imbricate, patent-divergent, 70° , unequally bilobed, antical lobe plane or slightly convex, crossing the stem, subrotund or broadly obovate, margin quite entire or erose by formation of gemmæ, postical lobe 3 to 4 times smaller, appressed to the antical lobe, quadrate, free angle acute, inner margin reaching to the middle of the stem, upper angle rotundate or acute; cells smallish to medium in size, hexagonal, walls firm, no trigones or thickened angles. Bracts unequally bilobed, antical lobe obovate-elongate, postical lobe about one-third smaller, oblong-quadrate, free angle acute or obtuse. Perianth projecting to about the middle beyond the bracts, obovate, complanate, truncate. Capsule brown, dividing into 4 longish oval valves, elaters usually monospiral; spores roundish. Andrœcia terminal on the chief stem or on long lateral branches; perigonal bracts closely imbricate, bilobed, turgid at the base, antical lobe oval, apex rotundate, postical slightly shorter, oval, apex obtuse; antheridia spherical. Gemmæ often abundant at the margin of the upper leaves.

DIMENSIONS.—Stems 1 to 2 inches long, with leaves 2 to 3 mm. wide, diam. of stem .15 mm.; leaves, antical lobe 1.5 mm. \times 1.25 mm., postical lobe .75 mm. \times .6 mm., antical 1.25 mm. \times 1 mm., postical .6 mm. \times .5 mm., antical 1.2 mm. \times .8 mm., postical .6 mm. \times .4 mm.; cells .0225 mm. \times .0225 mm., .03 mm. \times .03 mm., .0225 mm. \times .03 mm.; bracts, antical lobe 1.25 mm. \times .75 mm., postical lobe .75 mm. \times .5 mm.; perianth 2.25 mm. \times 1.1 mm.; elaters .3 mm. \times .006 mm.; spores .03 mm.

HAB.—In spreading flat patches, closely attached to damp rocks in exposed or shaded situations, usually in hilly or subalpine localities. Rare.

2. New Forest, *C. Lyell*, 1813, March 12, 1814. 7. Clogwyn-du-Arddu, Snowdon, Carnarvonshire, *W. H. P.* 12. Harter Fell, and Mardale, Westmorland, *G. Stabler*. Near Keswick, *Dr. Carrington and W. H. P.* 15. Braemar, *A. Croall*.

Found on the Continent and in Canada (rocks near Belleville), *Macoun*.

OBS.—Distinguished from *R. complanata* (L.) by its dioicous inflorescence; from *R. aquilegia*, Tayl., by its colour, and the

larger, plane postical lobe, which is not turgid at the base; from *R. Carringtoni*, Jack, by its greenish sordid brown colour, presence of gemmæ, coarser texture, and relatively larger postical lobe.

After the examination of numerous specimens of *Radula commutata*, G., I have been unable to find sufficient characters to separate it from *R. Lindbergii*, G.

This species was named by Dr. Gottsche after the late Prof. S. O. Lindberg, of Helsingfors, one of the most distinguished botanists of our time, and whose contributions to the knowledge of the Hepaticæ, especially of European species, have been numerous, original, and marked by an accuracy of observation which commands both our respect and admiration.

By an error it was first published in Hartmann's "Handbok i Scand. Flora" as *Radula Lindenberghiana*; as Lindberg was the discoverer of the species, I have further altered the name from *Lindenberghiana* to *Lindbergii*.

DESCRIPTION OF PLATE XXII.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 16$ (Clogwyn-du-Arddu, W. H. P.). 3. Ditto, postical view $\times 16$ (Braemar, A. Croall). 4. Ditto $\times 24$ (Hunneberg, Sweden, S. O. Lindberg). 5. Portion of leaf $\times 290$ (ditto). 6. Perianth with bracts $\times 16$ (ditto).

3. *Radula germana*, Jack.

Radula complanata (L.), var. *plumulosa*, Nees & var. *tenuis*, Nees, Nat. Eur. Leb. iii. p. 148 (1838), G.L.N. Syn. Hep. p. 257 (1844).

Radula germana, Jack, "Flora," n. 23 & 25, pp. 355, 395-7 (1881).

Dioicous, cæspitose, small, pale yellowish or bright pea-green in colour, young terminal branches darker green, the lower parts and older stems being of a pale sordid brown colour. Stems procumbent or erect when growing with mosses, imbricate, frontally compressed, narrow, graceful, flexuose; female plant subpinnate, furcate or dichotomous, barren stems almost simple, with few and very short branches, which are longer near the apex; radiculose, rootlets few, arising from the underside of the lobule, fasciculate, short, sordid white. Leaves imbricate, below approximate, alternate, unequally bilobed, antical lobe roundish-

ovate or obovate, convexulous, entire, or when gemmiparous, erose; postical lobe about one-third the size, rhomboid, subquadrate or quadrate, obtuse or acute at the free angle, tumid at the base, upper portion plane and appressed to the antical lobe; cells small, hexagonal, lumen usually filled with chlorophyllose granules, walls moderately firm, trigones very minute or not observable. Bracts, antical lobe oblong-obovate, postical oblong-quadrate narrow. Perianth projecting two-thirds beyond the bracts, oblong-obconical, with a tapering base, complanate, mouth truncate, quite entire. Pistillidia 8–10. Calyptra with a long neck, delicate, pyriform. Capsule oblong-oval, dividing to the base into 4 oval valves. Spores subspherical, finely granulate. Elaters bispiral, loosely twisted.

Male stems irregularly pinnate, catkins lateral, long or short, consisting of from 8–15 pairs of perigonal bracts, which are closely imbricate, erect, tumid, bilobed; antical lobe oval, postical shorter, roundish-oval; antheridia oval, large, solitary.

DIMENSIONS.—Stems $\frac{3}{4}$ inch to 1 inch long, with leaves 1 mm.—1·25 mm. wide, diameter ·17 mm. × ·11 mm., ·16 mm. × ·11 mm., ·15 mm. × ·11 mm., leaves, antical lobe 1·2 mm. × ·8 mm., 1·2 mm. × ·7 mm., 1·1 mm. × ·8 mm., 1 mm. × ·7 mm., 1 mm. × ·6 mm., postical ·7 mm. × ·3 mm., ·6 mm. × ·4 mm., ·6 mm. × ·35 mm., ·55 mm. × ·35 mm., ·4 mm. × ·3 mm.; cells ·02 mm.; bracts, antical lobe 1·1 mm. × ·6 mm., postical ·8 mm. × ·4 mm., antical 1 mm. × ·5 mm., postical ·9 mm. × ·4 mm.; pistillidia ·12 mm. × ·04 mm.; perianth 2·2 mm. × 1·1 mm., 2·1 mm. × ·9 mm.; valves of capsule ·9 mm. long; spores ·044 mm. diam.; elaters ·28 mm. × ·006 mm.; male spikes 1 mm. long, ·2 mm.—·4 mm. wide; perigonal bracts, antical lobe ·8 mm. × ·4 mm., ·7 mm. × ·45 mm., ·625 mm. × ·45 mm., ·6 mm. × ·45 mm., ·6 mm. × ·4 mm., postical ·6 mm. × ·4 mm., ·45 mm. × ·3 mm.; antheridia ·2 mm. × ·15 mm.; gemmæ ·1 mm. diam.

HAB.—In procumbent patches, with stems imbricating, on rocks, or erect when intertwined with mosses (*Dicranum falcatum*, &c.); in alpine situations. Rare.

15. Rocks by the Burn, Forfar, *A. Croall*. Loch-na-Gat, Ben

Lawers, *George E. Davies*. Mael Tarmachan near Ben Lawers, *C. J. Wild, G. A. Holt*. Ben Cruachan, Loch Awe; Ben Laoigh, Craig Calleach, *T. Rogers*.

Found on the Continent (Germany, Switzerland, Austria).

Obs.—Differs from *R. complanata* (L.) in its dioicous inflorescence; from *R. aquilegia*, Tayl., in its pale yellowish-green colour, the leaves not being so tumid at the base, and the perianth being longer and narrower; from *R. Lindbergii*, G. (*R. commutata*, G.) in its paler colour, narrower stems (with leaves), more erect leaves with smaller cells, and longer and narrower perianth.

Some authorities consider this species to be only a variety of the latter, but the characters indicated induce me to follow Jack in raising it to the rank of a separate species.

DESCRIPTION OF PLATE XXIII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 24$ (Mael Tarmachan, G. A. Holt). 3. Ditto, ♀ postical view $\times 16$ (ditto). 4. Leaf $\times 24$ (Germany, Jack). 5. Portion of leaf $\times 290$ (Mael Tarmachan, G. A. Holt). 6. Perianth and bracts $\times 24$ (Germany, Jack). 7. Perigonial bracts $\times 31$ (Ben Cruachan, T. Rogers).

4. *Radula Holtii*, *Spruce*.

Radula Holtii, Spruce in "Journ. of Bot." (July 1887).

Dioicous, creeping, small, rufulous or olive green. Stems slender, fragile, branches subpinnate or dichotomous. Leaves contiguous or subdissitous, at the base decurrent, complicato-saccate, keel at an angle of 45° , suberect, ascending, convex, abruptly widely patent, antical lobe broadly oblong, rotundate, plane or subconcave, repand, much incurrent, not hiding the stem at the basal angle, postical lobe one-third the length, trapeziform, obtuse or subacute, subplane, inflated at the keel only, running well in upon the stem but not passing over (or across) it; cells small, 4-, 5- and 6-angled, opaque or sub-pellucid, walls thick, angles but slightly thickened, without trigones. Flowers terminal, innovations unilateral or two opposite. Bracts often only one

pair, erect if more, closely imbricate, bilobed to the middle, antical lobe broadly obovate, lobule hardly half the size, subrotund. Perianth projecting very much, slender, subincurved, trumpet shaped, perfectly terete, only at the apex very slightly compressed, mouth truncate, obsoletely 4-lobed. Andrœcia terminal on branches; perigonal bracts 2, 3 pairs, similar to the leaves only lobule larger, slightly turgid, diandrous.

DIMENSIONS.—Stem $\frac{1}{2}$ inch long, .1 mm. diameter, with leaves 1.25 mm. wide; leaves, antical lobe .8 mm. \times .6 mm., .65 mm. \times .55 mm., .7 mm. \times .6 mm., postical lobe or lobule .25 mm. \times .3 mm., .2 mm. \times .175 mm., .3 mm. \times .275 mm.; cells .02 mm. \times .02 mm., .03 mm. \times .02 mm., .02 mm. \times .0175 mm., .0175 mm. \times .0175 mm.; bracts, antical lobe .6 mm. \times .4 mm., postical lobe .37 mm. \times .35 mm.; perianth, 2.1 mm. \times .3 mm. (mouth) \times .15 mm. below the middle, 2. mm. \times .35 mm. (mouth).

HAB.—Extremely rare, the only known station being near Torc Waterfall, Killarney, growing with *Dumortiera irrigua*, *Jubula Hutchinsiae* and *Lejeunea Mackaii*. G. A. Holt, June 1885; D. McArdle, 1897.

Obs.—This distinct species cannot be confounded with any other British ones; from all it is distinguished by its smaller size and slender habit; *R. germana*, Jack, which is also dioicous and somewhat slender, has larger and squarer leaf lobules, the fold of which is not decurrent nor divergent from the antical lobe, and the perianth being of a different shape and complanate. The most important character of *R. Holtii*, however, is the slender, trumpet-shaped, terete perianth, sufficing to distinguish this *Radula* from every other European species.

Justly named by Dr. Spruce after its discoverer, Mr. G. A. Holt, of Manchester, who is one of the most accurate students of the British Mosses and Hepaticæ.

The description and notes are taken from Dr. Spruce's communication to the "Journ. of Bot." for July 1887.

DESCRIPTION OF PLATE XXIV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view, \times 24. 3. Ditto, postical view, \times 24. 4. Portion of branch, postical view, \times 24. 5, 6. Leaves,

antical view $\times 64$. 7. Ditto, postical view, $\times 64$. 8. Portion of leaf $\times 290$. 9. Perianth $\times 31$. 10. Portion of male stem $\times 31$ (Tore Cascade, G. A. Holt).

5. *Radula aquilegia*, Taylor.

Jungermania aquilegia, Tayl. Trans. Bot. Edin. vol. xi. p. 115–117 (1845).

Radula aquilegia, Tayl. G. L. N. Syn. Hep. p. 260 (1844).

Jungermania complanata, var. *b. minor*, Hook. Brit. Jung. t. 81, f. 17 (1816).

Dioicous, broadly and shallowly caespitose, medium to largish in size, olive-brown in colour. Stems prostrate, irregularly pinnate or subpinnate, branches often at nearly right angles to the stem; cortical cells 18–20 brown, inner pellucid, 6 cells in diameter. Leaves contiguous or imbricate, distichous, patent-divergent to patent, 60° , unequally bilobed, antical lobe convex, quite entire, obovate or semi-rotund, apex rotundate, crossing the stem, often inflexed, postical lobe about 4 to 5 times smaller, subquadrate or oblong-quadrate, remarkably involute, tumid at the base, free upper margin appressed to the antical lobe, apex acute or obtusate, margin nearest the stem covering it to nearly the middle; cells small, walls thick, angles thickened, sometimes showing trigones. Flowers ♀ terminal on long lateral branches with one or two innovations produced from below. Bracts about the same size as the largest leaves or slightly larger, unequally bilobed, antical lobe similar in shape to stem leaves, postical lobe about half the size of antical, subquadrate, apex obtuse or rotundate, plane. Perianth projecting nearly two-thirds beyond the bracts, elongate-obconical, compressed, mouth wide, truncate, quite entire. Male plants smaller; perigonal bracts on main stem or on middle or end of lateral branches, closely imbricate, parallel with the stem or erect, smaller than the stem leaves, base rotundate, pendant below its insertion on the stem, unequally bilobed, antical lobe oblong-oval, convex, postical lobe about half the size, oval, much swollen; antheridia single, large, subspherical.

DIMENSIONS.—Stem 1 to 2 inches long, with leaves 1·5 mm. wide; diameter of stem ·1 to ·15 mm.; leaves, antical lobe ·8 mm.

× ·65 mm., postical lobe ·45 mm. × ·3 mm., antical lobe 1· mm. × ·8 mm., postical ·6 mm. × ·4 mm., antical ·9 mm. × ·75 mm., postical ·4 mm. × ·35 mm., antical ·9 mm. × ·8 mm., postical ·4 mm. × ·3 mm.; cells ·02 mm.; bract, antical lobe 1· mm. × ·9 mm., postical ·7 mm. × ·4 mm.; perianth 2· mm. × 1· mm. wide at the mouth, perigonal bracts, antical lobe ·6 mm. × ·3 mm., postical ·4 mm. × ·3 mm., antical ·7 mm. × ·3 mm., postical ·4 mm. × ·3 mm.; antheridia ·2 mm.

HAB.—On wet rocks, very closely attached. Rare; fertile plants extremely so.

7. Tyn-y-Groes, Merionethshire, April 1876, *W. H. P.*; 1885 *G. A. Holt* (cum fr.). Cwm Idwal, Carnarvonshire, *W. H. P.* Llanberis, Carnarvonshire, *J. Cash and W. H. P.* 12. Grasmere, Westmorland, *Rev. C. H. Binstead.* Lodore, Cumberland, *W. H. P.* Stonethwaite, Cumberland, *J. R. Byrom and W. H. P.* 16. Moidart, West Inverness, *S. M. Maccicar* (cum per). I. Near Bantry, *Miss Hutchins.* Killarney, *Dr. Carrington* (cum per.). Glena, *Prof. Lindberg,* Knockavohila, *Dr. Taylor.* Killarney, *Dr. Moore,* &c. Blackstair, Slieve Donard, Co. Down, *Rev. C. H. Waddell.*

Obs.—Distinguished from *Radula complanata* (L.) by its inflorescence and olive-brown colour; from *Radula Carringtoni*, Jack, see notes under that species.

It is easily recognised by the swollen base of its leaves, the perigonal bracts being remarkably tumid.

Radula physoloba, Mont., from Auckland Island, is a different species.

DESCRIPTION OF PLATE XXV.—Fig. 1. Plant natural size. 2. Portion of stem, antical view × 24 (C. & P. n. 43). 3–7. Leaves × 24 (Ireland, Taylor). 8. Portion of leaf × 290 (ditto). 9. Perianth with bract × 16 (ditto). 10. Portion of male stem, postical view × 24 (C. & P. n. 43). 11, 12. Perigonal bracts × 24 (ditto).

6. *Radula Carringtonii*, Jack.

Radula Carringtonii, Jack, in "Flora," p. 385 (1881).

Radula aquilegia, Tayl. var. *major*, Carrington, Trans. Bot. Soc. Edin. vii. p. 455 (1863).

Dioicous, closely but shallowly cæspitose, medium to largish in size, pale or olive-brown colour. Stems closely imbricate, prostrate, irregularly bipinnate, moderately firm, cortical cells similar to the inner, about 30, inner 5×8 , with brownish walls; branches alternate, somewhat ascending. Leaves slightly imbricate or approximate, patent-divergent to patent 70° – 50° , unequally bilobed, margin quite entire; antical lobe plane or very slightly convex, rotund or subreniform, crossing the stem; postical lobe $\frac{1}{4}$ – $\frac{1}{3}$ smaller, quadrate or trapeziform, outer angle acute, inner margin reaching to about the middle of the stem, plane, appressed to the antical lobe; texture thin; cells smallish, hexagonal, walls firm, without trigones. Flowers ♀ terminal on short lateral branchlets, produced from the pinnæ, always subtended by an innovation. Bracts rather larger than the leaves, unequally bilobed, antical lobe turbinate to oblong-oval, apex rotundate, inflexed, postical lobe, about half the size, somewhat similar in shape, apex rotundate. Archegonia 7, 8. Perianth (young) compresso-campanulate, bilabiate, lips retuse. Male plant smaller, irregularly pinnate, branches alternate, short; androecia on short catkins, produced from main stem; perigonal bracts 5–10 pairs, closely imbricate, erect, turgid, bilobed to about $\frac{1}{4}$ or $\frac{1}{3}$, antical lobe oblong-oval, postical rather shorter, oval; antheridia small, spherical, bearers long.

DIMENSIONS.—Stems 1 to 2 inches long, with leaves 2· mm. to 2·5 mm. wide, diameter of stem ·15 mm. to ·2 mm., leaves, antical lobe 1·2 mm. \times 1· mm., postical ·55 mm. \times ·5 mm., antical 1·2 mm. \times ·9 mm., postical ·55 mm. \times ·4 mm., antical 1·5 mm. \times 1·1 mm., postical ·7 mm. \times ·5 mm., antical 1·1 mm. \times ·8 mm., postical ·45 mm. \times ·35 mm.; cells ·03 mm. \times ·0225 mm., ·0275 mm. \times ·025 mm., ·0275 mm. \times ·0275 mm., ·0225 mm. \times ·02 mm.; bracts, antical lobe 1·25 mm. \times ·9 mm., postical 1· mm. \times ·6 mm.; male

ramuli $1\frac{1}{2}$ mm. to 3 mm. long, perigonial bracts, antical lobe $\cdot 7$ mm. \times $\cdot 4$ mm., postical $\cdot 6$ mm. \times $\cdot 35$ mm.; antheridia $\cdot 1$ mm. diameter, bearer $\cdot 15$ mm. long.

HAB.—In wide closely imbricated patches on rocks or trees, South of Ireland, Tore Woods; Cromaglow; Glena; Tomes Woods, Killarney, *Dr. Carrington*, June 1861. Rocks near Tore Cascade, Killarney (male plant), *G. E. Hunt*, April 1872. O'Sullivan's Cascade; Glena; Cromaglow, Killarney, *Prof. S. O. Lindberg*, 1873. Killarney, *Dr. D. Moore*. Damp shady rocks, Tore Cascade, *Stewart and Holt* (male plants), June 1885. Aunis-caul, Co. Kerry, *D. McArdle* (cum per.), June 1898. 16. Moirdart, West Inverness, *S. M. Macvicar*.

Found on the Continent (Norway), *B. Kaalaas*. Extremely rare.

Obs. — This, the handsomest of our native *Radulae*, was deservedly named by Jack in honour of its original discoverer, *Dr. Carrington*, who collected it in the South of Ireland in 1861, and thought it was a distinct species, although he had not seen either the male plant or perfect perianths, but deferring to the opinion of some of his friends, he published it as var. *major* of *Radula aquilegia*, Taylor; since then, the male plant along with more perfect female plants have been met with, which clearly show its specific difference from the latter.

It is distinguished from *R. aquilegia* by its larger size, rather paler brown colour, which is golden brown by transmitted light, leaves with less convex antical lobes; postical lobe relatively larger, plane, appressed to the antical lobe, not turgid at the base, free angle more acute, texture thinner and more translucent; andrœcia on short catkins proceeding from the main stem. From any of the other British *Radulae* it is abundantly distinct.

DESCRIPTION OF PLATE XXVI.—Fig. 1. Plant, female, natural size. 2. Ditto, male. 3. Portion of stem, postical view $\times 24$ (Killarney, *Dr. D. Moore*). 4. Ditto, with male spike $\times 24$ (Tore Waterfall, *Holt and Stewart*). 5–7. Leaves $\times 24$ (Killarney, *Dr. Carrington*). 8. Portion of leaf $\times 290$ (Tore Waterfall, *G. E. Hunt*). 9. Bracts $\times 24$ (Killarney, *Dr. Carrington*). 10, 11. Perigonial bracts $\times 24$ (Tore Waterfall, *Holt and Stewart*).

7. *Radula complanata* (L.), Dum.

Jungermania complanata, Linn. Sp. Pl. 1599 (1753); Hook. Brit. Jung. t. 81 (1816).

Radula complanata, Dum. Comm. p. 112 (1822).

Paroicous, imbricately, widely, and shallowly cæspitose, largish, pale yellowish-green colour. Stems creeping, stratiöse, subpinnate, cortical cells about 35, similar in size to inner, only with thicker walls, cells 8×10 in diameter; slightly radiculose, rootlets dirty white, produced from postical side of postical lobes of leaves. Leaves imbricate, patent to patent-divergent, 60° , unequally bilobed, quite entire or erose, antical lobe roundish, slightly convex, covering the stem, postical lobe about $\frac{1}{3}$ smaller, quadrate, angle obtuse or subacute, sometimes arcuate; cells smallish-medium size, hexagonal, walls thin, trigones very small, lumen full of chlorophyll granules. Bracts similar in size to the leaves, antical lobe elongato-obovate, postical lobe about half the size, ovate, apex rotundate. Perianth projecting about half beyond the bracts, obconical, complanate, mouth wide, truncate, quite entire. Capsule dark brown, oval; spores large, about 3 times the diameter of the elaters, which are bispiral. Perigonial bracts 3–5 pairs, immediately below the perianth (or on a lateral branch produced from below it at the apex of which is always an imperfect female flower), closely imbricate, erect or erecto-patent, tumid, unequally bilobed, antical lobe oval, postical about half the size; antheridia single, globose.

Gemmiparous, gemmæ discoid, on the margins of leaves, rendering them often irregular and erose.

DIMENSIONS.—Stems 1 to 2 inches long, diameter $\cdot 15$ mm., with leaves $2\cdot 25$ mm. to $2\cdot 5$ mm. wide; leaves, antical lobe $1\cdot 3$ mm. \times $1\cdot 1$ mm., postical lobe $\cdot 7$ mm. \times $\cdot 5$ mm.; cells $\cdot 035$ mm. \times $\cdot 025$ mm.; innermost and perigonial bracts, antical lobe $1\cdot 12$ mm. \times $\cdot 82$ mm.; postical $7\cdot 5$ mm. \times $5\cdot 5$ mm.; perianth $3\cdot$ mm. \times $1\cdot 25$ mm.; capsule $1\cdot 25$ mm. \times $\cdot 75$ mm.; spores $\cdot 03$ mm.; elaters, $\cdot 2$ mm. \times $\cdot 01$ mm.; antheridia $2\cdot 25$ mm. \times $\cdot 2$ mm.

HAB.—On the bark of trees. Common. 1 to 17. I.

Found on the Continent and in North America.

Obs.—This, the commonest of our British *Radulæ*, is distinguished from all the others by its paroicous inflorescence.

The antheridia are normally situated below the young perianth, but with its maturing, they disappear and the bracts assume the form of ordinary leaves; but a lateral young branch, proceeding from below the perianth, usually bears 3–5 perigonial bracts with an immature perianth at its apex.

DESCRIPTION OF PLATE XXVII.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 11$ (Barmouth, W. H. P.). 3. Ditto $\times 16$ (ditto). 4. Ditto, postical view $\times 11$ (Dove Dale, W. H. P.). 5. Portion of stem with perianth $\times 21$ (Jack del.). 6. Portion of leaf $\times 290$ (Dove Dale, W. H. P.). 7. Perianth with bracts $\times 11$ (ditto). 8. Perigonial bracts $\times 16$ (ditto). 9. Young flower, showing ♀ and ♂ $\times 40$ (Gottsche del.).

Subtribe II. PORELLEÆ.

Genus 5. PORELLA, Dill.

Porella, Dill. Hist. musc. p. 459 (1741); Lindb. in Act. soc. sc. fenn. p. 329 (1869).
Bellincinia et Antoiria, Raddi Jung. Etr. in Mem. Moden. xviii. p. 18 et 19 (1820).
Cavendishia, Gr. and Benn. Nat. Arr. Brit. Pl. i. p. 689 (1821).
Madotheca, Dum. Comm. p. 111. (1822).

Dioicous. Stems regularly pinnate and feather-like; branches lateral, axillary. Leaves incubous, often subopposite, complicato-bipartite; postical lobe much smaller, exterior base often decurrent. Stipules large, basal angles decurrent with a lacinate and crispate wing.

Flowers ♀ lateral, nearly sessile. Bracts 2-pairs, bilobed, dentate or ciliate. Perianth short, ovate, frontally compressed, trigonous on section, mouth plurilacinate, at first constricted, afterwards bilabiate or campanulate. Calyptra globose, carnosose, rupturing below the apex. Pedicel very short, not projecting beyond the perianth. Capsule globose, pale, membranous, divided nearly to the base into 4 valves. Elaters small, short, bi-trispiral, free, attenuate at both ends. Spores rather large, somewhat angular. Andrœcia shortly spicate; perigonial bracts exactly

opposite and connate with the intervening stipules; closely imbricate, bilobed. Antheridia solitary, large, oval-globose, stipitate, situated in the saccate bases of the bracts.

1. *Porella laevigata* (Schrad.) Lindb.

Jungermania laevigata, Schrad. Syst. Samm. 11, n. 104, p. 6 (1797); Hook. Brit. Jung. t. 35 (1816).

Madotheca laevigata, Dum. Comm. p. 111 (1822).

Porella laevigata, Lindb. Musc. scand. p. 3 (1879).

Dioicous, loosely caespitose, largish to large, olive-green to yellowish-brown. Stems procumbent, lying over each other in an irregularly imbricated manner, irregularly bipinnate, branches horizontal, irregular in size, number and position, apices somewhat attenuate; on a cross-section oval, frontally compressed, 24 cells \times 32, the cortical and next inner layer of cells being small with very thick brown walls, the third row having brown walls but thinner, and the inner cells becoming gradually larger with thinner and more hyaline walls; radiculose, rootlets few, very small, proceeding from the lower part of the stem. Leaves closely imbricate, alternate, appressed to stem, incubous, bifarious, unequally bilobed, antical lobe much the largest, horizontal, convex or subplane, obliquely ovate, acute or acuminate, margin more or less entire, near antical base often furnished with 2 or 3 teeth; postical lobe erect or erecto-patent, almost parallel with the stem, oblong, plane, appressed to antical lobe, about as long but narrower than the stipules, ciliate-dentate. Texture somewhat thin, epidermis polished, rarely dull; cells small, roundish, trigones distinct. Stipules appressed to stem, broadest at the base, slightly decurrent, ovate-rectangular, apex subtruncate, margin undulate, ciliate-dentate. Flowers ♀ produced on short branchlets at right angles to the branches; sub-bracts somewhat similar to the leaves only larger and ciliate dentate; sub-bracteole similar to stipules only larger; bracts patent-divergent, much larger than the leaves, antical lobe broadly ovate, rotundate, ciliate; postical lobe patent-divergent, broader than the leaf lobules,

ciliolate; bracteole broadly ovate, ciliolate. Perianth cuneate, mouth very wide, irregular, ciliolate, ciliola being about 4 cells long. Pistillidia very large.

DIMENSIONS.—Stems 2 to 3 inches long, $\cdot 4$ mm. to $\cdot 5$ mm. in diameter, with leaves 3 mm. wide; antical lobe $2\cdot 5$ mm. \times $1\cdot 75$ mm., $2\cdot$ mm. \times $1\cdot 5$ mm., postical $1\cdot 1$ mm. \times $\cdot 4$ mm., $1\cdot 25$ mm. \times $\cdot 5$ mm., $1\cdot 2$ mm. \times $\cdot 5$ mm.; branch leaves, antical lobe $1\cdot 6$ mm. \times $1\cdot 25$ mm., $1\cdot 75$ mm. \times $1\cdot 25$ mm., postical $\cdot 7$ mm. \times $\cdot 22$ mm.; cells $\cdot 02$ mm., $\cdot 0225$ mm. \times $\cdot 02$ mm., $0\cdot 225$ mm. \times $\cdot 0225$ mm.; stipules, $1\cdot 25$ mm. \times $\cdot 75$ mm., $1\cdot$ mm. \times $\cdot 9$ mm.; sub-bract, antical lobe $2\cdot 4$ mm. \times $1\cdot 5$ mm., postical $1\cdot 35$ mm. \times $\cdot 7$ mm.; sub-bracteole $1\cdot 25$ mm. \times $\cdot 7$ mm.; bract, antical lobe $3\cdot$ mm. \times $1\cdot 75$ mm., postical $1\cdot 75$ mm. \times $1\cdot$ mm.; bracteole $2\cdot 25$ mm. \times $2\cdot$ mm.; perianth $3\cdot$ mm. \times $3\cdot 5$ at the mouth; teeth at mouth of perianth $\cdot 05$ mm.— $\cdot 075$ mm.; pistillidia $\cdot 3$ mm. \times $\cdot 1$ mm.

HAB.—ON trunks of trees (especially at the base), stones or rocks. Rare. 1? 5. Gt. Doward Hill, Hereford, *B. M. Walkins*. 7. Barmouth, *Holt and Wild*. Tyn-y-groes, *W. H. P.* 10. Nr. Dent, *W. West*. 12. Borrowdale, Cumberland, *Dr. Carrington and W. H. P.* 13. Frequent in subalpine glens, Dumfries, *Craickshank, Scott.* 15. 16. Moidart, West Inverness, *Symers M. Maccicar*. I.

Found on the Continent.

Obs.—Distinguished from other *Porellæ* by its polished leaves, with antical lobes acute or acuminate, postical ciliate dentate, margin of bracts finely ciliolate, perianth short, but very wide at the mouth. Plants bearing perianths have, I believe, only been once found, by Prof. Henriques in Portugal; the male plant has never been met with. This plant has the singular character (which was first noticed by Prof. Lindberg), of producing a burning sensation in the mouth when chewed.

DESCRIPTION OF PLATE XXVIII.—Fig. 1. Plant natural size. 1. Portion of branch, antical view $\times 11$ (*C. & P.* n. 45). 3. Portion of stem, postical view $\times 16$ (ditto). 4. Leaf, postical view $\times 11$ (ditto). 5. Postical lobe or lobule $\times 16$ (ditto). 6. Portion of leaf $\times 290$ (ditto). 7. Stipule $\times 24$ (ditto).

8. Sub-bract $\times 16$ (Portugal, hb. S.O.L.). 9. Sub-bracteole $\times 16$ (ditto). 10. Bract $\times 11$ (ditto). 11. Bract and bracteole $\times 11$ (ditto). 12. Perianth $\times 11$ (ditto). 13. Portion of mouth of perianth $\times 85$ (ditto).

2. *Porella Thuja* (Dicks.), Moore.

Lichenastrum arboris vitæ facie, foliis rotundioribus, Dill. Hist. musc. p. 502, t. 72, f. 33 (1741).

Jungermania Thuja, Dicks. Pl. Crypt. Brit. Fasc. 4, p. 19 (1801); Tayl. in Trans. Bot. Soc. Edin. xi. p. 116 (1841).

Madotheca Thuja, Dum. Comm. p. 111 (1822).

Porella Thuja (Dicks.), Moore in Proc. R. I. A. 2nd ser. vol. ii. p. 618 (1876).

Dioicous, imbricately cæspitose, largish to large, brown or olive-brown, apices of branches often pale yellow. Stem irregularly bipinnate, frontally compressed, cross-section showing about 100 cortical cells very small with thick dark walls, 25×30 cells in diameter, inner cells large and hyaline; more or less robust, firm; radiculose, rootlets fasciculate, coarse, reddish-brown, produced from the base of the stipules. Leaves incubous, appressed, involute when dry, closely imbricate, horizontal, unequally bilobed, antical lobe much larger, convex, obliquely rotund-ovate, apex decurved, rotundate-obtuse, margin entire, or rarely with few distant teeth; postical lobe or lobule hardly decurrent, very slightly attached at its base to the antical lobe, patent, ovate to ovate-oblong, apex obtuse or acute, sometimes uncinatè, margin recurved, entire or rarely with few small teeth near the base; a little longer and narrower than the stipules; texture subopaque, firm but pellucid, epidermis slightly polished, verruculose, cells smallish 4-, 5- and 6-angled, roundish-quadrate, walls thick, trigones distinct. Stipules imbricate, appressed to the stem, decurrent, sub-reniform, sub-cordate or oval, broader than long on stem, longer than broad on branches, margin reflexed, entire or rarely with few teeth near the base. Female flowers on short lateral branchlets, only imperfect ones seen. Bracts larger than the leaves, antical lobe oblong-ovate or obliquely rotund-ovate, apex subacute, margin irregularly dentate, postical lobe

about 3 times smaller than the antical, oblong or oblong-ovate, apex obtuse or subacute, margin irregularly dentate; bracteole broadly ovate, irregularly dentate. Pistillidia numerous, 10-22 long and narrow. Male stems pinnate, with few short branches andrœcia numerous on short lateral alternate catkins; perigonial bracts 6-8 pairs, closely imbricate, erect, bilobed, postical lobe small and oblong; antheridia subspherical to oval, solitary.

DIMENSIONS.—Stem 2 to 3 inches long (var. *torva* 1 inch), diameter .4 to .5 mm., with leaves 2.25 mm. to 3 mm. wide; leaves, antical lobe 1.8 mm. \times 1.8 mm., postical 1.2 mm. \times .5 mm., antical 1.5 mm. \times 1.2 mm., postical .85 mm. \times .5 mm., antical 1.8 mm. \times 1.5 mm., postical 1 mm. \times .6 mm., antical 2 mm. \times 1.75 mm., postical 1.4 mm. \times .75 mm., antical 1 mm. \times .8 mm. postical .6 mm. \times .4 mm.; cells .03 mm. \times .02 mm., .025 mm. \times .025 mm., .025 mm. \times .02 mm.; stipules 1 mm. \times 1 mm., 1.3 mm. \times .9 mm., .7 mm. \times .7 mm., .7 mm. \times .8 mm., 1 mm. \times .8 mm.; bract, antical lobe 1.7 mm. \times 1.2 mm., postical 1.35 mm. \times .6 mm., antical 2.25 mm. \times 2 mm., postical 1.5 mm. \times 1 mm.; bracteole 1.25 mm. \times 1.25 mm., 1.1 mm. \times .8 mm. at base; pistillidia .4 mm. \times .075 mm.; perigonial bract, antical lobe 1.5 mm. \times 1 mm., postical .8 mm. \times .4 mm.; perigonial bracteole .75 mm. \times .45 mm.; antheridia 4 mm. \times .35 mm.

HAB.—On rocks, stones or trunks of trees. Rare.

1. Var. *torva*, Penzance, *W. Curnow*. 2. Var. *torva*, Sussex, *G. Davies*. 7. Ravine above Barmouth, Merioneth, *Dr. Carrington*. Near Snowdon, Carnarvon, *Dr. Carrington*. 12. 16. Braemar, *Dr. A. O. Black*. I. Cromaglow, *Dr. Carrington*. By Lough Mangerton, *Holt and Stewart*.

Found on the Continent (France, *Montagne*. Oporto, Portugal, *Newton, ♂*. Var. *torva*, Italy, *de Notaris*).

North America.

Obs.—Remarkable for its somewhat robust habit, dark brown to almost black colour, leaves being very closely imbricate, involute when dry and slightly polished, and rounder than any other of the British species.

Distinguished from *P. platyphylla* (L.) by its rounder leaves.

more quadrate cells with large trigones, bracts very much more dentate or denticulate.

From *P. lævigata* (Schrad.) by its much less polished leaves, its darker brown colour (never greenish), antical lobe being never acute, postical entire and proportionally broader, stipules broader and entire, and by its not having the pungent taste of *P. lævigata*.

The North American species *P. platyphyloidea* (Schweintz.), which has been confounded with it by some authors, is its nearest ally, but is of a lighter yellowish colour, with longer leaves and relatively smaller lobules and stipules, and with bracts only slightly dentate. Var. *torva* (de Not.) Lindb. (*Madotheca torva*, de Not. MSS.) is a much smaller form with the stem irregularly branched, and the leaves very closely imbricate and polished.

DESCRIPTION OF PLATE XXIX.—Fig. 1. Plant natural size. 2. Portion of branch, antical view $\times 11$ (Killarney, Dr. Carrington). 3. Ditto, postical view $\times 11$ (ditto). 4. Leaf $\times 11$ (ditto). 5, 6. Leaves $\times 16$ (ditto). 7. Leaf and stipule $\times 16$ (Mangerton, Holt and Stewart). 8. Leaf $\times 24$ (France, Montagne). 9. Lobule of leaf $\times 16$ (Killarney, Dr. Carrington). 10. Portion of leaf $\times 290$ (ditto). 11, 12. Stipules $\times 16$ (ditto). 13. Bract $\times 24$ (France, Montagne). 14. Ditto $\times 11$ (Mangerton, Holt and Stewart). 15. Bracteole $\times 11$ (ditto). 16. Ditto $\times 24$ (France, Montagne). 17. Perigonial bract $\times 16$ (Oporto, Newton). 18. Ditto, explanate $\times 16$. 19. Perigonial bracteole $\times 16$ (ditto). 20. Antheridium $\times 24$ (ditto).

3. *Porella platyphylla* (L.), Lindb.

Lichenastrum arboris vite fucie, foliis minus rotundis, Dill. Hist. Musc. p. 501, t. 72, f. 32 (1741).

Jungermania platyphylla, L. Sp. pl. ed. 2, 2, p. 1600 (1762); Hook. Brit. Jung. t. 40 (1816).

Madotheca platyphylla, Dum. Comm. p. 111 (1822).

Porella platyphylla (L.), Lindb. Musc. Scand. p. 3 (1879).

Dioicous, caespitose, large, in colour yellowish, brownish or blackish green. Stems firm, ligneous, opaque, brownish or dull dark green, imbricate, procumbent or suberect, irregularly pinnate,

oval on cross-section, about 50 cells in circumference, which are small with firm dark walls, 2nd and 3rd outer layers with dark walls, inner cells larger with hyaline walls, 20×16 cells in diam.; radiculose, rootlets few, proceeding from the lower portion of the stem. Leaves incubous, closely imbricate, bifarious, distichous, alternate, horizontal, unequally bilobed, antical lobe much the largest, obliquely ovate or broadly ovate, slightly convex, near the base more or less concave, margin curvate and undulate, entire, but usually with a solitary tooth on the upper margin near the middle, apex rotundate-obtuse, slightly decurved; postical lobe or lobule erect or erecto-patent, appressed to antical lobe, slightly decurrent, subobliquely ovate or oval, apex obtuse or subacute, margin recurved, entire, sometimes furnished with one or two small teeth at the base; texture opaque, epidermis without gloss, cells smallish to medium in size, roundish, walls thin, trigones very small but distinct. Stipules approximate, appressed to the stem, decurrent, semi-rotund or oval, margin reflexed, entire.

Female flowers produced on very short lateral branchlets at right angles to the branches. Bracts somewhat similar to the leaves but smaller, antical and postical lobes dentate, but the latter larger in proportion; bracteole semi-obovate, entire or with few small teeth near the base on both sides. Perianth subovate, compressed, margin involute, composed of a single layer of cells, mouth truncate, inciso-serrate. Pistillidia oblong, large, 8-10. Calyptra spherical, carnose, somewhat firm, near the base several small cells thick, upper portion composed only of a single layer. Pedicel very short, thick, 15 large cells in diameter. Capsule only just protruding from the perianth, pale yellowish-brown, dividing not quite to the base into 4 valves, which are composed of one layer of cells. Spores smooth, very large, brown. Elaters with about 10 to 12 turns of the spiral, bi-trispiral, much narrower than the spores, and lighter brown. Androecia on very short oval catkin-like lateral branches; perigonal bracts 4, 5 pairs, closely imbricate, very concave, semi-ovate, bilobed, lobes sometimes subequal, antical usually largest, margin slightly involute, entire; perigonal bracteole ovate, entire or with few minute teeth near the base on both

sides. Antheridia large, solitary in the axils of the perigonial bracts.

DIMENSIONS.—Stems $1\frac{1}{2}$ to 3 inches long, .4 mm. diameter, with leaves 3 mm. wide; leaves, antical lobe 2 mm. \times 1.75 mm., postical .8 mm. \times .6 mm., antical 2.1 mm. \times .7 mm., postical .75 mm. \times .5 mm.; cells .0325 mm. \times .0275 mm., .03 mm. \times .025 mm., .03 mm. \times .0275 mm., .03 mm. \times .03 mm.; .025 mm. \times .025 mm.; stipules 1 mm. \times .75 mm., 1 mm. \times .85 mm.; sub-bract, antical lobe 1.25 mm. \times .55 mm., postical .75 mm. \times .35 mm.; bracts, antical lobe 1.6 mm. \times 1.3 mm., postical .75 mm. \times .5 mm., antical 1.6 mm. \times 1 mm., postical .8 mm. \times .6 mm.; bracteole 1.1 mm. \times 1 mm.; perianth 3 mm. \times 2.5 mm., teeth at the mouth .1 mm. long \times .1 mm. broad, at the base .075 mm. \times .05 mm., .05 mm. \times .05 mm.; pistillidia .225 mm. \times .06 mm.; valves of capsule 1.15 mm. \times .6 mm.; spores .055 mm. \times .045 mm.; elaters .2 mm. \times .0125 mm.; male catkin 2 mm. \times 1.25 mm.; perigonial bract, antical lobe 1.1 mm. \times .75 mm., postical .6 mm. \times .5 mm.; perigonial bracteole .5 mm. \times .4 mm.; antheridia .35 mm. \times .3 mm.

HAB.—In large patches on stones, rocks, and trees, often common, especially in limestone districts. Fruit somewhat rare. 1 to 3, 5 to 18. I.

Found on the Continent and in North America.

OBS.—This is the commonest of the British *Porellæ*, for distinguishing characters of which see notes under the other species. It quickly discolours water upon immersion.

DESCRIPTION OF PLATE XXX.—Fig. 1. Plant natural size (Engl. Bot.). 2. Portion of branch, antical view \times 11 (C. and P. n. 71). 3. Portion of stem, postical view \times 11 (ditto). 4-6. Leaves \times 11 (ditto). 7. Lobule of leaf \times 16 (ditto). 8. Portion of leaf \times 290 (ditto). 9, 10. Stipules \times 16 (ditto). 11. Sub-bract \times 24 (Sweden, S. O. Lindberg). 12, 13. Bracts \times 16 (ditto). 14. Bracteole \times 16 (ditto). 15. Perianth \times 11 (ditto). 16. Portion of the mouth of perianth \times 85 (ditto). 17. Male catkin \times 16 (ditto). 18. Perigonial bract \times 16 (ditto). 19. Perigonial bracteole \times 24 (ditto). 20. Antheridium \times 24 (ditto).

4. *Porella rivularis* (Nees), Lindb.

Madotheca rivularis, Nees, Nat. Eur. Leb. 3, p. 196 (1838).

Porella rivularis (Nees), Lindb. Musc. Scand. p. 3 (1879).

Dioicous, depresso-cæspitose, medium to largish in size, varying in colour from pale to dark olive or brownish-green, when dry often yellowish-green. Stems irregularly pinnate or subdichotomous, apices often subfastigate, somewhat firm, frontally compressed, 15×20 cells in diameter; cortical cells very small 1-3, outer rows reddish-brown, inner much larger, hyaline. Leaves approximate, slightly appressed, incubous, horizontal or horizontal-patent-divergent, unequally bilobed, antical lobe much the larger, almost plane, obliquely rotund-ovate, apex slightly decurved, margin distantly denticulate or subentire, usually with 1-3 large teeth at the antical base; postical lobe or lobule erect or erecto-patent, contorted, much decurrent, obliquely ovate or ovate-lanceolate, acute, sometimes uncinata, margin recurved, undulate, repand, subentire or denticulate, often with few large teeth near the base; texture somewhat thin but firm, epidermis dull, rarely with a slight polish, cells medium size, roundish, walls thin, trigones very distinct. Stipules appressed to stem or slightly recurved, very decurrent, quadrate-oval, apex rotundate, margin reflexed, undulate, repand, subentire or dentate, especially at the base. Flowers ♀ produced on short lateral branches, nearer the postical than the antical side of stem; bracts about 3 times smaller than the leaves, unequally bilobed, antical lobe oval, apex acute, margin entire, postical lobe about half the size, quadrate-oval, margin quite entire; bracteole small ovate-quadrate, retuse, margin quite entire. Perianth broadly oval, complanate, mouth small, subentire. Pistillidia about 8. Andrœcia on short lateral branches, small; perigonial bracts closely imbricate, 4, 5 pairs, unequally bilobed, complicate-concave, antical lobe oval-oblong, margin entire, postical lobe half the size, oblong-quadrate, margin quite entire. Antheridia oval.

DIMENSIONS.—Stems $1\frac{1}{2}$ to 2 inches long, 4 mm. to 5 mm. in diameter, with leaves 4 mm. wide; leaves, antical lobe 2·25 mm.

× 1·5 mm., 2· mm. × 1·6 mm., 2·1 mm. × 1·6 mm., 1·8 mm. × 1·7 mm., 1·7 mm. × 1·4 mm., 1·75 mm. × 1·5 mm., postical ·75 mm. × ·4 mm., ·7 mm. × ·35 mm., ·9 mm. × ·5 mm.; cells ·035 mm. × ·03 mm., ·035 mm. × ·025 mm., ·035 mm. × ·035 mm.; trigones ·0017 mm.; stipules ·75 mm. × ·6 mm., ·75 mm. × ·75 mm.; bract, antical lobe ·8 mm. × ·4 mm., postical ·5 mm. × 25 mm.; bracteole ·7 mm. × ·45 mm.; perianth 4·5 mm. × 1·75 mm.; pistillidia ·3 mm. × ·075 mm.; capsule 1·2 mm. × ·9 mm.; perigonal bracts, antical lobe 1·1 mm. × ·6 mm., postical ·85 mm. × ·4 mm., antical 1· mm. × ·55 mm., postical ·55 mm. × ·3 mm.; perigonal bracteole ·5 mm. × ·3 mm.; antheridia ·14 mm. × ·11 mm.

HAB.—On stones in rivers, or on rocks and trees by their side. Somewhat rare, and extremely so in fruit.

1? 7? 10. On limestone rocks at edge of stream, Malham, *W. West.* On rocks near Collingham, W. Yorks, *W. West.* 12. Staveley, Westmorland, *G. Stabler.* High Lorton, Cumberland, *Rev. C. H. Binstead.* Ullswater, Cumberland, *E. M. Holmes.* 13. Near Kenmure Castle, New Galloway, *J. McAndrew.* Balmaclennan, Dumfries, *J. McAndrew.* On trees and rocks, Newtondon, Berwickshire, *A. Brotherston.*

I. On trees near River Lagan, Co. Down, *Rev. C. H. Waddell.* Continent.

Obs.—Differs from *P. platyphylla* (L.) in its looser habit, more distant leaves, planer, rather more dentate, smaller, narrower and more contorted lobule, thinner texture, larger and distinct trigones, smaller and more irregular stipules, smaller bracts, margin entire, perianth with contracted mouth.

Porolla pinnata (D.) is a much more slender species, with more distant leaves, much smaller lobules and stipules, margins of which are all quite entire.

DESCRIPTION OF PLATE XXXI.—Fig. 1. Plant natural size. 2. Portion of stem, antical view × 11 (C. and P. n.). 3. Ditto, postical view × 11 (ditto). 4, 5. Leaves × 16 (ditto). 6. Lobule × 24 (ditto). 7. Portion of leaf × 290 (ditto). 8. Stipule × 24 (ditto). 9. Bract × 24 (Sweden, S. O. Lindberg). 10. Bracteole

× 24 (ditto). 11. Perianth × 11 (ditto). 12. Portion of mouth of perianth × 64 (ditto). 13, 14. Perigonial bracts × 24 (ditto). 15. Perigonial bracteole × 24 (ditto). 16. Antheridium × 85 (ditto).

5. **Porella pinnata** (Dill.), Lindb.

Jungermania Porella, Dicks. Trans. Linn. Soc. iii. p. 239 (1797).

Jungermania distans, Schwein. Musc. Hep. Amer. p. 9, n. 3 (1821).

Jungermania Cordeana, Hüben. Hep. Germ. p. 291 (1834).

Madotheca Porella, Nees, Nat. Eur. Leb. 3. p. 201 (1838).

Porella pinnata (Dill.) Lindb. Hep. Hib. Acta Soc. Sc. fenn. x. p. 493 (1875).

Dioicous, laxly caespitose, yellowish-brown to dark olive-green in colour. Stems irregularly pinnate or subdichotomous, frontally compressed, from 12×8 to 20×10 cells in diameter, cortical cells very minute with thick walls and reddish-brown 50-80, the 2nd and 3rd outer layers usually the same, inner large, walls hyaline. Leaves incubous, approximate or distant, unequally bilobed, antical lobe plane or very slightly convex, ovate-oblong, apices plane or indistinctly decurved, rotundate or obtuse, margin entire, postical lobe or lobule minute, plane or slightly undulate, a little decurrent, erecto-patent, oblong, obtuse or obtusate, margin entire; texture delicate, thin, cells smallish, 4-, 5- and 6-angled, walls thin, trigones absent or very minute, marginal cells with slightly thicker walls. Stipules appressed to the stem, ovate-rectangular, rotundate-obtuse, plane, margin entire. Flowers ♀ on long or short lateral branches; bracts smaller than the stem leaves, unequally bilobed, somewhat carinate, antical lobe oval, postical from $\frac{1}{3}$ to $\frac{1}{2}$ smaller; bracteole oval, apex rotundate. Perianth (young) compressed, margins decurved, convex antically, broadly ovate, mouth contracted, dentate. Pistillidia 6-8. Capsule dividing to the base into 4 valves, bistratose, the outer layer 3, 4 times thicker than the inner.

DIMENSIONS.—Stem 1 to 2 inches long, .15 mm. to .225 mm. in diameter, with leaves 3 to 4 mm. wide; leaves, antical lobe 1.6 mm. × 1 mm., 1.5 mm. × 1 mm., 2 mm. × 1.5 mm., 1.3 mm. × .8 mm., postical .6 mm. × .2 mm., .55 mm. × .125 mm., .7 mm. × .3 mm., .8 mm. × .35 mm., .45 mm. × .2 mm., .35 mm. × .175 mm. ;

cells $\cdot 02$ mm. \times $\cdot 025$ mm., $\cdot 025$ mm. \times $\cdot 025$ mm., $\cdot 03$ mm. \times $\cdot 02$ mm., $\cdot 04$ mm. \times $\cdot 02$ mm.; stipules $\cdot 8$ mm. \times $\cdot 6$ mm., $\cdot 4$ mm. \times $\cdot 15$ mm., $\cdot 4$ mm. \times $\cdot 25$ mm., $\cdot 35$ mm. \times $\cdot 25$ mm., $\cdot 7$ mm. \times $\cdot 4$ mm.; perianth $2\cdot$ mm. \times $1\cdot 25$ mm.

HAB.—On damp shaded rocks or stones, very rare.

1. River side, Fingal Bridge, Devonshire, *W. Curnow*.
I. South of Ireland, *Dr. Taylor, Dr. Moore, A. Carroll, &c.*
Lough Mangerton, *Stewart and Holt*.

Found sparingly on the Continent (France), also in North America.

Obs.—This is the smallest and most delicate of the British *Porellæ*, and is nearest related to *P. rivularis*, which see.

The description of the fertile plant is taken from North American specimens by Dr. Gottsche, sterile plants only having been found in Europe.

DESCRIPTION OF PLATE XXXII.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 16$ (C. and P. n. 132). 3. Ditto, postical view $\times 11$ (ditto). 4, 5. Lobules $\times 24$ (Mangerton, Holt and Stewart). 6. Portion of stem, with lobules and stipules $\times 31$ (C. and P. n. 132). 7. Lobule $\times 64$ (ditto). 8. Portion of leaf $\times 290$. 9, 10. Stipules $\times 24$ (Mangerton, Holt and Stewart). 11. Stipule $\times 31$ (ditto). 12. Ditto $\times 64$ (C. and P. n. 132).

Genus 6. PLEUROZIA, *Dum.*

Jungermania, Weiss, Pl. Crypt. Fl. Gott. p. 123 (1770).

Pleurozia, Dum. Recueil, i. p. 15 (1835).

Physiotium, Nees, Nat. Eur. Leb. 3, pp. 6 and 75 (1838).

Involucral bracts two, deeply bilobed, the upper broad and convolute. Perianth much exserted, long, cylindrical, mouth denticulate, decurved and plicate at the apex. Capsule 4-valved, coriaceous. Elaters bispiral, deciduous. Stipules absent. Leaves with postical lobes auriculate, the auricles inflated.

Pleurozia cochleariformis (*Weiss*), *Dum.*

Lichenastrum alpinum purpureum foliis auritis cochleariformibus, Dill. Hist. musc., p. 479, t. 69, f. 1 (1741).

Mnium Jungermania, Linn. Sp. pl. p. 1579 (1753).

Jungermania cochleariformis, Weiss, Pl. Crypt. p. 123 (1770); Sm. Engl. Bot. t. 2500 (1813); Hook. Brit. Jung. t. 68 (1816).

Jungermania purpurea, Scop. Fl. Carn. 2, p. 347 (1772).

Pleurozia cochleariformis, Dum. Syll. Jung. Eur. p. 38 (1831).

Physotium cochleariforme, Nees, Nat. Eur. Leb. 111, p. 79 (1838).

Pleurozia purpurea, Lindb. Musc. Scand. p. 3 (1879).

Dioicous, loosely or closely caespitose, large, pale to dark reddish-brown or purple in colour. Stems creeping or ascending, arcuate, simple or with 1-3 long or short branches, frontally compressed, 15 cells in diameter, cortical, with second and third outer layers of cells smaller, reddish-brown, inner whitish, opaque, walls thick. Leaves incubous, closely imbricate, distichous, convex, bilobed, antical lobe ovato-rotundate, emarginate to about a fourth, segments dentate, inflexed, near antical base furnished with 1-3 teeth, postical lobe about $\frac{1}{4}$ smaller, attached to the lower portion of the antical lobe, ovate-parabolic, utriculate, base contracted, decurrent, on the inner side deeply depressed and folded longitudinally. At the base of this furrow is a minute slit with a pendant roundish lip, which is slightly concave; upon this is appressed a very delicate lid of somewhat similar shape but plane, of very delicate cell structure, hanging from the other side of the slit, both these appendages being suspended within the lobule. Texture of leaf firm, epidermis verruculose, cells small to smallish, roundish-hexagonal, trigones very large, often hyaline, lumen deep red or purple, the lip within the lobule is composed of very delicate cells, thin walls, no trigones, about 20×30 , marginal cells subquadrate, still more delicate, about 50 to 60 round. No stipules. Androecia catkin-like, minute, solitary, produced from the axil of the antical lobe, subcylindrical; perigonal bracts 6-8, closely imbricate, appressed, concave, ovate or oval, bifid or tridentate; antheridia oval, solitary.

DIMENSIONS.—Stems 2 to 4 inches long, $\cdot 5$ mm. \times $\cdot 4$ mm. in diam., with leaves 3 mm. wide; leaves, antical lobe 2.5 mm. \times 1.5 mm.—1.8 mm.; segments $\cdot 75$ mm., $\cdot 5$ mm., lobule 1.25 mm.—1.5 mm. \times $\cdot 5$ mm.— $\cdot 8$ mm., lip of mouth $\cdot 2$ mm. \times $\cdot 2$ mm., lid of mouth $\cdot 25$ mm. \times $\cdot 225$ mm.; cells $\cdot 02$ mm. \times $\cdot 0225$ mm. $\cdot 02$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 03$ mm.; male spike $\cdot 75$ mm.—1.2 mm. \times $\cdot 4$ mm.— $\cdot 5$ mm.; perigonial bracts $\cdot 5$ mm. \times $\cdot 2$ mm., seg. $\cdot 1$ mm., $\cdot 5$ mm. \times $\cdot 5$ mm., seg. 1 mm., $\cdot 5$ mm. \times $\cdot 4$ mm., seg. $\cdot 3$ mm., $\cdot 5$ mm. \times $\cdot 5$ mm., seg. $\cdot 2$ mm.; antheridium $\cdot 2$ mm.— $\cdot 15$ mm. \times $\cdot 1$ mm.

HAB.—In large patches on damp moors in subalpine localities. Rare and local, but where found usually abundant. 13. Black Craig, New Galloway, *J. McAndrew*. Auchencairn Moss, Dumfries, *C. Scott*. 15. Ben Nevis, *J. R. Byrom*. Ben Voirlich, *Gowrie*. 16. Glen Finnan, *Dr. Carrington*. Moidart, *S. M. Macvicar and W. H. P.* Skye, *Prof. F. E. Weiss*. 17a. Cape Wrath, Sutherland. I. Mountainous bogs. Near Killarney, *Dr. Carrington*. Connor Hill, *Prof. S. O. Lindberg*. Mangerton, *S. O. Lindberg, Stewart and Holt*, male plants.

Found on the Continent (Norway, Denmark), Sandwich Islands, *Hb. Hooker*. East Indies, Butam proper, Jowga, 10,000 ft., *Hb. Mitten*.

Obs.—In the lobule of this species there is one of the most remarkable contrivances for the entrapping of small insects it is possible to imagine: on the inner, antical face of the utriculate lobule is a deep longitudinal fold having at the base a slit with two decurrent wings hanging free within, one slightly concave, the other plane—the unwary insect crawling through this slit, the lid opens with the slight pressure and closes after the prisoner has been secured; it is no unfrequent thing to find the chitinous remains of several of these insects within the lobule. It has not yet been clearly shown whether the plant derives nourishment by the assimilation of these animals, but we may rest assured that some object is served by this apparatus, and the plant may not inaptly be called an insectivorous hepatic. The late Dr. Gottsche was, I believe, the first to publish any notes on

this character; Herrn Jack and Stephani have also written on it.

This species is a very distinct one, and the only British representative of the genus.

Hooker says, "Weiss, who first adopted the name, describes the species with considerable accuracy," with which opinion I agree. Nees and Jack seem to think that he had a form of *Marsipella emarginata* before him, although Nees has seen specimens of the true plant from Weiss's herbarium.

Scopoli's *Jungermania purpurea* of 1772 may be the same as our species, but it is very uncertain. It may, however, be said that the description of *Jungermania purpurea* in Lightfoot's "Flora Scotica" (1777) is very inaccurate and vague if applied to this species.

DESCRIPTION OF PLATE XXXIII.—Fig. 1. Stem natural size (Eng. Bot.). 2. Leaf with lobule $\times 16$ (Cromaglowm, Stewart and Holt). 3. Ditto $\times 24$ (ditto). 4. Lobule $\times 24$ (ditto). 5. Ditto $\times ?$ (drawn by Herr Stephani, "Rev. Bryol," 1886). 6. Lip of inner mouth of lobule $\times 24$ (Cromaglowm, S. and H.). 7. Lid of the same $\times 24$ (ditto). 8. Cross-section of lobule near the apex $\times 24$ (ditto). 9. Portion of leaf $\times 290$. 10. Male spike $\times 24$ (ditto). 11–15. Perigonial bracts $\times 24$ (ditto). 16. Antheridium $\times 85$ (ditto).

Subtribe III. PTILIDIEÆ.

Genus 7. **ANTHELIA**, Dum.

Jungermania L. Fl. Lapp. (1737).

Jungermanice, sect. *Anthelia* Dum. Syll. Jung. p. 63 (1831).

Anthelia, Dum. Recueil, p. 18 (1835).

Chandonanthus, Mitt. in Hook. f. Handb. New Zeal. Fl. 11, p. 750 (1867).

Plants small or somewhat robust, densely cæspitose, green or olive glaucescent. Stems firm, composed of several layers of equal, opaque cells; unequally pinnate; all branches lateral, at the base sometimes denudate or furnished with minute leaves; flagella absent; radicles moderately plentiful in the young state, when

mature somewhat rarer. Leaves tristichous transverse, somewhat broad, complicate-carinate, where large confertus equitant, bilobed to the middle or beyond, lobes subacuminate, entire or often (principally the upper) denticulate or spinulose—sometimes the surface spinose-muricate; cells small pellucid quadrate-hexagonal, at the axis subelongate, walls more or less thickened. Postical leaves (stipules) similar to the lateral and hardly any smaller. Inflorescence dioicous, rarely paroicous, terminal; ♀ innovations often present. Bracts several pairs, more or less crowded capitate, distinctly larger than the leaves; in other characters hardly different, except sometimes trilobed, with the margin coarsely dentate, rarely connate. Perianth free emersed oblong, at the base 2 cells thick, above delicate, frontally subcompressed, anticly deeply unisulcate, postical 3 carinate, at the apex 10–8-plicate; mouth either wide or subconstricted, denticulate.

1. *Anthelia julacea* (L.), Dum.

Lichenastrum alpinum, *Bryi julacei argentei facie*, Dill. Hist. Musc. t. 73, f. 38 (1741).

Jungermania julacea, Linn. Sp. Pl. 11, p. 1601 (1753); Lightf. Fl. Scot. p. 785 (1777); Hook. Brit. Jung. t. 2 (1816).

Anthelia julacea, Dum. Recueil, p. 18 (1835); Spruce, On Ceph. p. 81 (1882).

Dioicous, densely and intricately caespitose, flagella wanting, from small to largish in size, brownish or olive-green in colour, glaucescent when dry, often infested with slimy or confervoid matter. Stems erect or procumbent, filiform, firm, composed of equal opaque cells, about 30 cortical, 10 to 12 cells in diam, when dry rigid, unequally pinnate, branches all lateral; radiculose, in the young state rootlets abundant, when mature somewhat rarer. Leaves tristichous, transversely inserted, appressed, erect, closely imbricate or rarely distant, complicate-carinate, concave, oblong, to about two-thirds bilobed, sinus acute, narrow, segments ovate-lanceolate, acute or subacuminate, entire or rarely erose-denticulate, recurved at both sides; texture firm, epidermis smooth, cells rather minute to small, subquadrate, 4-, 5-, and 6-angled, near the

base, at the middle a little elongate, walls thick, no trigones or thickened angles, composed of two layers of cells at the base, above one layer, upper portion often hyaline. The third postical leaf (stipule) similar to the others, sometimes slightly smaller. Bracts several pairs, more or less crowded, capitate, larger than the leaves, 2 to 3 cells thick near the base, oblong-oval, bilobed to about the middle, sinus narrow, acute, segments ovate-lanceolate, acute or acuminate, margin denticulate, or entire. Bracteole smaller than the bracts, bilobed to about the middle, erose-denticulate. Perianth composed of two layers of cells at the base, one layer and delicate above, near the middle about 100 cells round, free, terminal, projecting about half beyond the bracts, oblong-oval, upper half multi- and deeply plicate, frontally sub-compressed, antically deeply unisulcate, at both sides of the furrow the upper margin carinate, postical 3-(2) carinate, at the apex several small keels added (10-8-plicate), mouth wide or sub-constricted by the folds, laciniate, laciniæ denticulate. Calyptra ovoid-globose, 2 to 3 cells thick at the base, pistillidia few (5 or 6) dispersed on the upper portion of the calyptra. Capsule sub-globose, composed of two layers, small, dark brown. Spores pale brown, elaters bispiral about as broad or a little broader than the spores.

Androecia at the apex or middle of the stem, on separate ones from the ♀ although often entangled with them; perigonial bracts 4-6 pairs, somewhat similar to the leaves only a little broader, sometimes slightly denticulate, closely imbricate, sub-secund, ventricose at the base; antheridia large, single, oval, bearer short.

DIMENSIONS.—Stems from $\frac{1}{2}$ to 2 inches long (rarely more), diameter .2 mm., with leaves .4 mm. wide; leaves .5 mm. \times .2 mm., segments .3 mm., .55 mm. \times .3 mm., segments .3 mm., .4 mm. \times .25 mm., segments .3 mm.; cells .02 mm., .02 mm., .015 mm. \times .01 mm., .025 mm. \times .015 mm., .02 mm. \times .01 mm., .02 mm. \times .01 mm., .015 mm. \times .015 mm.; sub-bract .7 mm. \times .45 mm., segments .4 mm.; bracts .9 mm. \times .65 mm., segments .6 mm., .8 mm. \times .5 mm., segments .5 mm., .75 mm. \times .65 mm., segments

·5 mm., 1' mm. × ·6 mm., segments ·5 mm., 1·1 mm. × ·6 mm., segments ·5 mm.; bracteole ·65 mm. × ·4 mm., segments ·3 mm., ·6 mm. × ·5 mm., segments ·25 mm.; perianth 2' mm. × 1' mm., 1·75 mm. × ·75 mm., segments ·25 mm., ·4 mm.; capsule ·5 mm. × ·5 mm., valves ·6 mm. × ·3 mm., pedicel 4' mm. × ·3 mm.; spores ·015 mm. diameter, elaters ·15 mm. × ·01 mm.; perigonal bracts ·6 mm. × ·4 mm., segments ·3 mm.

HAB.—Growing on moist exposed or shaded rocks in large cushion-like tufts in alpine or subalpine localities.

Moderately common, somewhat rare in fruit.

1, 7, 10 to 13, 15, 17. I.

Found on the Continent and in Greenland.

OBS.—This is one of the commonest hepatics met with, when a certain altitude is attained, often growing in large densely tufted cushions of a silvery lustre; the stems are so intricately entangled that they are difficult to separate.

Distinguished at a glance from *Cesia concinnata* (Dicks.) and *Cesia obtusa* (Lindb.) by growing in damper situations and the larger size of tufts; stems longer, more rigid and filiform; more closely examined, leaves tristichous, narrower, deeply bilobed, segments acuminate, presence of true and deeply plicate perianth.

From *Anthelia Juratzkana* (Limpr.) see following notes.

In "Eng. Bot." 1024 the leaves of this species are figured wrongly as if entire, and in Hooker's "Brit. Jung." the bracts are described and figured as quadrifid, which is also incorrect.

DESCRIPTION OF PLATE XXXIV.—Fig. 1. Plants natural size. 2. Plant × 11 (Lyn Cwm, W. Wilson). 3–7. Leaves × 24 (Mangerton, Stewart and Holt). 8. Branch leaf × 85 (Meal na Ptargnachan, C. J. Wild). 9. Portion of leaf × 290 (Mangerton, Stewart and Holt). 10. Sub-bract × 24 (Lyn Cwm, Wilson). 11–13. Bracts × 24 (ditto). 14–16. Ditto × 24 (Mangerton, Stewart and Holt). 17, 18. Bracteoles × 24 (ditto). 19. Perianth × 16 (ditto). 20. Portion of the mouth of perianth × 85 (Lyn Cwm, Wilson). 21, 22. Perigonal bracts × 24 (ditto).

2. *Anthedia Juratzkana* (*Limpr.*), *Spruce*.

Jungermannia nivalis, Sw. in W. M. Ind. muse. p. 5 (1803); Wahlenb. Fl. Carp. p. 363 (1811) (?).

Jungermannia julacea var. *clavuligera*, Nees, Nat. Eur. Leb. 11, p. 307 (1836).

Jungermannia julacea var. *glaucescens*, G.L.N. Syn. Hep. p. 147 (1844).

Jungermannia Juratzkana, Limpr. in Kryptogamenfl. von Schles. 1, p. 289 (1876).

Anthedia nivalis (Sw.), Lindb. Musc. Scand. p. 5 (1879).

Anthedia Juratzkana, Spruce, On Ceph. p. 82 (1882).

Paroicous, depresso-cæspitose, small, pale in colour, apices green or glaucescent, brownish below. Stems creeping, closely entangled, subramose, branches few; radiculose, rootlets plentiful, short; on a cross-section 10 cells in diameter; cells large, clear, about 40 cortical cells, similar to inner, only slightly darker. Leaves closely imbricate, on sterile shoots distant, tristichous, erect, appressed to stem or secund, oblong-ovate or oblong, concave-complicate, bilobed to about $\frac{2}{3}$, sinus acute or slightly rounded, segments narrowly triangular, or broadly subulate, acute or acuminate, margin entire; composed of one layer of cells; texture somewhat lax, cells medium size, quadrate or oblong-quadrate, pellucid, walls thin, no trigones or thickened angles. Stipule (third leaf) similar to the others. Sub-bracts and bracts larger than the leaves, a little broader and swollen at the base, margin denticulate, containing single oval antheridia, rarely the bracts are trifid. Perianth projecting about $\frac{1}{2}$ beyond the bracts, ovate-oblong or oval, deeply multiplylicate, especially at the upper portion, mouth laciniate, laciniæ entire or denticulate; composed of two layers of cells at the base, above of a single layer. Calyptra composed of one layer: pistillidia 3-5. Capsule subspherical; spores and elaters reddish-brown.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long .1 mm. to .3 mm. in diameter, with leaves .5 mm. wide; leaves .3 mm. \times .2 mm., segments .2 mm., .3 mm. \times .15 mm., seg. .2 mm., .35 mm. \times .2 mm., seg. .2 mm.; cells .035 mm. \times .02 mm., .04 mm. \times .03 mm., .03 mm. \times .03 mm.; sub-bracts .5 mm. \times .25 mm., segments .225 mm., .35 mm., .25 mm., seg. .2 mm., .45 mm. \times .3 mm., seg. .3 mm.; bracts .75 mm. \times .5 mm., segments .5 mm., .9 mm. \times

·7 mm., seg. ·45 mm., l. mm. × ·6 mm., seg. ·4 mm.; bracteole ·7 mm. × ·5 mm., segments ·55 mm.; perianth 1·5 mm. × ·75 mm.; lacinia at the mouth ·2 mm., ·25 mm.; pedicel ·2 mm., ·3 mm. diam.; capsule ·45 mm. × ·4 mm.; valves ·65 mm. × ·35 mm.; spores ·015 mm.; elaters ·15 mm. × ·01 mm.; antheridia ·125 mm. × ·1 mm., bearer ·1 mm. long.

HAB.—On moist rocks in alpine situations. Very rare. 15. Below the summit of Ben Lawers, *W. West*, August 1880. Ben Laoigh, *Peter Ewing*, September 1882. Glen Callater, *Prof. Balfour*, 1841.

Found on the Continent.

OBS.—Distinguished from *A. julacea* (L.) by its smaller size, parvicous inflorescence, the antheridia being found at the base of the bracts immediately below the perianth, the somewhat secund leaves, which are much laxer in texture, and the perianth being less cylindrical, with the folds not so deep at the lower portion.

I detected this species first as British from specimens collected by Mr. West on Ben Lawers in 1880, who had named it *Anthelia julacea*. In Dr. Carrington's herbarium, specimens collected in Glen Callater by Prof. Balfour in 1841 and named *Anthelia julacea* var. *clavuligera* Nees, belong to this species.

Prof. Lindberg refers the *Jung. nivalis* of Swartz (*J. nivalis* Sw., *W. M. Ind. musc.*, p. 5. (1803); *Whalenb. Fl. Suec.*, pro parte) to this species. but on this matter Dr. Spruce writes: "However that may be, there is no evidence to show that either Swartz or Wahlenberg discriminated between the two forms, and did not equally include the *J. julacea* of Lightfoot, as well as *J. Juratzkana*, under their name, *J. nivalis*; so that to Limpricht belongs the honour of first distinguishing *J. Juratzkana* by its inflorescence."

DESCRIPTION OF PLATE XXXV.—Fig. 1. Plants natural size. 2. Fertile plant × 11. 3, 4. Leaves × 85. 5. Portion of leaf × 290. 6. Sub-bract × 85. 7, 8. Sub-bracts, ♂, × 85. 9. Sub-bract × 24. 10. Antheridium × 85. 11–13. Bracts × 24. 14. Bracteole (?) × 24. 15. Segment of bract × 85. 16 Peri-

anth $\times 24$. 17. Portion of the mouth of the perianth $\times 85$. (All drawn from plants collected by Mr. West, Ben Lawers.)

Genus 8. **HERBERTA**, *Gr. & B.*

Herberta, *Gr. & B. Nat. Arr. Brit. Pl. 1*, p. 705 (1821).

Schisma, *Dum. Comm. p. 114* (1822).

Sendtnera, *Nees in G.L.N. Syn. Hep. p. 238* (1845).

Dioicous; large; reddish-brown; slightly branched; branches postical; subfloral innovations sometimes lateral. Leaves incubous or almost transverse, tristichous, hamato-secund, narrow, much longer than broad, sometimes ciliate at the base, otherwise entire, deeply bilobed, lobes narrow, acuminate, vittate. ♀ flowers terminal. Bracts denticulate, ciliate or spinose, distinctly bisulcate. Perianth almost hidden by the bracts; very narrow, ovate-subulate, tricarinate. Calyptra free, small, obovate, deeply trifold, composed of one layer of cells. Capsule globose, 5–8 cells thick; valves 4 sometimes 2–6. Elaters bispiral, long, persistent. Andrœcia on short terminal spikes; perigonial bracts few, somewhat similar to the leaves. Antheridia 2 in each bract.

1. **Herberta adunca** (*Dicks.*), *Gr. & B.*

Jungermania adunca, *Dicks. Pl. crypt. Brit. fasc. 111*, p. 12 (1793).

Jungermania juniperina *b. adunca*, *Hook. Brit. Jung. t. 4* (1816).

Herberta adunca, *Gr. & B. Nat. Arr. Brit. Pl. p. 705* (1821).

Schisma adunca, *Dum. Comm. p. 116* (1822).

Sendtnera juniperina *var.*, *Nees in G.L.N. Syn. Hep. p. 239* (1845).

Sendtnera adunca, *Carr. in Trans. Bot. Soc. Edin. 11*, p. 454 (1863).

Dioicous, densely cæspitose, from medium to very large in size, reddish or dark brown in colour. Stems erect, flexuose simple or with one or two short assurgent or pendulous postical branches, flagella frequent, bearing minute leaves, branches and apices of stem very often hamate, firm, opaque, the outer layers of cells (to the 2nd or 3rd) reddish-brown, inner paler, full of dark green colouring matter, cells small, walls very thick, cortical cells about 50; about 16 in diameter. Leaves incubous or almost transverse, imbricate or approximate, tristichous, falcate-secund,

vittate, linear-lanceolate, narrow, about 3 times longer than broad, to the middle or below acutely bilobed, lobes straight or divergent, postical usually a little smaller, acuminate, entire, or rarely with one or two small teeth at the base, margin often revolute, leaf and segments channelled; texture firm, epidermis rough, marginal cells small, quadrate, pachydermous, middle elongate, about twice as long as broad, margin of cells irregular, walls thick, angles thickened, near the base the elongate cells contain very delicate spiral filaments. ♀ terminal, capitate, bracts several pairs, closely imbricate, attached at their base to the perianth, ovate-lanceolate, margin denticulate, divided to about the middle, sinus acute, segments lanceolate, acuminate. Perianth projecting about a third beyond the bracts, ovate-oblong, strongly plicate, composed of one layer of cells, mouth laciniate, almost to the middle, laciniæ 8, entire or sparsely denticulate. Calyptra small, orbicular, unicellular, only somewhat thick near the base; pistillidia about 20. Capsule thick, composed of about 6 layers, inner layer with numerous long, very narrow elaters attached to it. Spores large, pale brown, elaters bispiral, reddish-brown, darker colour and much shorter than those attached to the inner layer of capsule, about half the breadth of the spores or less. Andrœcia terminal, spicate, perigonial bracts about 12 pairs, closely imbricate, erect, ventricose at the base, oval-lanceolate, margin sparsely denticulate, bilobed to below the middle, segments subulate-acuminate, antheridia solitary, large, oval, bearers long.

DIMENSIONS.—Stems 1 to 4 inches long, sometimes shorter and even longer, diam. $\cdot 2$ mm. $\cdot 3$ mm., with leaves 2 mm. wide; leaves $1\cdot 25$ mm. \times $\cdot 4$ mm., segments $\cdot 75$ mm., 2 mm. \times $\cdot 6$ mm. seg. $1\cdot 2$ mm., 2 mm. \times $\cdot 7$ mm., seg. $1\cdot 25$ mm., $1\cdot 6$ mm. \times $\cdot 7$ mm. seg. 1 mm., $\cdot 75$ mm. \times $\cdot 3$ mm. seg. $\cdot 4$ mm.; cells, middle of leaf $\cdot 05$ mm. \times $\cdot 02$ mm., $\cdot 04$ mm. \times $\cdot 02$ mm., $\cdot 035$ mm. \times $\cdot 02$ mm., marginal cells $\cdot 02$ mm. \times $\cdot 02$ mm., $\cdot 015$ mm. \times $\cdot 015$ mm.; bracts 4 mm. \times $1\cdot 5$ mm., segments 2 mm.; perianth 6 mm. \times $1\cdot 5$ mm.; calyptra $1\cdot 5$ mm. \times 1 mm.; pistillidia $\cdot 3$ mm. \times $\cdot 05$ mm.; valve of capsule $2\cdot 25$ mm. \times 1 mm.; spores $\cdot 03$ mm.; elaters free $\cdot 1$ mm. \times $\cdot 01$ mm., $\cdot 15$ mm. \times $\cdot 01$ mm., attached elaters $\cdot 3$ mm. long;

perigonial bract 2· mm. \times ·75 mm., segments 1·25 mm. ; antheridia ·275 mm. \times ·175 mm., bearer ·275 mm. \times ·03 mm.

HAB.—Grows in dense tufts on exposed banks or crags in alpine or subalpine situations. Moderately rare, but often growing in great abundance where found. Extremely rare in fruit.

7, 12, 15, 16. I.

Found on the Continent and in North America. The large form *H. juniperina* (Sw.) in the West Indies, South America, Africa, Madagascar, Java, &c.

Obs.—This is a very distinct species and not likely to be confounded with any other British hepatic. It varies extremely in size from an inch or so to 5 and even 6, and in colour from a reddish to a dark brown.

Herberta juniperina (Sw.) is usually a more robust plant with larger leaves, broader at the base, often more ventricose, margin at the base distinctly dentate ; Hooker may probably be right in considering *H. adunca* only a variety of it.

I have never seen male or female of *H. adunca*, so have described and figured those of *H. juniperina* from Cuban specimens, which I have little doubt will be similar or nearly so to those of *H. adunca*.

Herberta Sauteriana (Hüben.) (*Herberta straminea*, Dum.) has been reported from Scotland, but all the specimens I have seen under this name are to be referred to *H. adunca*.

Herberta Sauteriana (Hüben.), which is found on the Continent, has a different habit, leaves close, shorter and broader, coarsely dentate at the base, with segments shorter and broader.

DESCRIPTION OF PLATE XXXVI.—Fig. 1. Plants nat. size. 2. Portion of stem \times 24 (Connor Hill, Ireland, Prof. Lindberg). 3. Leaf \times 24 (Ill Bell, Troutbeek, Westmorland, G. Stabler). 4. Ditto \times 24 (Connor Hill, Prof. Lindberg). 5. Ditto \times 24 (Ben Laiogh, Scotland, G. A. Holt). 6. Ditto \times 24 (Ben Eagh, Rosshire, Jenner & Howie). 7, 8. Leaves \times 24 (Clogwyn-d'ur-Arddu, Snowdon, G. A. Holt). 9. Portion of leaf, middle \times 290 (Connor Hill, Prof. Lindberg). 10. Ditto, margin \times 290 (ditto). 11. Bract \times 11 (Cuba, Wright). 12. Perianth \times 11 (ditto). 13. Perigonial bract \times 16 (ditto).

Genus. 9. **MASTIGOPHORA**, *Nees*.

- Jungermania*, Brid. Mss. Web.-F. Inst. musc. hep. prodr. p. 56, n. 49, (1815);
Hook. Brit. Jung. p. 18, n. 64 (1816).
- Jungermania*, sect. 2, *Blepharozia*, Dum. Syll. Jung. Eur. p. 46, p. p. (1831).
- Jungermania*, sect. 12, *Plumulose*, Hüben. Hep. Germ. p. 265, p. p. (1834).
- Mastigophora*, Nees. Nat. Eur. Leb. 1. p. 95, n. 3, et p. 101, n. 10, p. p. (1833);
in Lindl. Introd. Nat. Syst. Bot. 2 ed. p. 414 (1835), et Nat. Eur. Leb. 3,
p. 89, n. 1 (1838); Mitt. in Hook. F. Handb. N.-Zeal. Fl. 2, pp. 752 et 754,
n. 18-2 (1867).
- Mastigophora*, sect. 2, *Cladura*, Nees Nat. Eur. Leb. 3, suppl. p. 574 (1838).
- Blepharozia*, Dum. Recueil, l. p. 16, n. 15, p.p. (1835).
- Sentnerna*, Endl. Gen. pl., l. suppl. p. 1342, n. 472-16 (1840).
- Sentnerna*, sect. 2, *Mastigophora*, G. L. N. Syn. Hep. p. 241 (1845).
- Herberta*, Carruth. in. Seem. Journ. Bot. 3, p. 300, p. p. (1865).

Branches lateral, furcate or dichotomous, rarely simple, apices attenuate, decurved, secund. Leaves incubous, bifid to quadrifid, often calcarate at the base. Perianth produced from near the apex of the stem on a short, almost sessile lateral branch, sometimes on a longer branch, membranous, tubular, trisulcate, mouth denticulate. Calyptra delicate, membranous. Capsule firm, dividing to its base into 4 valves. Elaters dispiral.

Mastigophora Woodsii (*Hook.*), *Nees*.

- Jungermania Woodsii*, Hook. Brit. Jung. t. 66 (1816).
- Blepharozia Woodsii*, Dum. Recueil, p. 16 (1835).
- Mastigophora Woodsii*, Nees Nat. Eur. Leb. 111, p. 95 (1838).
- Sentnerna Woodsii*, G. L. N. Syn. Hep. p. 241 (1844).

Inflorescence (?), loosely cæspitose, very large, reddish to purplish-brown in colour, paler below. Stem ligneous, somewhat brittle when dry, reddish-brown, composed of thick-walled cells, cortical, similar in size to the inner, only slightly darker, about 30, inner brownish 10 × 10; flexuose, procumbent, bi-tripinnate, branches lateral, branchlets long, attenuate; rootlets few, proceeding from the attenuate branchlets, hyaline, delicate. Leaves patent-divergent to patent, bifarious, imbricate, very convex, conduplicate, roundish or broadly subquadrate, unequally bilobed to below the middle, antical smaller, lobes spinulose dentate, sinus

acute or slightly rounded; cells smallish, roundish-quadrate margin irregular, walls thick, angles thickened. Stipules very large, considerably broader than the stem, broadly ovate, divided to about the middle, segments broadly subulate, acute, irregularly spinulose, sinus obtuse, at both sides of their base calcarate.

Neither male nor female flowers have been observed.

DIMENSIONS.—Stems 2 to 6 inches long, diameter $\cdot 2$ mm., with leaves $1\cdot 5$ mm. wide; branches with leaves $\cdot 75$ m.m. wide; leaves $1\cdot 1$ mm. \times $1\cdot 5$ mm.; segments $\cdot 75$ mm., $\cdot 6$ mm., $\cdot 9$ mm. \times $1\cdot 2$ mm. seg., $\cdot 6$ mm., $\cdot 5$ mm.; branch leaves $\cdot 75$ mm. \times $\cdot 85$ mm., seg. $\cdot 4$ mm.; cells $\cdot 03$ mm. \times $0\cdot 2$ mm., $\cdot 025$ mm. \times $\cdot 025$ mm.; stipules $\cdot 9$ mm. \times $\cdot 9$ mm., segments $\cdot 55$ mm., $\cdot 8$ mm. \times $\cdot 6$ mm., seg. $\cdot 4$ mm., $\cdot 7$ mm. \times $\cdot 6$ mm., seg. $\cdot 45$ mm.; branch stipules $\cdot 6$ mm. \times $\cdot 8$ mm., seg. $\cdot 3$ mm.

HAB.—Growing in large and rather densely crowded patches in boggy places or damp banks and rocks, in subalpine localities. Extremely rare. Discovered by *Mr. Joseph Woods* in 1809 on the ascent of Mangerton from Cwm na Cappal, Ireland. Brandon Mountain, *Dr. Taylor, W. Wilson*. Devil's Punch Bowl, Mangerton, *Dr. Taylor, Stewart and Holt*. Conner Hill, Dingle, *Dr. D. Moore*. Carrantual, *Dr. D. Moore*. South of Ireland. 16. Moidart, West Inverness, *S. M. Maccicar*, 1898. 17. Faroe Isles, Rostrup, 1867. Himalayas (fide *Mitten*).

OBS.—This fine, beautiful and extremely rare species is remarkably distinct, and not to be confounded with any of our native ones, except perhaps *Blepharozia ciliaris*, which might be mistaken for it, but from which it differs in the shape, margin, and structure of the leaves and stipules.

DESCRIPTION OF PLATE XXXVII.—Fig. 1. Plants natural size (Mangerton, Holt). 2. Portion of stem, antical view (after Hooker). 3. Leaf (ditto). 4–6. Leaves $\times 24$ (Mangerton, Holt). 7. Branch leaf $\times 24$ (ditto). 8. Portion of leaf $\times 290$ (ditto). 9–11. Stipules $\times 24$ (ditto). 12. Stipule (after Hooker). 13. Branch stipule $\times 24$ (Mangerton, Holt).

Genus 10. **BLEPHAROZIA**, *Dum.*

Jungermania, Linn. Sp. Pl. p. 1601; Hook. Brit. Jung. (1816).

Blepharozia (Section) Dum. Syll. Jung. p. 46 (1831).

Blepharozia, Dum. Recueil Jung. p. 16 (1835).

Ptilidium, Nees Nat. Eur. Leberm. 1. p. 95 (1833).

Leaves incubous, appressed, palmatifid, or complicate-2-lobed, each lobe divided and ciliate. Stipules 4-5-lobed, ciliate. Perianth terminal on short branches. Bracts 2-5-lobed, segments with long cilia. Perianth pyriform, obovate or sub-cylindrical, inflated, smooth, mouth small and plicately contracted, ciliate. Calyptra pyriform, coriaceous. Capsule divided nearly to the base into 4 valves. Elaters bispiral. Antheridia covered by closely imbricated perigonal bracts.

1. **Blepharozia ciliaris** (*L.*), *Dum.*

Lichenastrum scorpioides pulchrum villosum, Dill. Hist. Musc. p. 481, t. 69, fig. 3 (1718).

Jungermania ciliaris, Linn. Sp. pl. p. 1601 (1753); Engl. Bot. t. 2241; Hook. Brit. Jung. n. 65 (1816).

Blepharozia ciliaris, Dum. Recueil, p. 16 (1835).

Ptilidium ciliare, Hamp. Prod. fl. Herc. (1836); Nees Nat. Eur. Leb. 111, p. 117 (1838).

Dioicous, cæspitose, large, greenish to purplish-brown. Stems erect or procumbent, bipinnate, slightly frontally compressed, cross-section showing 15 cells \times 20, cortical cells about 80, one or two rows with thicker, golden-brown walls, inner cells larger, walls hyaline, thin; branches lateral, short, alternate, ultimate pinnulæ very slender, rootlets few, short. Leaves incubous, almost transverse, patent, lower leaves somewhat distant or approximate, upper- and branch-leaves imbricate, bifarious, convex, conduplicate, roundish or subquadrate, quadrifid nearly to the middle, segments lanceolate-acuminate, antical segment largest, on lower leaves entire or furnished with a few long cilia at the base of the leaf, next segment entire also, or with few cilia, the postical segments smaller laciniate-ciliate, upper and branch-leaves with margin and segments ciliate, cilia long. Epi-

dermis slightly verruculose; cells medium size, roundish, walls thick, trigones distinct. Stipules almost half the size of the leaves, oblong, subquadrate, or semirobund, bifid, trifid or quadrifid, ciliate, cilia long. Sub-bracts subrotund, ciliate, quadrifid to the middle, segments lanceolate-acuminate, ciliate. Sub-bracteole oblong-oval, ciliate, bifid to about $\frac{1}{3}$, segments lanceolate, ciliate. Bracts rotund, ciliate, quadrifid, segments unequal, lanceolate-acuminate, ciliate. Perianth terminal on main stem or on short branches, projecting about $\frac{2}{3}$ beyond the bracts, large, oblong-obovate, composed of a single layer of cells with a few double rows irregularly interposed, about 300 cells round near the middle, slightly folded at the upper portion, mouth contracted, 15–20 cilia of 2–4 cells long. Capsule dark brown, valves dividing to the base, thick. Spores large, pale brown. Elaters very narrow, $\frac{1}{3}$ less wide than the spores, darker brown in colour. Male stems irregularly bipinnate, slender, andrœcia usually terminal, on short branches, perigonial bracts much smaller than the leaves, 4–6 pairs, bi-trifid, saccate, antheridia 1 or 2 in each bract, oval, bearers short.

DIMENSIONS.—Stems 2 to 3 inches long, .25 mm. in diameter, with leaves about 2 mm. wide; leaves 2 mm. \times .2 mm., segments 1 mm., 1.5 \times 1.5, segment .75; branch leaves 1.5 mm. \times 1.25 mm., segment .75 mm.; cells .035 mm. \times .04, .04 \times .03, .03; sub-bract 1.75 mm. xl. .5 mm., segment .1 mm.; sub-bracteole 1.5 mm. \times 1 mm., segment .5 mm.; bract 2.5 mm. \times 2.25 mm., segment 1.25 mm.; bracteole 2 mm. \times 1.5 mm., segment .75; perianth 5 mm. \times 2.25 mm.; spores .035 mm., .03 mm.; elaters .11 mm. \times .01 mm.

HAB.—Growing in densely matted tufts of considerable size in bogs or damp places on heaths or moors, especially subalpine. Rare in fruit. l. 6–16. I.

Found on the Continent and in North America.

OBS.—Following Lindberg, I have assumed that the common large form is the true *J. ciliaris* of Linnæus, and as such have described it and have separated the small rock and tree form as *B. pulcherrima* (Hoffm.).

My figure 2, pl. xxxviii. is from the *lower* portion of the stem. In Hooker's "Brit. Jung.," pl. 65, f. 3, is a drawing of the *upper* portion of a stem and branches, with a perianth of the true *B. ciliaris*.

Blepharozia pulcherrima (Hoffm.) differs from this species in its smaller size, more procumbent habit, stems irregularly dichotomously branched, leaves more finely ciliate, never with segments entire on the stem-leaves, perianth cylindrical.

Blepharozia ciliaris is a very beautiful species, and not to be confounded with any other, the nearest approach to it of our British ones being *Mastigophora Woodsii* (Hook.), which differs in the margin of the leaves being lacinate, not ciliate, in its bifid stipules, which also are only spinose-dentate, not ciliate, and in the very different cell structure. *Trichocolea tomentella* (Ehrh.) was confounded by some of the older botanists with this species, to which it has a superficial resemblance, but apart from the differences at once revealed by the microscope, it is readily distinguished by its pale green colour, whilst *B. ciliaris* has a greenish to purplish-brown, or rich yellow.

DESCRIPTION OF PLATE XXXVIII.—Fig. 1. Plant natural size (Cader Idris, W. H. P.), 2. Portion of stem, antical view $\times 24$ (ditto). 3. Stem-leaf $\times 24$ (ditto). 4. Branch-leaf $\times 24$ (ditto). 5. Portion of leaf $\times 290$ (ditto). 6. Stipule $\times 24$ (ditto). 7. Branch stipule $\times 24$ (Ditto). 8. Sub-bract $\times 16$ (Helsingfors, S. O. Lindberg). 9. Sub-bract $\times 16$ (ditto). 10. Bract $\times 16$ (ditto). 11. Bracteole $\times 16$ (ditto). 12. Perianth $\times 11$ (ditto).

2. *Blepharozia pulcherrima*, (*Hoffm.*) *Lindb.*

Jungermania pulcherrima, Hoffm. Deutschl. Fl. 2, p. 83 (non Linn. f.) (1796).

Jungermania Leersii, Roth. Tent. fl. Germ. 11, p. 402 (1800).

Jungermania Hoffmanni, Wallroth, Fl. crypt. Germ. 1, p. 51 (1831).

Blepharozia Hoffmanni, Cogn. Hep. in Bull. Soc. Bot. Belg. (1872); Dum. Hep. Eur. p. 54 (1874).

Blepharozia pulcherrima, Lindb. Musc. Scand. p. 5 (1879).

Dioicous, cæspitose, small, tawny or brownish-green in colour. Stems procumbent or rarely suberect, irregularly repeatedly

dichotomously ramose, branches ascending, cortical cells about 20, walls golden-brown, inner hyaline 8×10 , slightly frontally compressed. Leaves crowded, patent, incubous, imbricate, conduplicate, semirobund, trifid or quadrifid to about a third or more, segments broadly lanceolate subulate, margin and segments with long cilia, cells medium size, roundish, walls thick, angles thickened. Stipules about half the size of the leaves, semirobund, bifid to about a fourth, margin with long cilia. Bracts roundish-oblong-quadrate, trifid to about a third, segments lanceolate subulate, margin and segments with long cilia; bracteole ovate, bifid to about a fifth, margin and segments with long cilia. Perianth terminal on main stem or branches, projecting about two-thirds beyond the bracts, cylindrical, composed of a single layer of cells, about 100 round the middle, slightly obtusely trigonous, mouth contracted, ciliate, cilia 3 cells long, few. Pistillidia numerous, linear-lanceolate. Androecia terminal or situated on the middle of the branches, perigonial bracts 4-6, small, closely imbricate, saccate at the base, subrotund, bifid to below the middle, margin and segments ciliate, antheridia oval, large.

DIMENSIONS.—Stems $\frac{1}{2}$ – $\frac{3}{4}$ inch long, diam. .3 mm.; leaves 1.75 mm. \times 2 mm., segments .75 mm., .5 mm., 1.5×1.75 , segments .75 mm., .6; cells .03 mm., $.03 \times .035$; stipules .85 mm. \times 1 mm., segments .4 mm., .2 mm.; bracts 1.25 mm. \times .9 mm., segments .6 mm., .5 mm.; bracteole 1.25 mm. \times 1 mm.; perianth 3 mm. \times 1 mm., cilia at the mouth .2 mm. long; perigonial bract .5 mm. \times .6 mm., segments .3 mm.; antheridia .2 mm. \times .15 mm.

HAB.—Growing on trees and rocks. Rare. 10. On trees, near Coneythorpe, *Dr. Spruce*. 15. Carn Fiachan, Balmoral, Scotland, *G. Stabler*. Found on the Continent and in North America.

Obs. Distinguished from *Blepharozia ciliaris* (L.) by its smaller size, more procumbent habit, brownish-green colour (never rose or purple), its irregularly dichotomous spreading branches, not gracefully plumose and regularly bipinnate, its crowded, much more ciliated stem leaves, segments never entire, and cylindrical perianth, not oblong obovate.

DESCRIPTION OF PLATE XXXIX.—Fig. 1–3. Plants natural size. 4. Portion of stem \times ?. 5, 6. Leaves and stipules \times 24 (Husnot Hep. Gall. n. 45). 7. Leaf \times 24 (Greenland, R. Brown). 8. Portion of leaf \times 290 (Norway, S. O. Lindberg). 9, 10. Bracts \times 14 (Balmoral, G. Stabler). 11. Bracteole \times 24 (ditto). 12. Perianth \times 16 (ditto). 13. Cross-section of perianth \times 16 (ditto). 14. Cilia from mouth of the perianth \times 85 (ditto). 15. Perigonial bract \times 24 (Newfoundland, Waghorne). 16. Antheridium \times 85 (ditto).

Genus 11. **TRICHOCOLEA** (*Dum.*), *Nees*.

Thricolea, Dum. Comm. Bot. p. 113 (1822).

Tricholea, Dum. Syll. Jung. Eur. t. I. f. 8 (1831).

Trichocolea (Dum.), Nees Nat. Eur. Leberm. 111, p. 98 et 101 (1838).

Dioicous. Stems glaucous-green, conspicuous, pinnate compound or decomposed. Leaves lacinate almost to their base, setaceo-multifid, succubous. Stipules multipartite. Involucre terminal, or from the growth of innovations axillary. Perianth when mature either free, naked and not incrassate, surrounded only at the base or a little beyond by the abortive pistillidia and the narrow ring of involucreal scales. Or undergoing more complete metamorphosis, in which the cortical layer of the tomentose receptacle invests and becomes blended with it, so as to form a cylindrical coriaceous hirsute involucre bearing at the apex the abortive pistillidia. Calyptra wanting. Capsule oblong, cleft to the base into 4 coriaceous valves. Pedicel bulbous at the base, inserted deep within the receptacle. Elaters free, bispiral. Antheridia large, axillary in the terminal leaves of separate stems.

Trichocolea tomentella (*Ehrh.*), *Dum.*

Lichenastrum filicinum pulchrum villosum, Dill. Hist. musc. t. 73, f. 35 (1741).

Jungermania tomentella, Ehrh. Beitr. 2, p. 150 (1785); Hook. Brit. Jung. t. 36 (1816).

Tricholea tomentella, Dum. Com. p. 113 (1822).

Trichocolea (Dum.) Nees Nat. Eur. Leberm. iii. p. 103 (1838).

Dioicous, loosely caespitose, large, of a white or yellowish-green colour. Stems roundish, firm, pale yellowish-green, com-

posed of narrow, elongate cells, about 12 to 16 in diameter, cortical cells 60 to 70, slightly smaller and firmer than the inner, surface clothed with delicate linked branched leafy processes, which resemble the last divisions of the leaves; prostrate or suberect, flexuose, furcate, bi-tripinnate, branches lateral, alternate, somewhat distant, ultimate pinnæ very delicate; rootlets wanting, or very few near the base of the stem, pellucid, short, simple. Leaves on main stem somewhat distant, horizontal, imbricate on the branches and crowded into little heads at the ends of the stem and branches, about 3 times wider than the stem, conduplicate, unequally bipartite, antical lobe larger, plane or slightly convex, appressed to the stem, divided almost to its base into two lanceolate segments, which are again divided and subdivided into numerous hair-like processes, which are either straight, curved, or zigzag, and at the apices extremely delicate; postical lobe divided in a similar manner; cells medium to rather large in size, oblong-quadrate at the base of the leaf, on the segments oblong-cylindrical, 3 to 4 times longer than broad, walls delicate, no trigones. Stipules large, about as wide as the stem or slightly wider, and about half the size of the leaves, subquadrate or roundish, narrower at the base, divided nearly to the base into 3 or 4 linear-lanceolate, lacinate segments, laciniaë hair-like, straight, curved, or zig-zag. Bracts wanting or minute, finely divided, scale-like processes at the base of the perianth. Perianth terminal in the axils of the primary divisions of the stem, oblong-obovate, cylindrical, carnose, composed of about 6 layers of cells near the base, at one part where it is welded 12 to 15 cells thick, cells narrow, elongate, epidermis hirsute, covered with capillary, branched processes; before rupture apex covered with about 10 abortive pistillidia mixed with the hair-like processes, mouth wide, irregularly lacerate, segments 5, smooth, cilia projecting over, but produced from the surface of the perianth. Calyptra wanting. Pedicel thick, cortical layer composed of about 140 small dark-walled cells, about 20 cells in diameter, inner larger, increasing in size to the middle. Capsule oval, dark reddish-brown; outer layer slightly papillose, hyaline, thin; inner layers (several) dark reddish-

brown. Spores smooth, pale reddish-brown. Elaters bispiral, from 12 to 20 turns, as wide as the spores and rather darker, reddish-brown. Andrœcia situated on the upper surface of the stem, perigonal bracts but little different from the stem leaves, antheridia round, pedicel short.

DIMENSIONS.—Stems 2 to 4 inches long, diameter $\cdot 35$ mm., leaves $\cdot 1$ mm. \times $1\cdot 3$ mm.; cells $\cdot 06$ mm. \times $\cdot 04$ mm., $\cdot 08$ mm. \times $\cdot 02$ mm., $\cdot 07$ mm. \times $\cdot 02$ mm., $\cdot 05$ mm. \times $\cdot 02$ mm.; stipules $\cdot 5$ mm. \times $\cdot 85$ mm.; perianth $6\cdot$ mm. long \times $2\cdot$ mm. wide near the apex; pistillidia $\cdot 25$ mm. \times $\cdot 075$ mm.; pedicel $\cdot 5$ mm. diameter, capsule $1\cdot 75$ mm. \times $1\cdot$ mm.; spores $\cdot 0125$ mm.; elaters $\cdot 1$ mm. \times $\cdot 0125$ mm.

HAB.—Growing in damp shady woods amongst other mosses and hepatics, or on exposed swampy banks.

1, 2, 5, 7 to 16. I.

Found on the Continent and in North America.

Obs.—This is one of the most beautiful and distinct of our species; as it is the only one of the genus found in Britain it is not to be confounded with any other.

Although generally distributed it is extremely rare in fruit.

The perianth appears to be a continuation of the stem, swollen and hollowed out, from the base of which proceeds the pedicel.

As the abortive pistillidia are found on the surface at its apex I consider the calyptra to be wanting; I have dissected a great number of perianths, having copious material from North America, where it fruits more freely, without observing any trace of such organ, and always finding the abortive pistillidia mixed with the hair-like processes on the upper surface of the perianth.

DESCRIPTION OF PLATE XL.—Fig. 1, 2. Stems natural size. 3, 4. Portion of leaves \times 64 (Switzerland, Jack). 5. Portion of leaf \times 290 (ditto). 6. Stipule \times 64 (ditto). 7. Perianth \times 11 (Oneida, N. America, Hb. Austin). 8. Cross-section of perianth, lower half \times 16 (ditto). 9. Ditto, upper half \times 16 (ditto). 10. Mouth of perianth, explanate \times 16 (ditto). 11. Cilia on epidermis of perianth \times 85 (ditto). 12. Pistillidium \times 85 (Closter, N. America, Austin). 13. Capsule \times 11 (Oneida, Hb. Austin).

Genus 12. **BLEPHAROSTOMA**, Dum.

Jungermania, Linn. Fl. Suec. (1745).

Jungermania, sect. *Blepharostoma*, Dum. Syll. Jung. Eur. p. 65 (1831).

Blepharostoma, Dum. Recueil, p. 18 (1835).

Ptilidium, Mitt. in Journ. Linn. Soc. (1861).

Chaetopsis, Mitt. in Journ. Linn. Soc. viii. n. 29, p. 51 (1864).

Plants small, caespitose, or creeping amongst mosses. Stems slender, opaque, about 5 cells in diameter, exterior smaller; radiculose, subdichotomously branched; branches few, long, patulous, all lateral; flagella absent. Leaves transverse or slightly incurved, almost to the base 4-partite; cura capillaceous, subparallel, composed of about 12 uniseriate cells; postical a little shorter, middle rarely bifurcate; cells medium size, oblong-quadrate leptodermous, slightly chlorophyllose, almost smooth. Stipules about half the length of the leaves, 3-crura. Inflorescence parocious and dioicous, terminal. Bracts ♀ tristichous, about 3 pairs, those immediately surrounding the perianth being longer than the leaves, verticillate, slightly connate, deeply 4-fid (pagina at the base 4-6 cells high); lobes dichotomous or plurifid, laciniae filiform. Exterior bracts less divided; in parocious specimens base turgid and antheridiferous. Perianth projecting, white, cells sub-elongate, composed of a single layer of cells, pyriform-cylindrical, at first distinctly obtusely triplicate, afterwards almost inflated or terete, apex constricted, trigonous, mouth shortly plurilacinate. Calyptra half the size of the perianth, slender, oblong, rupturing into two lips, about 5 sterile pistillidia surrounding its base. Pedicel elongate, calceolus obconical. Capsule cylindrical-oblong, 4-valved, composed of two layers of cells. Elaters bispiral, very obtuse, follicule very delicate, quickly disappearing. Spores smooth. Perigonial bracts about 8-pairs, equal in size to the leaves, incurved, 6-partite, the middle crura 2 or 3 bifurcate, monandrous.

1. *Blepharostoma trichophyllum* (L.) Dum.

Lichenastrum trichooides minimum in extremitate florens, Dill. Hist. Musc. p. 105, t. 73, f. 37 (1741).

Jungermania trichophylla, Linn. Sp. Pl. p. 1601 (1753); Hook. Brit. Jung. n. 15 (1816).

Blepharostoma trichophyllum, Dum. Recueil, p. 18 (1835).

Paroicous, caespitose or creeping, flagella absent; small, pale green in colour. Stems procumbent, rootlets few; subdichotomously branched; branches few, long, patulous, all lateral. Leaves transverse or very slightly incubous, quadripartite almost to the base, segments hair-like, erect, subparallel, composed of from 8 to 12 uniseriate cells, postical segment a little shorter, middle rarely bifurcate, cells medium to rather large in size, oblong-quadrate, leptodermous, walls thin, no trigones or thickened angles. Stipules about half the size of the leaves, tripartite. Bracts larger than the leaves, deeply quadri- or multifid, basal pagina 4-6 cells high, lobes dichotomous or plurifid, segments filiform, outer bracts less divided, swollen at the base, and containing single small roundish-oval antheridia; bracteole quadri- or multifid, pagina 3 or 4 cells high. Perianth terminal, highly exserted, white, cells subelongate, composed of one layer of cells, obtusely trigonous, mouth somewhat constricted, laciniate-ciliate, laciniæ 4, cilia 30-40, composed of 3 to 6 uniseriate cells, sometimes furcate and occasionally produced from the upper surface of the perianth. Calyptra delicate, oblong, surrounded at the base by about 5 sterile antheridia. Pedicel elongate. Capsule cylindrical-oblong, valves 4, very thin, composed of two layers of cells. Spores very small, smooth, reddish-brown. Elaters very long, narrow, as broad as the spores, bispiral, about 30 turns of the spiral, the whole length of about equal thickness, similar in colour to the spores.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, .1 mm. diameter, with leaves spread out .7 mm. wide; leaves spread out .5 mm. \times .8 mm., cura .45 mm., .5 mm.; cells .075 mm. \times .05 mm. to .04 mm. \times .0125 mm.; stipule .35 mm. \times .35 mm.; bracts .8 mm., .6 mm. \times 1. mm., cura .55 mm., .5 mm.; bracteole .65 mm. \times .5 mm.,

cura .35 mm., .5 mm.; perianth 1.8 mm. × .6 mm., 1.5 mm. × .6 mm.; cilia at the mouth .25 mm.; cells of perianth .06 mm. × .02 mm., .05 mm. × .03 mm.; calyptra .9 mm., .55 mm., .3 mm. × .175 mm.; pistillidia .175 mm. × .05 mm.; pedicel .125 mm.; capsule .8 mm. × .5 mm., .8 mm. × .4 mm.; valve .8 mm. × .3 mm.; spores .01 mm.; elaters .4 mm. × .01 mm., .3 mm. × .01 mm.; antheridia .075 mm. × .06 mm.

HAB.—Growing in small tufts or creeping amongst mosses or other hepatics, generally distributed, fruits abundantly.

1-4, 7-13, 15, 16. I.

Found on the Continent and in North America.

Obs.—A very distinct species, and not to be confounded with any other British one. Dr. Spruce has found some of the plants to be dioicous; all I have had the opportunity of examining I find to be paroicous. He describes the spores as being rather large compared with spores of other British species, but I find them to be very small.

The description is partly taken from Dr. Spruce's valuable notes.

DESCRIPTION OF PLATE XLI.—Fig. 1. Plants natural size. 2. Portion of stem, postical view, × 64 (Llanberis, W. H. P.). 3, 4. Leaves × 64 (ditto). 5, 6. Portion of leaf × 290 (ditto). 7. Stipule × 64 (ditto). 8. Bract × 64 (ditto). 9. Bracteole × 64 (ditto). 10. Perianth × 24 (ditto). 11. Cross-section of the perianth × 24 (ditto). 12. Perianth opened out × 24 (ditto). 13. Portion of the mouth of the perianth × 85 (ditto). 14. Capsule × 24 (Europe, Hb. Lesquerieux). 15. Antheridium × 85 (Llanberis, W. H. P.).

Genus 10. CHANDONANTHUS, *Mitt.*

Jungermania, Linn. Fl. Suec. ed. 1., p. 337 (1745).

Chandonanthus, Mitt. in Hook. Handb. New Zeal. Fl. 2, p. 750 (1867).

Blepharostoma, Lindb. Musci Asiae bor. p. 28 (1888).

Fruit terminal. Perianth tubular, many plicate; mouth open; stem erect or ascending.

Chandonanthus setiformis (*Ehrh.*), *Mitten.*

Jungermania setiformis, Ehrh. Beit., 3, p. 80 (1787-92).

Anthelia setiformis, Dum. Recueil, p. 18 (1835).

Chandonanthus setiformis, Mitt. in Hook. f. Handb. New Zeal. Fl. 11, p. 750 (1867).

Blepharostoma setiforme, Lindb. Musc. Asiae bor. p. 28 (1888).

Dioicous, caespitose, medium to largish in size, of a yellowish-brown colour. Stems simple or slightly irregularly furcate, flexuose, filiform, rigid and somewhat brittle when dry, erect or procumbent, on a cross-section 15 cells in diameter, cells opaque, cortical cells 40-50, reddish-brown, smaller than the inner; rootlets few, near the base of the stem. Leaves closely imbricate, bifarious, erect, appressed, semi-amplexicaul, subtransversely inserted, subquadrate, broader than long, quadripartite, segments lanceolate, acute, furrowed, margin outwardly curved, near the base furnished with long recurved teeth; texture firm, cells smallish, roundish-quadrate or oblong roundish-quadrate, walls very thick, no trigones. Stipules large, oblong-subquadrate or ovate, bipartite, segments lanceolate, acute or acuminate, furrowed. Bracts larger than the leaves, subquadrate, broader than long, quadridentate to about the middle, segments broadly subulate or lanceolate, acute or acuminate, furrowed, margin of bract and segments laciniate-dentate; bracteole oblong subquadrate, bidentate to the middle, segments broadly subulate or lanceolate, acute or acuminate, furrowed, with a smaller outer lobule at both sides at the base, margin laciniate-dentate. Perianth terminal, projecting about half beyond the bracts, oblong-oval, deeply 9-10-plicate to the base, 2 to 3 cells thick near the base, above one cell layer, mouth delicate, hyaline, laciniate-ciliate, cilia 4-6 cells long, 2 cells wide at the base; pistillidia 12-15. Male stems much more slender, with more distant leaves.

DIMENSIONS.—Stems 1 to 2 inches long, .125 mm. to .2 mm. in diameter, with leaves .5 mm. to .75 mm. wide; leaves .6 mm. × .7 mm., segments .4 mm. × .2 mm., .5 mm. × .7 mm., seg. .45 mm. × .2 mm., 7 mm. × 1 mm., seg. .45 mm. × .25 mm.;

cells $\cdot 025$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 02$ mm., $\cdot 025$ mm. \times $\cdot 025$ mm.; stipules $\cdot 5$ mm. \times $\cdot 4$ mm., seg. $\cdot 35$ mm.; subbracteole $\cdot 7$ mm. \times $\cdot 5$ mm., seg. $\cdot 5$ mm.; bract $1\cdot 1$ mm. \times $\cdot 75$ mm., segments $\cdot 4$ mm., $\cdot 5$ mm., $\cdot 6$ mm.; bracteole $1\cdot 1$ mm. \times $\cdot 75$ mm., seg. $\cdot 6$ mm.; perianth $1\cdot 8$ mm. \times $\cdot 9$ mm.; cilia at the mouth $\cdot 175$ mm.

HAB.—Growing in large entangled patches or straggling amongst mosses in alpine situations. Very rare.

15. Balmoral, *George Stabler*, July 1884.

Var. *alpina*. 15. Catlow Hills, *C. Lyell*, 1813, Glen Dole, 1855, *Ilb. Carrington*. Glen Muick, *J. Sim*. Slack of Birnie, *J. Sim*. Cairngorm, *Hooker*. Scotch Alps, *Dickson, Donn*.

Found on the Continent and in North America.

Obs.—Very distinct and not to be confounded with any other of our British species. As Dr. Spruce remarks: "The whole habit, the leaves and their cells, &c., recall *Chandonanthus squarrosus* and *hirtellus*." By some authorities it has been referred to *Blepharostoma*, but in that genus the perianth is uniformly trigonous; by others to *Anthelia*, where the leaves are only bifid and along with the stipules, which are similar and give a tristichous insertion to them; the perianth also is not so multiplicate.

Hooker figures the mouth of the perianth without cilia, but in well developed specimens it is beset with them. It is only recently that copious specimens with perianths have been found in Norway.

The var. *alpina*, Hook. (*Jungermania flum*, Dum.), is a much smaller form, very slender, filiform, with more distant and less dentate leaves; it might be confounded with *Anthelia julacea*, but is at once distinguished by its quadripartite leaves.

The typical form has, so far as I know, only been found in Britain by Mr. George Stabler.

I have not seen the male plant nor perfect fruit.

DESCRIPTION OF PLATE XLII.—Fig. 1. Plants natural size. 2. Portion of stem \times ?. 3. Leaves \times 31 (Balmoral, G. Stabler). 4, 5. Leaves, explanate \times 24 (ditto). 6–8. Leaves \times 31 (ditto). 9. Leaf and stipule \times 24 (ditto) 10. Segment of leaf \times 85

- (ditto). 11. Portion of leaf \times 290. 12. Stipule \times 24 (ditto).
 13. Ditto \times 31 (ditto). 14. Sub-bracteole \times 31 (Norway, A. Blytt).
 15. Bract \times 31 (ditto). 16. Bracteole \times 31 (ditto). 17. Perianth \times 24 (ditto). 18. Cross-section of perianth \times 24 (ditto).
 19. Portion of mouth of perianth \times 85 (ditto).

Subtribe IV. TRIGONANTHÆ.

Genus 11. **LEPIDOZIA**, *Dum.*

Jungermania, Linn. Sp. pl. 1, p. 1133 (1753).

Pleuroschisma, sect. *Lepidozia*, Dum. Syll. Jung. p. 69 (1831).

Mastigophora, Nees, Nat. Eur. Leberm., 1, p. 101 (1833), nec. Syn. Hep.

Lepidozia, Dum. Recueil, p. 19 (1835); Nees in G.L.N. Syn. Hep. p. 200 (1845).

Hepetium, sect. 1, *Lepidozia*, Nees, Nat. Eur. Leberm. 111, p. 31 (1838).

Plants large, rarely small, pale or yellowish-green, rarely very green, densely cæspitose, tufts depressed, rarely erect or pendulous. Stems in many species firm, beautifully feather-like, pinnate or bipinnate; branches lateral, sometimes attenuate and radiculose at the apices, rarely, and principally in small species with postical branches, which are frequently flagelliferous and radiculose. Leaves incubous, small, in some species very minute, sometimes broader than long, very oblique, with antical margin much longer and rotundate, decurvo-concave, palmate or quadrifid almost to the base, rarely 5-6- or only 2-3-fid, segments subulate, entire or furnished at the antical base with a few teeth, in a few species all the margin dentate; cells usually smallish, quadrato-hexagonal, inferior subelongate, angles slightly thickened, cuticle often rough; in *Micro-Lepidozia* very small oblong-quadrangle. Stipules similar to the leaves but symmetrical, in *Eu-Lepidozia* slightly smaller, in *Micro-Lepidozia* about half the size of the leaves. Inflorescence dioicous, in a few species (chiefly *Micro-Lepidozia*) monoicous; ♀ on the stem, rarely on the branches, hypogenous. Bracts 3-5 pairs, appressed, concave, innermost frequently about three times (in small-leaved species up to eight times) larger than the leaves, at the apex 2-4-fid, margin denticulate or spinose. Pistillidia 20 or less, the sterile surrounding the base, or a little higher,

of the calyptra. Perianth almost always elongate, ovate-subulate or narrowly fusiform, upper portion obtusely trigonous, in *Eulepidozia* carnose, mouth entire or denticulate, *Micro-Lepidozia* leptodermous, mouth ciliato-laciniate. Calyptra 2-4 times shorter, pyriform or oblong, below somewhat carnose, or in *Micro-Lepidozia* whole length delicate, afterwards rupturing into two lips. Capsule on a more or less firm shortly exerted pedicel, oblong-cylindrical, dividing to the base into 4 valves, 2-4-strata. Elaters slender, bispiral. Spores minute, smooth or asperulous. Androecia very often constantly on slender postical branches, rarely (and in *Micro-Lepidozia* principally) terminal on lateral branches; perigonial bracts 5-10 pairs, suborbiculate concave, apex bidentate; antheridia solitary large pedicellate.

1. *Lepidozia cupressina* (Sw.)

Jungfermannia cupressina, Swartz Prod. Fl. Ind. occid. p. 144 (1797?).

Jungfermannia reptans var. *pinnata*, Hook. Brit. Jung. n. 75 (1816).

Pleuroschisma reptans var. *pinnata*, Dum. Syll. Jung. p. 69 (1831).

Lepidozia pinnata, Dum. Recueil, p. 19 (1835).

Herpetium reptans var. *pinnatum*, Nees Nat. Hist. Eur. Leberm. 111, p. 32 (1838).

Lepidozia tumidula, Tayl. in G.L.N. Syn. Hep. p. 206 (1844).

Lepidozia cupressina var. *tumidula*, Carr. Trans. Bot. Soc. Edin. VII., 453, t. xi., f. 7 (1863).

Dioicous, densely caespitose, flagelliferous, medium size, greenish to olive or reddish-brown in colour. Stems creeping or suberect, curled, on a cross-section 16×20 cells in diameter, cortical about 50, these and the next inner layer large with thick, dark walls, inner cells smaller with thinner walls, of a light golden brown colour; closely pinnate or bipinnate, branches alternate, unequal, often attenuate, apices flagelliferous. Leaves incubous, closely imbricate, patent or patent-divergent, incurved, very concave, cordate-orbiculate or broadly subquadrate-cordate, quadrifid to nearly the $\frac{1}{2}$, segments acute, 8 to 12 cells broad at the base, sometimes even more, postical segments much inflexed; cells smallish, opaque, subquadrate-hexagonal. walls thick, angles

slightly thickened, no trigones. Stipules large, orbicular or subrotund, or roundish-subquadrate, concave, to nearly the $\frac{1}{2}$ quadrifid, segments acutate. Perianth on short postical branches, bracts several pairs, innermost largest, oval-orbicular, apex with 4 or 5 small teeth; bracteole orbicular, quadri-denticulate; sub-bracteole ovate, quadri-dentate. Perianth projecting $\frac{3}{4}$ beyond the bracts, subulate, cylindrical, upper half plicate, mouth contracted. Andrœcia on short postical catkins, often 3 or 4 on a stem; perigonial bracts closely imbricate, turgid, bifid; perigonial bracteole oval, bidentate, texture as with the perigonial bracts much more delicate than the leaves, cells larger with thinner walls. Antheridia solitary, large, roundish-oval, shortly stipitate.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inch long, diameter $\cdot 2$ mm., with leaves 1' mm. wide; leaves 1' mm. \times $\cdot 85$ mm., segments $\cdot 4$ mm., $\cdot 9$ mm. \times $\cdot 9$ mm., seg. $\cdot 3$ mm.; cells $\cdot 02$ mm. \times $\cdot 025$ mm., $\cdot 02$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 025$ mm., $\cdot 03$ mm. \times $\cdot 03$ mm., $\cdot 035$ mm. \times $\cdot 02$ mm.; stipules $\cdot 55$ mm. \times $\cdot 55$ mm., segments $\cdot 2$ mm., $\cdot 5$ mm. \times $\cdot 45$ mm., seg. $\cdot 2$ mm., $\cdot 5$ mm. \times $\cdot 6$ mm., seg. $\cdot 2$ mm., $\cdot 5$ mm. \times $\cdot 5$ mm., seg. $\cdot 2$ mm.; bracts 1'1 mm. \times $\cdot 8$ mm., teeth $\cdot 15$ mm.; bracteole $\cdot 8$ mm. \times $\cdot 6$ mm., teeth $\cdot 1$ mm.; sub-bracteole $\cdot 6$ mm. \times $\cdot 4$ mm., teeth $\cdot 1$ mm.; perianth 4' mm. \times $\cdot 8$ mm.; perigonial bract $\cdot 5$ mm. \times $\cdot 5$ mm., seg. $\cdot 15$ mm.; perigonial bracteole $\cdot 25$ mm. \times $\cdot 175$ mm., seg. $\cdot 075$ mm.; antheridium $\cdot 2$ mm. \times $\cdot 175$ mm.

HAB.—Growing in large dense patches on exposed or shaded banks, rocks and trees. Rare.

1. Carn Galva, Cornwall, *W. Curnow*. 9. Helsby Crag, Cheshire, *W. Wilson*. Clougha, Lancashire, *G. Stabler*, July 1881. 10. On gritstone boulders, Idle Woods, *Dr. Carrington*, 1857. 12. Borrowdale, Cumberland, *Dr. Carrington and W. H. P.*, April 1884. 16. Moidart, West Inverness, *S. M. Maccicar*, 1898, *W. H. P.*, 1899. South of Ireland, more or less abundant, *Miss Hutchins, Dr. Taylor, Dr. Spruce*, and others.

Extremely rare on the Continent, Germany, *Prof. A. Braun*; France, near Cherbourg, *Mons. Thuret*.

Found in the West Indies and South America.

Obs.—Distinguished from *L. reptans* by its dioicous inflorescence, its tawny to reddish-brown colour, more robust habit, stems more erect and irregularly pinnate with long flagella, leaves more closely imbricated, cordate-orbiculate (not quadrate), cells across the base of segments more numerous, cells smaller and more opaque with thicker walls.

From *L. Pearsoni*, Sp., by its much more robust habit, shape of leaves and stipules and andrœcia on short postical branches. Collected first in the British Isles by Miss Hutchins and recognised as distinct from *L. reptans* by Hooker, who named it var. *pinnata*, collected afterwards by Dr. Taylor, who made a new species of it (*L. tumidula*, Tayl.). It has been referred to by later botanists as *L. cupressina*, var. *tumidula*, but I am unable to detect any difference between it and the type found in the West Indies and South America.

DESCRIPTION OF PLATE XLIII.—Fig. 1. Plant natural size. 2. Stem, antical view $\times 11$ (Original of *Lepidozia tumidula*, Tayl., Dr. Taylor, Killarney). 3, 4. Leaves $\times 31$ (ditto). 5. Portion of leaf $\times 290$ (ditto). 6–10. Stipules $\times 31$ (ditto). 11, 12. Bracts $\times 24$ (Killarney, S. O. Lindberg). 13. Bracteole $\times 24$ (ditto). 14. Sub-bracteole $\times 24$ (ditto). 15. Perianth $\times 11$ (ditto). 16. Perigonial bract, with antheridium $\times 64$ (Killarney, G. A. Holt). 17. Perigonial bracteole $\times 64$ (ditto).

2. *Lepidozia reptans* (L.), Dum.

Muscoides terrestre repens ex obscuro virescens, foliis superioribus et inferioribus ad extremitatem dentatis, Mich. Nov. pl. gen. p. 10, t. 6, f. 2 (1729).

Lichenastrum multifidum exiguum, ad basin florens, per siccitatem imbricatum, Dill. Hist. Musc. p. 494, t. 71, f. 24 (1741).

Jungermania reptans, L., Sp. pl. 1599 (1753).

Pleuroschisma reptans, Dum. Syll. Jung. Eur. p. 69 (1831).

Mastigophora reptans, Nees. Nat. Eur. Leb. 1, p. 101 (1833).

Lepidozia reptans, Dum. Recueil. p. 19 (1835).

Herpetium reptans, Nees. Nat. Eur. Leb. 111, p. 31 (1838).

Monoicous, densely cæspitose, tufts depressed, flagelliferous, medium size, green, when older pale or yellowish-green, when dry

cærulescent. Stems creeping, horizontal, irregularly subpinnate or sub-bipinnate, flexuose, on a cross-section 12 to 15 cells in diam., hyaline, cortical larger, about 30; branches all lateral, some attenuate; radiculose, rootlets numerous, near base of the plant, fasciculate, hyaline. Leaves incubous, imbricate or subimbricate on main stem, on branches, and attenuated branches small and distant, patent or patent-divergent, convex, subquadrate or semi-oval, slightly longer than broad, quadri-dentate to about $\frac{1}{3}$, segments acute, 4-7 cells broad at the base, sinus acute, apices incurved, branch leaves tridentate, axillary leaves bidentate; cells medium size, subquadrate, often broader than long, subopaque, walls thick, but somewhat delicate, no trigones or thickened angles. Stipules about twice the width of the stem, very convex, subquadrate, broader than long, quadrifid to about a third, on branches trifid, segments acute. Bracts several pairs at the base of the perianth, very delicate texture, subrotund or broadly oval, irregularly dentate at the apex; bracteole very delicate texture, oval or broadly oval, irregularly dentate at the apex. Perianth produced on very short postical branches, projecting $\frac{2}{3}$ beyond the bracts, almost hyaline, sub-membranaceous, lower half composed of two layers of cells, upper half of a single layer, near the middle about 100 cells round, oblong-subulate, below cylindrical, above somewhat plicate, mouth constricted, dentate, teeth about 8. Calyptra large, oval, composed of one layer of cells. Pistillidia few, 4 or 5. Capsule oblong-ovate, deep brown, splitting into 4 equal lanceolate valves. Spores small, verruculose, reddish-brown. Elaters bispiral, not quite as broad as the spores, reddish-brown. Andrœcia postical, amentiform, catkins small, composed of 4-6 pairs of perigonal bracts, which are minute, delicate, complicate, broadly oval when explanate, bidentate to about a fourth; perigonal bract-coles oval, bidentate.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ long, .2 mm. to .3 mm. in diam., with leaves 1 mm. wide; leaves .7 mm. \times .6 mm., segments .15 mm., .6 mm. \times .45 mm. seg. .2 mm.; cells .025 mm. \times .025 mm., .035 mm. \times .03 mm., .045 mm. \times .035 mm; stipules .4 mm. \times .4 mm., segments .2 mm., .4 mm. \times .45 mm. seg. .15 mm.; bract .15

mm. \times 1.25 mm., segments .35 mm., .2 mm.; bracteole 1.25 mm. \times .9 mm., segments .2 mm.; perianth 5. mm. \times 1. mm., teeth at the mouth .1 mm., .075 mm.; pistillidia .175 mm. \times .05 mm.; valve of capsule 1.5 mm. \times .7 mm.; pedicel .3 mm. diam.; spores .015 mm. diam.; elaters .3 mm. \times .01 mm.; perigonal bracts, explanate .325 mm. \times .2 mm., segments .075, .3 mm. \times .25 mm.; segments .075 mm.; antheridia .125 mm. \times .1 mm.

HAB.—Growing in dense tufts or straggling amongst mosses. Common. 1 to 17. I. C.

Found on the Continent, and in North America.

Obs.—This is a common species; for its distinguishing characters from *L. cypressina* and *L. Pearsoni*, see notes under those species; being monoicous it is easily recognised by this character.

DESCRIPTION OF PLATE XLIV.—Fig. 1. Plants nat. size. 2. Portion of stem, antical view \times 16. 3–6. Leaves \times 31. 7. Leaves and stipule \times 24. 8. Portion of leaf \times 290. 9, 10. Stipules \times 31. 11. Bract \times 24. 12. Bracteole \times 24. 13. Perianth \times 11. 14. Cross-section of the perianth near the middle \times 16. 15. Ditto, the upper half \times 16. 16. Mouth of the perianth, explanate \times 85. 17, 18. Perigonal bracts \times 85. 19. Antheridium \times 85 (all Castle Howard Woods, M. B. Slater).

3 *Lepidozia Pearsoni*, Spruce.

Lepidozia Pearsoni, Spruce Journ. of Bot. p. 31 (1881).

Lepidozia Wulfsbergii, Lindb. Soc. F. Fl. Fenn. 1882; Bot. not. (1882).

Dioicous, creeping, medium to largish in size, from pale to tawny-green in colour. Stems subterete, on a cross-section cells 15 \times 18, cortical 40 to 50, a little larger; flaccid, very slender, elongate, simple or furcate, afterwards laxly and distantly pinnate; branches short, unequal, simple, very rarely ramulose, some with apices flagelliferous, microphyllous or radiculose; rootlets proceeding more from the stem than from the flagella, or almost absent; all branches more or less lateral, axillary, often with male flowers; rarely a postical stolon is observed and sometimes postical amenti-

form male flowers. Leaves small, more or less distant, rarely subcontiguous, obliquely incubous, patent or erecto-patent, subquadrate, usually more than half or to the middle palmatifid, segments 4, very rarely 5 or 6, subulate, subacuminate incurved, uncinatè, at the base 3-5 cells broad, the two middle ones broadest, postical shorter; cells medium size, subquadrate-hexagonal, a little elongate, subpellucid, walls thin, sometimes with the angles slightly thickened, branch leaves smaller 3, 4-fid, upper ones longer and narrower, profoundly bifid. Stipules shorter than the leaves, subrotund to subquadrate, divided to about the middle, segments 4 rarely 5 and more rarely 6, broadly subulate, obtuse, incurved. Andrœcia spicate at the apex of delicate lateral branches, rarely at base, more rarely on short postical branches; perigonial bracts, 3-10 pairs, slightly smaller than the leaves, imbricate, concave, swollen, bilobed, rarely with an additional antical basal tooth, lobes ovate, acute, incurved; bracteole subquadrate, longer than broad, bi-trilobed, antheridia solitary, large, oval, shortly stipitate.

Habitat. Creeping loosely amongst mosses and other hepatics on steep banks or rocks. Rare.

7. Tyn-y-Groes, Merionethshire, *W. H. P.*, April 1879. 8. Kinder Scout, Derbyshire, *J. Whitehead and G. A. Holt*, March 1884. 12. Borrowdale, Cumberland, *W. H. P.*, Skelwith Bridge, Westmorland, *W. H. P.* 13. New Galloway, *J. McAndrew*. 16. Banks of Loch Maree, Argyle, *Dr. Carrington*, October, 1889, Moidart, West Inverness, *S. M. Macvicar*, 1898, *W. H. P.*, 1899. Norway.

DIMENSIONS.—Stems 1 to 2 inches long, 2 mm. in diameter, with leaves .5 mm. wide; leaves .55 mm. × .45 mm. middle segment, .35 mm., .4 mm. × .4 mm. seg., .2 mm., .4 mm. × .3 mm. seg., .2 mm., .5 mm. × .3 mm. seg., .25 mm., .4 mm. × .35 mm. seg., .2 mm.; cells .033 mm., .05 mm. × .03 mm., .025 mm. × .035 mm., .04 mm. × .025 mm., .045 mm. × .03 mm.; stipules .3 mm. × .4 mm., .275 mm. × .3 mm.; segments .1 mm., .35 mm. × .375 mm. seg., .15 mm., .3 mm. × .35 mm. seg., .15 mm.; perigonial bracts .4 mm., .475 mm. × .3 mm. seg., .225 mm., .35 mm. × .3 mm. seg., .15 mm., .4 mm. × .4 mm. seg., .15 mm.; perigonial bracteole .2 mm. × .2 mm. segments, .075 mm.; antheridia .13 mm. × .11 mm.

OBS.—“*Lepidozia Pearsoni* is well distinguished from *L. reptans* by the following characters.

“In *L. Pearsoni* the whole plant is very slender and elongate, and of a pale tawny colour. Stems distantly pinnate, without any rooting flagella from the underside. Leaves small, those of the stem usually distant, or at most contiguous, cloven to beyond the middle into 4, sometimes (though rarely) into 5 or 6, subulate subacuminate segments. Stipules cloven to the middle into 4, or not unfrequently into 5, more rarely into 6, subulate obtuse segments. Inflorescence dioicous. Male spikes terminal (rarely basal) on the *lateral* branches; very rarely indeed on a short postical ramulus.

“*L. reptans* is of a more robust habit, with shorter, more closely-branched stems; of a deep green colour when fresh, often turning blueish-white, or glaucous, in drying. Leaves subimbricated, cloven only half-way into never more than 4 segments, which are 4–7 cells wide at the base; cells broad as long. Stipules with acute segments, which are never more than 4 in number even on the main stem, and are sometimes reduced to 3. The chief distinction, however, is in the *monoicous inflorescence*, with the male flowers uniformly in short catkins springing from the underside of the stem (which is their normal position on nearly every other *Eulepidozia* known to us, except *L. Pearsoni*).” R. Spruce.

DESCRIPTION OF PLATE XLV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 11$. 3–6. Leaves from main stem and branch $\times 64$. 7. Portion of leaf $\times 290$. 8, 9. Stipules $\times 64$. 10. Stipule $\times 31$. 11, 12. Perigonial braets $\times 64$. 13. Perigonial bract $\times 31$. 14. Perigonial bracteole $\times 85$. 15. Antheridium $\times 85$. (All drawn from specimens collected at Tyny-Groes, N. Wales, *W. H. P.*).

4. *Lepidozia setacea* (Web.), Mitt.

Jungermania setacea, Web. Spic. pl. Goett. p. 143 (1778), Hook. Brit. Jung. t. 8 (1816).

Blepharostoma setacea, Dum. Recueil (1835).

Lepidozia setacea (Web.) Mitt. Proc. Journ. Linn. Soc. v. p. 103 (1841).

Dioicous, densely cæspitose or creeping, small, pale yellowish-green to dark or olive-brown in colour. Stems very slender, filiform, firm, flexuose, on a cross-section 5 and 6 cells in diameter, large, clear, cortical 10–12, similar in size to the inner; walls firmer and darker; irregularly pinnate, or subpinnate, often denudate below; branches lateral, unequal, alternate; flagella few, postical; radiculose, rootlets few, minute, hyaline. Leaves on main stem contiguous or distant, on branches imbricate; erect, incurved, in outline subquadrate, tri-, rarely quadri-partite almost to the base, where they are 6 cells broad, segments setaceous, subulate, 3–6 cells long, 2, 3 cells wide at the base, branch leaves often bipartite only; texture delicate; cells 4-, 5- and 6-angled, smallish to medium size, lumen clear, walls thin but firm, no trigones or thickened angles. Stipules equal in width to the stem or slightly wider, erect, sometimes appressed to the stem, oval-orbicular in outline, tripartite almost to the base, segments setaceous, subulate, usually 4 cells long, a row of 2 at the base. Perianth postical, arising usually from near the base of the stem from an axil of stipule, on short branches, projecting $\frac{2}{3}$ beyond the bracts. Innermost bracts much larger than the leaves, oval-orbicular, bidentate, segments ciliate-dentate, acuminate; bracteole oval, bidentate, segments ciliate-dentate, acuminate. Perianth 4 times longer than broad, oblong, cylindrical below, plicate above, mouth somewhat contracted by the folds, ciliate-dentate, cilia few, 3, 4 cells long, texture delicate, cells laxer than those of the leaves, elongate, almost white in colour, lower half composed of two layers of cells, above of one layer. Calyptra obovate, very delicate; pistillidia 4–6, linear. Pedicel long, pellucid, delicate. Capsule oval, dark chocolate-brown. Spores dark brown. Elaters bispiral, slightly broader than the spores, similar in colour. Androëcia

usually on short lateral branches at the middle or end, amentiform, when terminal often subspherical, rarely on main stem; perigonal bracts 4, 5 pairs, closely imbricate, of delicate texture, pale colour, bifid, rarely trifid, margin dentate, rarely entire. Antheridia solitary, small, oval, shortly stipitate.

HAB.—Growing in dense depressed tufts or straggling amongst *Sphagna* or other mosses and hepatics on damp shady banks, moors, or marshy ground. Common.

1-3, 5, 7-10, 12-16, I.

Found on the Continent and in North America.

DIMENSIONS.—Stems $\frac{1}{4}$ to 1 inch long, diameter $\cdot 075$ to $\cdot 1$ mm., with leaves $\cdot 2$ mm. wide; leaves $\cdot 175$ mm. \times $\cdot 15$ mm., segments $\cdot 125$ mm., $\cdot 15$ mm., $\cdot 25$ mm. \times $\cdot 2$ mm., seg. $\cdot 2$ mm., $\cdot 15$ mm. \times $\cdot 125$ mm., seg. $\cdot 1$ mm., 125 mm. \times $\cdot 1$ mm., seg. $\cdot 1$ mm.; cells $\cdot 02$ mm. \times $\cdot 03$ mm., $\cdot 025$ mm. \times $\cdot 035$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 035$ mm. \times $\cdot 02$ mm.; stipules $\cdot 175$ mm. \times $\cdot 125$ mm., seg. $\cdot 125$ mm.; bracts $\cdot 45$ mm. \times $\cdot 25$ mm., seg. $\cdot 125$ mm., $\cdot 55$ mm. \times $\cdot 35$ mm., seg. $\cdot 175$ mm., $\cdot 75$ mm. \times $\cdot 35$ mm., seg. $\cdot 15$ mm.; bracteole $\cdot 4$ mm. \times $\cdot 2$ mm., seg. $\cdot 15$ mm.; sub-bract $\cdot 25$ mm. \times $\cdot 2$ mm.; sub-bracteole $\cdot 2$ mm. \times $\cdot 1$ mm.; perianth 2 mm. \times $\cdot 5$ mm., $3\cdot 5$ mm. \times $\cdot 75$ mm.; cilia at the mouth $\cdot 15$ mm.; calyptra $\cdot 6$ mm. \times $\cdot 4$ mm.; pistillidia $\cdot 2$ mm. \times $\cdot 05$ mm.; capsule $\cdot 7$ mm. \times $\cdot 35$ mm., valves $\cdot 8$ mm. \times $\cdot 3$ mm.; pedicel $\cdot 175$ mm. diam.; spores $\cdot 01$ mm. diam.; elaters $\cdot 175$ mm. \times $\cdot 0125$ mm.; perigonal bracts $\cdot 25$ mm. \times $\cdot 15$ mm., seg. $\cdot 175$ mm., $\cdot 3$ mm. \times $\cdot 2$ mm., seg. $\cdot 2$ mm., $\cdot 325$ mm. \times $\cdot 225$ mm., seg. $\cdot 175$ mm.; perigonal bracteole $\cdot 25$ mm. \times $\cdot 1$ mm., seg. $\cdot 2$ mm., $\cdot 1$ mm.; antheridia $\cdot 08$ mm. \times $\cdot 06$ mm.

OBS.—Distinguished from all other British *Lepidozies* by its smaller size, deeply divided leaves with subulate segments; from *Blepharostoma trichophyllum* by its smaller size, more robust habit, darker colour, shorter segments of leaves, lateral branches, long narrow perianth, and dioicous inflorescence.

The varieties *sertularioides* and *Schultzii* (*Jung. sertularioides*, Linn. f. suppl., p. 449; *Jung. Schultzii*, Spreng Pugill., 1, p. 64) with smaller, closer imbricated leaves, are found in drier situations, and pass to the normal form in damper localities.

One form (near Festiniog, *Dr. C. and W. H. P.*, and Killarney, *S. O. L.*) is larger, more regularly pinnate, of a softer texture with the bracts hardly so laciniate as the usual form, but I have observed no other characters to separate it from the type.

Dr. Spruce found on Strensall Moor a stout and often fertile form which has leaves mostly 4-cleft, although in laxer forms of the species, leaves with more than 3 divisions are rare.

The perfect fruit of this species is very rare.

DESCRIPTION OF PLATE XLVI.—Fig. 1. Plants natural size
 Portion of stem, antical view $\times 24$ (Killarney, *S. O. Lindberg*)
 3. Ditto, postical view $\times 85$, showing stipules (ditto). 4, 5
 Leaves $\times 85$ (ditto). 6, 7. Leaves $\times 85$ (Barton Moss, Lanc. *W. H. P.*). 8. Leaf $\times 85$ (*Aust. Hep. Am. Bor. n. 76*). 9, 10.
 Branch leaves $\times 85$ (Killarney, *S. O. L.*). 11. Branch leaf $\times 85$
 (Barton Moss, *W. H. P.*). 12. Portion of leaf $\times 290$ (ditto).
 13, 14. Bracts $\times 64$ (White Mts., N. America, *Oates*). 15.
 Bracteole $\times 64$ (ditto). 16. Sub-bract $\times 64$ (ditto). 17. Sub-
 bracteole $\times 64$ (ditto). 18. Perianth $\times 31$ (ditto). 19. Portion
 of the mouth of the perianth $\times 85$ (*Tyn-y-Groes, N. Wales, W. H. P.*).
 20. Capsule and calyptra $\times 31$ (White Mts., *Oakes*). 21 Perigonial bract $\times 85$ (*Aust. Hep. Am. bor., n. 76*).
 22, 23. Ditto $\times 64$ (*Sussex, G. Davies*). 24. Perigonial bracteole
 $\times 64$ (ditto). 25. Antheridium $\times 85$ (ditto).

Genus 12. **BAZZANIA**, *Gr. & B.*

Jungermania, Linn. Fl. Suec. ed. 1, p. 335 (1745).

Bazzania, Gr. & Benn. Nat. Arr. Brit. Pl. 1, p. 704 (1821).

Pleuroschisma, sect. *Pleuroschismotypus*, Dum. Syll. Jung., p. 70 (1831).

Pleuroschisma, Dum. Recueil, p. 19 (1835).

Herpetium, Nees, Nat. Hist. Eur. Leberm., 111, p. 214 (1838).

Mastigobryum, G.L.N. Syn. Hep. p. 214 (1845).

Stems firm, almost round, slightly compressed frontally, repeatedly furcate, dichotomous. Branches postical, very short and floriferous, or often elongate, microphyllous and radiculose. Cells of the stem several layers, cortical similar to the inner ones, opaque. Leaves incubous, alternate, in a few species opposite, at the base more or less imbricate, apex more or less distant, decurved,

sometimes (principally when dry) secund, always oblique, sometimes falcate, about twice as long as broad, at the base semicordato-ovate, gradually becoming narrower, the upper half subligulate, apex plane, almost always truncato-tridentate, rarely 4-dentate or subentire—in a few species equally bidentate, or unequally bilobed; margin in most species entire, in a few species postical base spinose or dentate. Cells near the base elongate, others small, subquadrate, guttulate, usually smooth, walls and angles distinctly thickened. Stipules everywhere present, about half the size of the leaves, rarely 3–4 times shorter, broader than the stem, appressed, very often subrotundo-quadrate, rarely longer, apex truncate, very often 4-crenate or incised, rarely subentire, margin entire or subdentate; in a few species cordate at the base, auricles sometimes spinose. Flagella unequally leaved; leaves minute, tristichous, ovate, concave, apex bidentulate, rarely only apiculate or tridentulate, producing from near the base long pale radicles. Inflorescence dioicous, both sexes cladogenous, constantly on postical branches. Bracts ♀ 3- 5-pairs, innermost largest (but often shorter than the leaves), closely imbricate, concave, orbiculate or ovate, rarely ovato-lanceolate, apex lobulate, laciniate or ciliate, subscariose; cells rather large, elongate, 4- 6-angled. Pistillidia 10–16. Perianth ovato-subulate or fusiform. 3 to 4 times longer than broad, subcarnose at the base, leptodermous, at first tricarinate at the base, keels broad, quasi 6-plicate, on the maturing of the fruit the keels almost obliterated, sometimes subterete, with only the apex trigonous constricted, mouth in perfect state with 12–15 long cilia. Calyptra about half the size of the perianth, pyriform or cylindrical-oblong, at the base 3-strata, surrounded by the sterile pistillidia, above 2-strata. Capsule about half the size of the calyptra, oblong, subcylindrical, about 5-strata, dividing to the base into 4 valves. Elaters slender, subobtuse, about half the breadth of the minute spores. Amentula ♂ antical, proceeding from the axil of the stipule, short, incurved: bracts 5, rarely up to 10-pairs, ovate, concave or subcomplicato-convolute, apex truncate, bifid, or bispinose, rarely entire; antheridia two longistipitate, rarely solitary.

1. *Bazzania trilobata* (L.), Gr. & B.

Muscoules terrestris repens, ex obscuro virescens, foliis superioribus et inferioribus ad extremitatem dentatis, Mich. Nov. pl. gen. p. 10, t. 6. f. 2 (1727).

Lichenastrum pinnulis obtuse trifidis nervo geniculato, Dill. Hist. musc., p. 493, 7, 71, f. 22 (1741).

Jungermania trilobata, Linn. Sp. pl. 1599 (1753); Hook. Brit. Jung. t. 76 (1816).

Bazzania trilobata, Gr. & B. Nat. Arr. Brit. Pl. p. 704 (1821).

Pleuroschisma trilobatum, Dum. Syll. Jung. p. 70 (1831).

Herpetium trilobatum, Nees, Nat. Eur. Leb. 111, p. 49 (1838).

Mastigobryum trilobatum, Nees in G.L.N. Syn. Hep. p. 230 (1845).

Dioicous, densely cæspitose, flagelliferous, large, dark to olive green in colour. Stems on a cross-section showing about 20 cells in diameter, cortical about 90, the 2 or 3 outer layers composed of subquadrate cells with firm walls, equal in size to the inner, which are hyaline with thin walls; simple or once or twice dichotomously branched, erect procumbent or creeping horizontally on the ground, flexuose, rather rigid; flagella abundant, about an inch long, descending from the postical side of the stem, beset with minute leafy scales; radiculose, rootlets few, fibrous. Leaves more or less imbricate on the antical side of the stem, horizontal, distichous, semi-broadly-ovate, broadly truncate at the apex, tridentate, teeth acute, sinuses acute; texture firm, epidermis slightly polished, cells medium to rather large in size, roundish-quadrate, angles thickened or with large distinct trigones, walls thick. Stipules transversely inserted (not cordate), oblong quadrate, coarsely and irregularly dentate, cells with thickened angles. Inflorescence cladocarpous, ♀ on short postical branches, bracts few, much smaller than the leaves, of a delicate texture, cells elongate, walls thin; orbicular or subrotund, ciliate at the apex. Perianth highly exserted, lanceolate, cylindrical at the base, which is 4 layers of cells thick, near the middle 2, upper portion triplicate and composed of a single layer of cells, about 170 cells round, mouth small, with few teeth 3 to 4 cells long, 2 to 4 cells wide at the base. Calyptra small, oblong-ovate 4 cells thick at the base, 2 above, pistillidia about 8, long and

narrow. Pedicel on a cross-section showing 16 large round cortical cells with firm walls, inner cells 5 in diameter, extremely delicate, hexagonal or subquadrate. Capsule ovate, dark shining brown, dividing nearly to the base into 4 oblong valves, of a thick texture. Spores reddish-brown, verruculose. Elaters bispiral, similar in colour to the spores, not quite as broad.

Andrœcia postical, minute, amentiform; perigonial bracts very delicate, 4, 5 pairs, closely imbricate, concave-complicate, bifid or with few teeth; antheridia solitary, small, shortly stipitate.

Var. *minus* Nees. Usually growing on rotting wood, is much smaller than the type, prostrate, dichotomously branched, branches spreading.

DIMENSIONS.—Stems usually 3 to 4 inches long, sometimes 1 to 2, rarely 5; $\cdot 4$ mm. in diameter, with leaves 5 mm. wide; leaves 2.5 mm. \times 1.75 at the base and $\cdot 6$ mm. at the apex, teeth $\cdot 2$ mm. long, 3 mm. \times 2 mm. near the base and $\cdot 5$ mm. near the apex; cells $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 045$ mm. \times $\cdot 04$ mm., $\cdot 04$ mm. \times $\cdot 04$ mm.; stipules 1 mm. \times $\cdot 8$ mm., $\cdot 8$ mm. \times $\cdot 7$ mm.; bracts 1.5 mm. \times 1 mm., 2 mm. \times 1.5 mm., 1.75 mm. \times 1 mm.; cilia $\cdot 75$ mm., $\cdot 5$ mm.; pistillidia $\cdot 325$ mm. \times $\cdot 06$ mm.; perianth 6 mm. \times 1.25 mm., teeth at the mouth $\cdot 125$ mm.; pedicel $\cdot 5$ mm. diam.; valves of capsule 1.6 mm. \times $\cdot 5$ mm.; spores $\cdot 0175$ mm. diam.; elaters 3 mm. \times $\cdot 01$ mm.; perigonial bracts $\cdot 5$ mm. \times $\cdot 5$ mm.; antheridia 1 mm. \times $\cdot 075$ mm.

HAB.—Growing in dense patches on damp, shady banks or rocks, rarer on rotting wood. Common in subalpine districts, very rare in fruit.

1, 2, 6–8, 10–16. I.

Found on the Continent and in North America.

OBS.—A very striking and one of our finest native species. From *B. tricrenata* (Wahlenb.) it is distinguished by its much larger size, broader stems, greener colour, less deflexed leaves and its oblong-quadrate stipules, which are coarsely and irregularly dentate.

Mr. George Stabler has found on specimens collected on Black Crag, Staveley, Westmoreland, flagella both branched and bearing male catkins.

DESCRIPTION OF PLATE XLVII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 11$ (C. & P. Hep. Brit. Exsicc. n. 187). 3–5. Leaves $\times 11$ (ditto). 6. Portion of leaf $\times 290$ (ditto). 7, 8. Stipules $\times 24$ (ditto). 9–11. Bracts $\times 16$ (ditto). 12. Perianth $\times 11$ (ditto). 13. Cross-section of the perianth near the base $\times 16$ (ditto). 14. Ditto lower half near the middle $\times 16$ (ditto). 15. Ditto, near the mouth $\times 16$ (ditto). 16. Teeth, mouth of the perianth $\times 85$ (ditto). 17–19. Perigonial bracts $\times 24$ (Killarney, S. O. Lindberg). 20. Ditto $\times 64$ (ditto). 21. Antheridium $\times 85$ (ditto).

2. *Bazzania triangularis* (Schleicher), Lindb.

Jungermania triangularis, Schleich. Pl. Crypt. Helv. ii. n. 61 (1805).

Jungermania deflexa, Mart. Fl. Crypt. Erlang. p. 135, tab. 3, Fig. 8 (1817).

Bazzania triangularis (Schleich.), Lindb. Hep. in Hep. 499 (1874).

Dioicous, loosely cæspitose, or creeping, flagelliferous, small, brownish-green or olive-brown. Stems dichotomously innovantly branched, innovations proceeding from the axil of the stipules, slender, fragile, cortical cells about 20, about 8 in diameter, all similar; flagella abundant, microphyllous; radiculose, rootlets fasciculate, hyaline. Leaves incubous, horizontal or patent-divergent, distant or approximate, caducous, deflexed, convex or plane, oblong-ovate or ovate, apex entire acute or irregularly bi-tridentate; cells smallish to medium size, roundish, walls firm, trigones large and distinct. Stipules patulous, orbicular, subrotund or obovate, entire, retuse, emarginate, or irregularly crenate. Andrœcia postical, proceeding from axil of stipule, bud-like, globular. Perigonial bracts 4, 5 pairs, concave-complicate, broadly ovate, bidentate, sinus and segments small, acute; bracteole oval-orbicular, retuse. Antheridia solitary, oval, stipitate.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .15 mm. to .2 mm. in diameter, with leaves 1 mm. wide; leaves .6 mm. \times .4 mm., .7 mm. \times .4 mm., .7 mm. \times .35 mm., 1.2 mm. \times .6 mm., 1.5 mm. \times .7 mm.; cells .03 mm.; stipules .4 mm. \times .35 mm., .25 mm. \times .25 mm., 2 mm. \times .2 mm.; perigonial bract .4 mm.

× 3 mm. ; sinus 05 mm. ; perigonal bracteole 3 mm. × 25 mm. ; antheridia 115 mm. × 09 mm.

HAB.—Growing in loose tufts or creeping loosely amongst mosses and other hepatics, on exposed or shaded banks, rocks, or trunks of living trees. 7. Tyn-y-Groes, Merioneth, *Dr. Carrington & W. H. P.* Cwm Idwal, Carnarvon, *W. H. P.* 10. Dent, Yorks, *George Stabler.* 13. Borrowdale, Cumberland, *Dr. Carrington & W. H. P.* 16. Moidart, West Inverness, *S. M. Macvicar.* I. Killarney, *Dr. Carrington* and others.

Found on the Continent and in North America.

OBS.—I am uncertain whether to regard this as the male form of *B. tricrenata*, or as a distinct species, or as merely a variety ; the numerous specimens I have been enabled to examine are either sterile or male plants only.

It is distinguished from *B. tricrenata* by its smaller size, more slender stems, which are usually, but not always, dichotomously innovantly branched, leaves soon falling away, proportionately shorter (except in var. *flaccida*) ; cells rounder, with large and distinct trigones, stipules patulous, usually sub-entire. In var. *flaccida* the leaves are plane, narrower, often entire and apiculate.

From *B. Pearsoni* (Steph.) it differs in its smaller size, more delicate habit, brownish-green or olive-brown colour, dichotomous ramification, antical base of leaf not large or overlapping, cells with large trigones and broader stipules.

DESCRIPTION OF PLATE XLVIII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view × 24 (C. & P. Hep. Brit. Ex. 124). 3. Leaf × 24 (ditto). 4, 5. Ditto × 64 (ditto). 6–8. Ditto × 24 (G. & R. Hep. Eur. n. 198). 9. Ditto × 24 (G. & R. Hep. Eur. n. 401). 10. Portion of leaf × 290 (C. & P. n. 124). 11. Stipule × 24 (G. & R. n. 198). 12–14. Ditto × 64 (C. & P. n. 124). 15, 16. Ditto × 85 (ditto). 17. Male amentulum × 24 (ditto). 18. Perigonal bract × 64 (ditto). 19, 20. Perigonal bracteoles × 64 (ditto). 21. Antheridium × 85 (ditto).

3. *Bazzania tricrenata* (Wahlenberg).

Jungermania tricrenata, Wahlenb. Fl. Carp. p. 364, n. 1207 (1814).

Dioicous, densely or loosely cæspitose, flagelliferous, largish to large in size, brownish-green to dark brown in colour. Stems erect or procumbent, slightly branched, branches erect; cortical cells about 40, similar to the inner cells, only with firmer walls, 15 to 18 cells in diameter; somewhat brittle when dry, flagella abundant, microphyllous, proceeding from the axil of the stipules; radiculose, rootlets few, fasciculate, hyaline. Leaves approximate or subimbricate, alternate, horizontal, strongly deflexed, when dry involute, semi-cordate-ovate or semi-ovate-oblong, falcate, arcuate at the antical margin, bi-tridentate at the narrow apex; cells medium size, roundish-quadrangle, walls firm, angles thickened or with trigones distinct. Stipules twice as broad as the stem, roundish-quadrangle or suborbicular, usually broader than long, margin irregularly crenate or dentate, sometimes emarginate. Inflorescence ♀ cladocarpous, arising from the axil of stipule; sub-bracts and sub-bracteole ovate, bifid; innermost bracts ovate, quadrifid. Perianth lanceolate, cylindrical, plicate at the apex, mouth small, denticulate. Pistillidia long, about 7.

Capsule not seen.

DIMENSIONS.—Stems about 2 inches long, diameter .2 mm., with leaves 1.25 mm. wide; leaves .75 mm. × .45 mm. at apex .175 mm. wide, 1.4 mm. × .9 mm. at apex, .25 mm., 1.3 mm. × .8 mm. at apex, .3 mm., 1.1 mm. × .7 mm. at apex, .2 mm., .9 mm. × .65 mm. at apex, .25 mm.; cells .04 mm. × .03 mm., .035 mm. × .03 mm., .03 mm. × .025 mm.; stipule .4 mm. × .5 mm., .3 mm. × .5 mm., .35 mm. × .35 mm.; sub-bracts .55 mm. × .45 mm., .5 mm. × .4 mm., .6 mm. × .5 mm.; sub-bracteole .4 mm. × .3 mm.; innermost bracts .5 mm. × .4 mm. segments, .25 mm., .6 mm. × .4 mm. segments .3 mm.; pistillidia .2 mm. × .05 mm.

HAB.—Growing in large tufts on exposed or shaded banks in subalpine localities.

7, 10, 12, 13, 15-17. I.

Found on the Continent and in North America.

Obs.—Differs from *B. trilobata* (L.) in its smaller size, brownish colour (not pale or dark green), more deflexed, and when dry, involute leaves, which are shorter and narrower, with narrower apices, teeth longer and more acute.

From *B. triangularis* (Schleicher) and *B. Pearsoni* (Steph.); see notes under each species.

DESCRIPTION OF PLATE XLIX.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 24$ (C. & P. Hep. Brit. Ex. n. 266). 3, 4. Leaves $\times 31$ (ditto). 5, 6. Ditto $\times 31$ (C. & P. n. 122). 7, 8. Ditto $\times 31$ (C. & P. n. 123). 9. Portion of leaf $\times 290$ (Rosthwaite, Cumberland, Carrington & Pearson). 10. Stipule $\times 31$ (C. & P. n. 122). 11, 12. Ditto $\times 31$ (C. & P. n. 123). 13. Stipule $\times 31$ (C. & P. n. 266). 14–16. Sub-bracts $\times 24$ (Killarney, Stewart & Holt). 17. Sub-bracteole $\times 24$ (ditto). 18, 19. Innermost bracts $\times 24$ (ditto). 20. Perianth $\times ?$ (from Lindenb. Spec. Hep.). 21. Pistillidium $\times 85$ (Killarney, Stewart & Holt).

4. *Bazzania Pearsoni* (Stephani).

Mastigobryum Pearsoni, Stephani, "Hedwigia" (1893).

Dioicous, loosely caespitose, flagelliferous, largish, ochraceous. Stems erect or procumbent, simple or with one, rarely two short branches, flexuose, filiform, uncinatate at the apex, on a cross-section cortical cells about 25, with thick walls, inner more delicate, 8–10 cells in diam.; flagella few, microphyllous; radiculose, rootlets few, hyaline, fasciculate, delicate. Leaves distant, alternate, much deflexed when dry, somewhat fragile, reniform, with large overlapping base, apex acute or truncate, entire or irregularly bi-tridentate; cells small, roundish-quadrate or elongate, guttulate, walls thick, angles very much thickened, no trigones. Stipules patulous, convex, slightly decurrent, obovate, ovate or orbicular, entire or retuse. Inflorescence ♀ cladocarpous, arising from axil of the stipules. Sub-bracts small, few (4), ovate, bifid; bracteole obovate, entire. Innermost bracts ovate, bi-tridentate, margin

entire or denticulate. Pistillidia small, few (4-6). No perfect perianth seen.

DIMENSIONS.—Stems 2 inches long, 2 mm. in diameter, with leaves 1·5 mm. wide; leaves 1 mm. × 75 mm.; cells ·03 mm. × ·02 mm., ·025 mm. × ·02 mm., ·035 mm. × ·02 mm.; marginal cells ·02 mm. × ·02 mm., ·015 mm. × ·02 mm.; stipules ·5 mm. × ·4 mm., ·4 mm. × ·3 mm., ·5 mm. × ·5 mm., ·4 mm. × ·3 mm.; sub-bracts ·4 mm. × ·3 mm., ·3 mm. × ·2 mm.; sub-bracteole ·4 mm. × ·3 mm.; innermost bracts ·3 mm. × ·2 mm., ·5 mm. × ·35 mm.; pistillidia ·125 mm. × ·04 mm.

HAB.—Very rare, the only known stations being on banks and rocks Eagle's Nest, Horses Glen, Cromaglow, Killarney, *Stewart & Holt*, June 1885.

OBS.—Differs from *B. tricrenata* (Wahlenb.) in its ochraceous colour, the proportionately broader leaves with large overlapping, antical base, smaller cells with thicker walls and much thicker angles. From *B. triangularis* (Schleich.) by its larger size, ochraceous colour and cell structure.

DESCRIPTION OF PLATE L.—Fig. 1. Plants natural size. 2. Portion of stem, antical view × 24. 3-5. Leaves × 24. 6. Portion of leaf × 290. 7-13. Stipules × 24. 14-17. Sub-bracts × 24. 18. Sub-bracteole × 24. 19, 20. Innermost bracts × 85. 21. Pistillidium × 85.

Genus 13. **KANTIA.** *Gr. § B.*

Mnium, Dill. Hist. muse. p. 236, n. 5, et p. 237, n. 6 (1741); Linn. Sp. Pl. 1 ed., 2, p. 1114, nn. 16 et 17 (1753).

Jungermania, Mich. Nov. pl. gen. p. 8, n. 2, tab. 5, Fig. 14 (1729).

Calypogeia, sect. *B. Amphigastriatæ*, Radd. in Att. soc. Modena, 18, p. 44, tab. 6, Figs. 3 and 4 (1818).

Kantia, Gr. & Benn. Nat. Arr. Brit. Pl. 1, p. 706, n. 28 (1821).

Cincinnulus, Dum. Comm. bot. p. 113 (1822).

Plants rather large, depressed cæspitose, pale green or olive, rarely brownish, prostrate or with apices (often gemmiparous), assurgent. Stems moderately firm, simple, rarely furcate,

branches postical axillary to the stipules. Leaves rather large, imbricate, incubous, alternate, plane or convexulous, oblong, sometimes twice as long as broad, often subrhomboid, entire, apex rotundate or retuse, rarely acute, bidentate or bilobed; cells lax, rather large, rarely large or of medium size, quadrate or oblong-hexagonal. Stipules everywhere present, about half the size of the leaves, subrotund, rarely reniform, apex entire, retuse or bifid, margin entire, rarely denticulate or spinulose or on both sides unidentate or lobulate; often very delicate. Flowers hypogenous, produced from the axils of the stipules, dioicous or monoicous (sometimes paroicous). Bracts ♀ 2-3 pairs, tristichous, much smaller than the leaves, subrotund, oval, or lanceolate, entire or 2-4-fid, subconnate. Pistillidia about 12. Perianth pendulous, attached by one side of its mouth to the stem, pendant or descending into the earth, clavate or subcylindrical, carnose, pluristratose, hairy. Calyptra membranous, a little shorter than the perianth, attached to the perianth, but free in the upper fourth part. Capsule on a long, firm pedicel, cylindrical, 3-4 times longer than broad, bistratose, inner layer with semi-annular fibres, valves linear, twisted, deeply coloured. Elaters filiform, somewhat short, subobtuse, bispiral. Spores minute, about the same diameter as the elaters, scaberulous.

1. *Kantia Trichomanis* (L.). Gr. & B.

Jungermania terrestris repens, foliis ex rotundinate acuminatis, bifidis, apertura pene visibili, Mich. Nov. pl. gen. 8, t. 5, f. 14 (1739).

Mnium Trichomanis facie, foliis integris, Dill. Hist. musc., p. 236, t. 31, f. 5 (1741).

Mnium Trichomanis facie, foliis bifidis, Dill. Hist. musc., p. 237, t. 31, f. 6 (1741).

Mnium Trichomanis, Linn. Sp. pl., p. 1579 (1753).

Mnium fissum, Linn. Sp. pl., p. 1579 (1753).

Jungermania Trichomanis, Dicks. Pl. crypt. Brit. fasc. 111, t. 8, f. 5 (1793); Hook. Brit. Jung. t. 79 (1816).

Jungermania fissa, Scop. Fl. Carn. 2, p. 348 (1772).

Kantia Trichomanis, Gr. & B. Nat. Arr. Brit. Pl. p. 706 (1821).

Cincinnulus Trichomanis, Dum. Comm. Bot., p. 113 (1822).

Calypogeia Trichomanis, Corda in Opiz. Nat., p. 653 (1829); in Sturm Deutsch. Fl. fasc. 19, p. 38, t. 10 (1835).

Heteroicous (monoicous and paroicous), depresso-cæspitose, medium to largish in size, pale to dark green in colour. Stems prostrate or apices assurgent, moderately firm, simple or rarely furcate, branches postical, elongate, attenuate, gemmiparous; radiculose, rootlets many, proceeding in tufts from base of the stipules. Leaves usually small at the base and at apex, largest at the middle of stem, imbricate, incubous, alternate, patent-divergent or horizontal, slightly convex, ovate, entire, apex rotundate or rarely acute, or very slightly bidentate, cells lax, oblong-hexagonal or hexagonal, medium to rather large, walls thin, trigones very small. Stipules nearly half the size of the leaves, about twice as broad as the stem, subrotund, bifid to about a third, retuse or subentire, lobes obtuse, sinus obtuse, margin entire. Braets very small, 2 or 3 pairs, oblong-quadrate, slightly bifid. Perianth arising from axil of stipule, pendulous, subterranean, cylindrical or subclavate, carnose, composed of several layers of cells, near base 6 layers, near the mouth surrounded by layers of small and broadly subulate scales, which are often found on other parts of the perianth; radiculose, rootlets long delicate hyaline, interior layer covered with long papillæ, composed of single, elongated cells. Calyptra free, 2-4 cells thick near the base, pistillidia long, narrow, about 10. Pedicel thick, about the same diameter as the capsule. Capsule cylindrical, 3 to 4 times longer than broad, composed of two layers, valves spiral, linear. Spores pale brown. Elaters reddish-brown, 20-30 turns of the spiral, bispiral. Androecia bud-like, sometimes catkin-like, postical, situated in the axil of the stipule, near the ♀, perigonial braets very small, about 3 to 4 pairs, subrotund, trifid, segments acute, sinus obtuse, antheridia about 10, oval.

Gemmæ often pedicellate, in spherical heads, yellow-green.

DIMENSIONS.—Stems $\frac{3}{4}$ to $1\frac{1}{2}$ inch long, .3 mm. to .4 mm. in diameter, with leaves 3 mm. broad; leaves 2 mm. \times 1.5 mm., sinus .1 mm.; cells .04 mm. \times .03 mm., .07 mm. \times .04 mm.,

·05 mm. × ·04 mm.; trigones ·0075 mm.; stipules ·75 mm. × ·8 mm., segments ·25 mm., ·7 mm. × ·9 mm., seg. ·2 mm., ·55 mm. × ·6 mm., seg. ·05 mm., ·5 mm. × ·6 mm.; bract ·15 mm. × ·1 mm.; perianth 5· mm. × 1· mm.; scale near the mouth of the perianth ·2 mm. × ·125 mm., projecting cells, interior of the perianth ·075 mm. × ·03 mm., ·06 mm. × ·035 mm.; pistillidia ·25 mm. × ·03 mm.; pedicel ·75 mm. diam.; capsule 3·25 mm. × ·75 mm.; spores ·015 mm. diam.; elaters ·2 mm. × ·02 mm.; perigonal bracts ·3 mm. × ·25 mm., seg. ·1 mm.; antheridia ·125 mm. × ·1 mm.

OBS.—This is a very distinct species, and cannot well be confounded with any other, except the following, which see.

The attenuate, gemmiparous stems, the rotundate, acute or slightly bidentate leaves, the lateral, pendant perianth and cylindrical capsule distinguishing it from other species.

Kantia arguta (Mont.), the other British species of this genus is a much smaller, more delicate plant, with deeply bidentate leaves, and is dioicous.

HAB.—Growing in moderate-sized patches in bogs, on damp or wet banks in woods, &c. Common.

1-17. I.

Generally distributed on the Continent and in North America.

DESCRIPTION OF PLATE LI.—Fig. 1. Plants nat. size. 2. Stem, antical view × 11 (Loch Bray, Prof. Lindberg). 3. Portion of leaf, showing sinus × 24 (ditto). 4. Portion of leaf × 290 (ditto). 5. Stipule × 24 (Goathland, York., Slater). 6, 7. Stipules × 24 (Loch Bray, Prof. Lindberg). 8, 9. Ditto × 24 (Ottawa, Macoun). 10. Bract × 24 (ditto). 11. Perianth × 11 (Tyn-y-Groes, C. J. Wild). 12. Scale, near mouth of perianth × 85 (ditto). 13. Projecting cells from interior of the perianth × 85 (ditto). 14. Capsule × 11 (ditto). 15. Perigonal bract × 85 (Closter, N. America, C. F. Austin). 16. Antheridium × 85 (ditto). 17. Perigonal bracteole (ditto).

2. *Kantia Sprengelii* (Mart.).

Jungermania Sprengelii, Mart. Fl. Crypt. Erlang., p. 133, t. 3, f. 6 (1817).

Cincinnatius Sprengelii, Dum. Syll. Jung., p. 73 (1831).

Calypogeia Trichomanis, var. *Sprengelii*, Nees Eur. Leb., 111, p. 9 (1838).

Heteroicous (monoicous and paroicous), cæspitose, medium size, pale to dark-green in colour. Stems prostrate or suberect, simple or furcate, attenuate often at the apex and gemmiparous; radiculose, rootlets plentiful, proceeding from the base of the stipules. Leaves approximate or imbricate, horizontal or patent-divergent, broadly ovate, apex entire, acute or rotundate or acutely and shallowly bidentate, sinus and segments acute, margin entire; texture lax; cells rather large, hexagonal or oblong-hexagonal, walls thin, nucleate granules clinging to the walls making them appear thicker, trigones very minute or absent. Stipules about a fifth to a fourth smaller than the leaves, about twice as broad as the stem, irregular in shape, suboblate to subreniform, bifid to about a third, sinus wide, acute or obtuse, segments spreading acute or obtusate, lobate, outer lobe smaller. Male and female flowers proceeding from axil of stipules, sometimes the two proceeding from the one axil. Perfect fruit and male flowers I have not seen.

DIMENSIONS.—Stems from $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, .3 mm. in diameter, with leaves 2.5 mm. wide; leaves 1.6 mm. \times 1.2 mm., sinus .01 mm., 1.4 mm. \times 1.1 mm., 1.3 mm. \times 1. mm., sinus .01 mm.; cells .05 mm. \times .05 mm., .06 mm. \times .05 mm., .05 mm. \times .04 mm.; stipules .25 mm. \times .3 mm. segments .1 mm., .4 mm. \times .5 mm., seg. .2 mm., .4 \times .6 mm. seg. 2; .5 mm. \times .6 mm., seg. .2 mm.

HAB.—Growing in patches on damp shady banks, in woods, &c. Somewhat rare, probably often mistaken for *Kantia Trichomanis*. 1. Penzance, Cornwall, *W. Curnow*. 4. 7. 10. Castle Howard, Yorks, *M. B. Slater*. Shipley Glen, *W. West*. 16.

Found on the Continent and in North America.

OBS.—Distinguished from *K. Trichomanis* (L.) by the laxer texture of the leaves, the thinner cell-walls, stipules irregular in

shape, more deeply and acutely divided, segments spreading, often acute and again lobate, outer lobe smaller.

It may be considered by some authorities as only a variety of *K. Trichomanis*, but as the distinguishing characters are always permanent, I give it as a species.

DESCRIPTION OF PLATE LII.—Fig. 1. Plants nat. size. 2. Portion of stem, postical view $\times 24$ (Castle Howard, M. B. Slater). 3. Leaf $\times 24$ (G. & R. n. 587, as *Calypogia Trichomanis adscendens*). 4, 5. Leaves $\times 24$ (Suffolk, Skepper). 6. Portion of leaf $\times 290$ (Castle Howard, M. B. Slater). 7. Stipule $\times 24$ (G. & R. n. 587). 8, 9. Stipules $\times 85$ (ditto). 10. Stipule $\times 24$ (Suffolk, Skepper).

3. *Kantia arguta* (Mont. et Nees), Lindb.

Calypogia arguta, Montagne et Nees in Nees Nat. Eur. Leb. 111, p. 24 (1838).

Cincinnatius argutus, Dum. Hep. Eur. p. 117 (1874).

Kantia arguta, Lindb. in Not. soc. F. Fl. Fenn. 13, p. 363 (1874).

Dioicous, laxly and thinly spreading, small, pale green in colour. Stems simple or sparingly branched, delicate, sometimes elongate, attenuate, depauperate, frequently gemmiparous; branches proceeding from axil of stipules; radiculose, rootlets few. Leaves distant or approximate, largest near the middle of stem, smaller below, and often near the apex minute and remote, horizontal to patent-divergent, postical margin usually decurrent, oval or oblong-oval, bidentate to about one-tenth, sinus broad, semilunate, segments a little divergent, acute; texture fragile, lax, cells rather large, 4-, 5- and 6-sided, walls thick, no trigones. Stipules small, scarcely twice as broad as the stem, irregular in shape, much broader than long, bidentate to below the middle, segments divergent, lobate to the middle or below, lobules acute, divergent.

I have seen no perfect σ or ♀ ; the drawing of the perianth is from a sketch sent me by Mr. Slater, who found a single one on a plant collected by Mr. Curnow near Penzance. Andrœcia on separate plants, bud-like, small, proceeding from axil of stipules.

DIMENSIONS.—Stem $\frac{1}{2}$ to $\frac{3}{4}$ inch long, .2 mm. in diameter, with leaves 1.5 mm. wide; leaves 1. mm. \times .6 mm., segments .1 mm.; cells .07 mm. \times .04 mm., .04 mm. \times .035 mm., .06 mm. \times .04 mm.; stipules .25 mm. \times .35 mm., segments .1 mm., .15 mm. \times .25 mm., seg. .075 mm.

HAB.—Growing on shady clayey banks, in woods or by roadsides, moderately rare, or overlooked.

1. Near Penzance, *W. Curnow*. 2. Near Ditchling, Sussex, *G. Davies*. 3. Epping Forest, Essex, *E. M. Holmes*. 7. Torrent Walk, Dolgelly, Merionethshire, *W. H. P.* Near Pandy Mill, Bettws-y-Coed, Carnarvonshire, *M. B. Slater*. 8. Near Leicester, *F. T. Mott*. 9. Hazel Grove, Cheshire, Cotterill Clough, Cheshire, *G. A. Holt*. 10. Park Quarry, Castle Howard, Yorks, *G. Stabler*, *M. B. Slater*. Near Mallion Spout, Goathland, *M. B. Slater*. Scarborough, *M. B. Slater*. Near Baildon, North-West Yorks, *W. West*. 12. 14. Helensburgh, Scotland, *Dr. Graham*. I. Killarney, *D. Moore*. Connor Hill, *Prof. Lindberg*. Clonallon, *Rev. C. H. Waddell*.

Found on the Continent (France) and introduced in greenhouses in North America.

In a collection of Hepaticæ made near Natal, South Africa, by Mrs. Ellen Sophie Bertelsen, widow of a Norwegian missionary, specimens of this species were found, agreeing in every respect with ours. Two other British species were found in the same collection, namely, *Lejeunea humatifolia* (Hook), and *Cephalozia connivens* (Dicks.).

OBS.—A very distinct species. Distinguished from *K. Trichomanis* (L.) and *K. Sprengelii* (Mart.) by its dioicous inflorescence, much smaller size, leaves more oblong; wider, semilunate sinus, divergent segments, much laxer and more delicate texture, small stipules which are deeply bidentate, with segments divergent and again lobate, perianth narrower than in *K. Trichomanis*. In habit it resembles small forms of *Lophocolea bidentata* (L.), from which it is at once distinguished, even when barren, by its less bidentate leaves and smaller stipules.

DESCRIPTION OF PLATE LIII.—Fig. 1. Plants natural size.

2. Portion of fertile stem, postical view $\times 16$ (Penzance, Curnow).
 3. Portion of stem, antical view $\times 24$ (ditto). 4. Stem, postical view $\times 16$ (Natal, South Africa, Mrs. Bertelsen). 5. Portion of leaf $\times 290$ (Penzance, Curnow). 6. Stipule $\times 85$ (Epping Forest, Holmes). 7, 8. Stipules $\times 85$ (Natal, Mrs. Bertelsen). 9. Stipule $\times 85$ (Penzance, Curnow).

Genus 14. **CEPHALOZIA**, *Dum.*

- Licheuastrum*, Dill. Cat. pl. Giss. p. 213 (1718), et Hist. musc. p. 481, n. 4 (1741).
Jungermania, Mich. Nov. pl. gen. p. 9, n. 5, tab. 6, Fig. 17 (1729).
 ,, sect. *Cephalozia*, Dum. Syll. Jung. Eur. p. 60 (1831).
 ,, sect. *Bicuspides*, Nees, Nat. Eur. Leber. 11, p. 211 (1836).
Cephalozia, Dum. Recueil, 1, p. 18, n. 21 (1835).
Zoopsis, Hook. f. et Tayl. Crypt. Antart. p. 55, n. 22 (1845).
Trigonanthus, Spruce, Trans. Bot. Soc. Edinb. (1849).
Nowellia, Mitt. in C.-Godman Nat. Hist. Azor., p. 321, n. 12 (1870).
Pleuroschisma Odontoschisma, Dum. Syll. (1831).
Odontoschisma, Dum. Recueil (1835).
Sphagnoecetis, Nees in G. L. N. Syn. Hep. (1845).

Prothallium slender, linear or almost filiform, consisting of only a single (more rarely in part of a double) series of cells; either simple or subramose; often passing at the apex insensibly into the stem and persisting a long time. Plants usually small and tender, in only a few species rather robust; of almost all shades of green and brown, or whitish and pellucid, sometimes tinged with rose; growing in depressed matted tufts, or flakes, or creeping over *Sphagna* and other mosses. Stems usually prostrate or procumbent, leafy throughout, or rhizomatous and leafless at the base—very rarely with the leaves reduced to mere scales—still more rarely frondose; branches all postical, springing from the underside of the stem, and axillary to the stipules where any exist; radicles usually copious, pale and slender. Leaves mostly succubous, in a few species transverse, in a very few subincubous; horizontal or assurgent, never deflexed, roundish, or subquadrate, or cuneate, rarely lanceolate, very seldom plane, usually concave,

and in most species somewhat complicate and bilobed (but never divided to the very base, nor with capillary lobes), in a very few species undivided or variable at the apex; margins uniformly plane or subincurved—never convex or recurved—mostly quite entire, but in a few species toothed. Reticulation in the typical species lax and pellucid, in a few species denser and subopaque; cells often subquadrate; cell-walls mostly thin, rarely conspicuously thickened at the angles; cuticle smooth or scaberulous.

Stipules much smaller than the leaves, and oftener undivided at the apex, but in some species subdentate at the margin; entirely absent from many species (except in the involucre, where they exist in every *Cephalozia*). Inflorescence dioicous or autoicous—very rarely paroiicous. Andrœcia amentiform, occupying the whole, or only a part, of a branch, rarely terminal on the stem. Bracts in many pairs, leafy (even where there are no stem-leaves), bifid, uniformly monandrous.

Gynœcia capitate, usually seated on an abbreviated branch (*i.e.*, cladocarpous), but sometimes terminal on larger branches or on the main stem (acrocarpous). Bracts much larger than the subjacent leaves (where any exist on the same axis) tristichous, *i.e.*, with stipules added, even where absent from the rest of the plant, and in three, or more amplexicaul rows; all cloven (usually bilobed, sometimes 3-5-lobed), and very often toothed or subspinose; cells elongate. Pistillidia about 20, shortish and flask-shaped. Perianth free, usually very long and narrow and elongate, reticulate like the bracts, fusiform, trigonous—rarely with the angles varying from 3 to 5 or 6 in the same species, but, whenever reduced to 3, with the third angle always postical, mouth truncate, but usually constricted (from the angles becoming more pronounced and plicæform at the apex), variously toothed, ciliate, laciniate, or entire. Calyptra free (superior), with the sterile pistillidia surrounding its base. Capsule on a long pedicel (which at the calceolate base buries itself deeply in the fertile branch), oblong or sub-cylindrical—usually about twice as long as broad, but in the subgenus *Cephalozia* often shorter, oblong-globose-4-valved to the base; capsule-walls of two layers of cells,

whereof the inner are strengthened by semiannular fibres. Elaters elongate bispiral, about as wide as the diameter of the smooth or scaberulous spores. Propagula apical, minute, red or whitish, polyhedral or amorphous; rarely present, except in a very few species.

Subgenus 1. *EUCEPHALOZIA*, Spruce.

Plants of a moderate size, rarely small or robust, virescent, rarely tawny or dull brown, sometimes with a rosy tinge, growing in broad tufts, or creeping amongst mosses in marshy places. Stems for the most part tender and fragile, rarely somewhat rigid, cortical cells sometimes large and pellucid, simple, very rarely furcate, postical more or less branched, in a few species flagelliferous. Leaves obliquely inserted, rarely subtransverse, always broader than the stem, often moderately large (between 0.3 and 1.35 mm. long), more or less oblong, concave or laxly complicate, rarely subplane, bifid, very rarely 3-4-fid, sinus rarely deep, in some subacute, in others lunate; apex of the segments various, but rarely rotundate or cuspidate; margin entire. Stipules (in a few species normally present) small, entire or bifid. Cells of the leaves moderately constant in size, varying in different species in diameter between $\frac{1}{20}$ and $\frac{1}{40}$ mm., rarely almost large ($\frac{1}{15}$ mm.), very rarely small ($\frac{1}{45}$ - $\frac{1}{48}$ mm.), equilateral-hexagonal, or often quadrate-hexagonal or quadrate, in most species subpellucid, in very few, wall thickened at the angles, cuticle almost smooth; cells of the bracts and perianth generally larger, rectangular-oblong. Inflorescence dioicous, or monoicous, very rarely parioicous; ♀ in some species constantly cladogenous, in some now clado- and now acrogenous, or almost acrogenous, but yet sometimes terminal on the same stem. Bracts 3 pairs, rarely fewer, innermost large bifid, rarely 3-4-fid, entire or very often dentate, spinulose, or incised, free or with the bracteole subconformable, of equal length or shorter, connate at the base. Perianth more or less highly emersed, fusiform—sometimes almost linear-trigonus-prismatic, in some species the keels in all stages acute,

in others (fruit mature) partly obliterated or only at the apex to be seen, mouth constricted denticulate, setulose, ciliate or laciniate; walls leptodermous, except at the very base, where it changes into the stem or branch, or in a few species, the lower half 2-3 cells thick. Andrœcia spicate or amentiform, in different places, but very rarely hypogenous, ♂ bracts immediately below the female flowers.

1. *Cephalozia catenulata* (Hüb.)

Jungermania catenulata, Hüb. Hep. Germ. p. 169 (1834).

Jungermania reclusa, Tayl. Lond. Journ. Bot. p. 278 (1846).

Jungermania bicuspidata, var. *ericetorum*, G.L.N. Syn. Hep. p. 139 (1844).

Cephalozia serriflora, Lindb. Medd. Soc. Fennica (1878).

Cephalozia catenulata (Hüb.), Spruce, "On Ceph." p. 33 (1882).

Dioicous, usually cladocarpous, densely but thinly cæspitose, flagelliferous, small, brown in colour. Stems prostrate, subpinnate, cells of the stems about 6 in diameter, cortical 14, inner slightly larger and more pellucid; branches radiculose; rootlets whitish. Leaves small, subimbricate, slightly concave, when dry much incurved, catenulate, oval-rotund, slightly decurrent, bifid to about the middle, sinus more or less obtuse, segments patulous or subconnivent, acute, 5 rows of cells, 1, 2, 3, 4, 5 wide; cells small to smallish, subquadrate or rhomboid, leptodermous, chlorophyllose and subopaque, walls firm, no trigones. Stipules wanting. Branches ♀ postical, short, rarely subelongate. Bracts twice as large as the leaves, oblong, bifid to about the middle, segments subulate-acuminate, margin denticulate or spinulose; bracteole similar, or entire and broadly subulate, free, margin denticulate or spinulose. Perianth deeply emersed, linear-fusiform, 4 times longer than broad, composed of one layer of cells, the whole length deeply tri-carinate, mouth constricted, setose or ciliate. Calyptra delicate. Capsule reddish-brown, oval-cylindrical. Andrœcia terminal on postical branches, julaceous; perigonial bracts somewhat similar to the leaves and of the same size, few pairs; perigonial bracteoles ovate-lanceolate, entire or with a slight notch on one side near the middle; antheridia oval.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .1 mm. in diameter, with leaves .5 to .6 mm. wide; leaves .3 mm. \times .2 mm., .25 mm. \times .17 mm., .2 mm. \times .2 mm., segments .1 mm., .225 mm. \times .175 mm., seg. .075 mm., .25 mm. \times .15 mm., seg. .1 mm.; cells .025 mm., .025 mm., .0225 mm. \times .0225 mm., .02 mm. \times .0225 mm., .03 mm. \times .02 mm.; bracts .55 mm. \times .4 mm., .6 mm. \times .35 mm., segments .3 mm.; bracteole .35 mm. \times .175 mm.; perianth 1.3 mm. \times .35 mm., 1.4 mm. \times .4 mm., teeth at the mouth .15 mm., .1 mm., .075 mm.; perigonal bracteoles .12 mm. \times .07 mm.; antheridia .125 \times .1 mm.

HAB.—On rotting wood, turfy banks and shady rocks. Rare.

2. Tunbridge Wells, *R. Spruce*. 10. Blaeberry Gill, near Whitby, *M. B. Slater*. 12. Borrowdale, Cumberland, *W. H. P.* 13. N. of Black Craig, New Galloway, *J. McAndrew*; Colvend, Kirkeudbrightshire, *J. McAndrew*. 15. Banchory, Aberdeenshire, *J. Sim*. I. Cromaglown and other places in the S.W., *Taylor, Spruce, Moore, Carrington* and others.

Found on the Continent and in North America.

OBS.—Similar in size and habit to *Cephalozia lunulæfolia* Dum. but more rigid, leaf cells smaller, bracts denticulate or spinulose, perianth composed of a single layer of cells.

Cephalozia pallida Spruce is much paler in colour, more branched, branches subfastigate, leaves subdecurent, bifid from $\frac{1}{3}$ to $\frac{1}{2}$, cells rather larger, bracts entire.

DESCRIPTION OF PLATE LIV.—Fig. 1. Plants natural size. 2. Stem, antical view \times 64 (Blaeberry Gill, *M. B. Slater*). 3. Leaf \times 85 (ditto). 4, 5. Leaves \times 85 (Canada, Macoun). 6. Portion of leaf \times 290 (Blaeberry Gill, *M. B. Slater*). 7, 8. Bracts \times 85 (Canada, Macoun). 9. Bracteole \times 85 (ditto). 10. Perianth \times 24 (*G. & R. n. 594*). 11. Portion of the mouth of perianth \times 85 (ditto). 12, 13. Perigonal bracteoles \times 85 (ditto). 14. Antheridium \times 85 (ditto).

2. *Cephalozia pallida*, Spruce.

Cephalozia catenulata var. *pallida* (*Ceph. pallida* nobis in hb.), Spruce, On Cephalozia. (1882.)

Dioicous, cladocarpous, depresso-cæspitose, eflagelliferous, small, pale green to yellowish in colour. Stems much branched, branches subfastigiata; cortical cells 15, rather larger than the inner ones, 5, 6 cells in diameter. Leaves small, approximate, from patent-divergent to erecto-patent, orbicular to oval-rotund, subdecurent, from a third to the middle bifid, rarely more, sinus obtuse, segments acute or obtuse, connivent; cells smallish to medium in size, subquadrate, walls thick, no trigones or thickened angles. Stipules wanting. Bracts larger than the leaves, oval-rotund, bifid to a third, segments acute or obtuse, margin entire, bracteole similar, sub-bracts and sub-bracteole similar but much smaller. Perianth projecting much beyond the bracts, linear-fusiform, composed of a single layer of cells, obtusely trigonous, mouth ciliolate or setulose, ciliola 2 cells long. Calyptra moderately coarse; pistillidia few, 8-10. Capsule oval, dark-brown. Spores pale yellow. Elaters slightly broader and of a darker colour, loosely bispiral. Andrœcia on short postical branches; perigonial bracts closely imbricate, erect, oval-rotund, concave, bifid to about a third, with usually a third smaller tooth near the middle, segments acute; antheridia oval.

DIMENSIONS.—Stem $\frac{1}{2}$ inch long, .1 mm. in diam., with leaves .75 mm. wide; leaves .35 mm. \times .3 mm., segments .2 mm., .4 mm. \times .3 mm., seg. .175 mm., .4 mm. \times .3 mm., seg. .2 mm.; cells .03 mm. \times .03 mm., .03 mm. \times .025 mm., .04 mm. \times .03 mm.; sub-bracts .45 mm. \times .45 mm., seg. .15 mm., .5 mm. \times .45 mm., seg. .2 mm., .4 mm. \times .25 mm., seg. .15 mm.; sub-bracteole .45 mm. \times .3 mm.; bracts .9 mm. \times .7 mm., seg. .3 mm., .8 mm. \times .7 mm., seg. .3 mm.; bracteole .75 mm. \times .65 mm., seg. .25 mm.; perianth 2. mm. \times .65 mm., 1.75 mm. \times .6 mm., teeth at the mouth .05 mm.; pistillidia .125 mm. \times .025 mm.; capsule .5 mm. \times .3 mm., valve of capsule .85 mm. \times .225 mm.; spores .01 mm.; elaters .1 mm. \times .0115 mm.; perigonial bracts .5 mm. \times .5 mm.,

seg. .2 mm.; perigonial bracteole .25 mm. × .1 mm.; antheridia .15 mm. × .1 mm.

HAB.—On turfey banks or moors, or on shady rocks. Rare.

9. Frodsham, Cheshire, *G. E. Hunt.* 10. Strensall Moor, *G. Stabler*; Stockton Forest, *G. Stabler*; Yeadon, *Dr. Carrington.*
I. Lachan Bay, Co. Mayo, *D. Moore.* Loch Bray, Co. Wicklow, *D. McArdle.*

Found on the Continent.

OBS.—Distinguished from *Ceph. catenulata* (Hüb.) which it approaches most in habit, by its paler colour (pale green or yellowish, and not a tawny brown), leaves not so deeply bifid, cells slightly larger and bracts entire. From *Ceph. lunulæfolia* Dum. by its smaller leaf-cells, and perianth composed of a single layer of cells only.

DESCRIPTION OF PLATE LV.—Fig. 1. Plants natural size. 2. Portion of stem × 24 (Stockton Forest, *G. Stabler*). 3–6. Leaves × 64 (ditto). 7. Portion of leaf × 290 (ditto). 8, 9. Bracts × 31 (Loch Bray, *D. McArdle*). 10. Bracteole × 31 (ditto). 11–13. Sub-bracts × 31 (ditto). 14. Sub-bracteole × 31 (ditto). 15. Perianth × 16 (ditto). 16. Cross-section of perianth × 31 (ditto). 17. Portion of the mouth of perianth × 85 (ditto). 18. Perigonial bract × 64 (Stockton Forest, *G. Stabler*). 19. Perigonial bracteole × 64 (ditto). 20. Antheridium × 85 (ditto).

3. *Cephalozia lunulæfolia*, Dum.

Jungermania connivens, Mart. Fl. crypt. Erl. p. 169, t. 5, f. 44 (1817); Mong. et Nestl. St. crypt. Vog., 5, n. 432.

Jungermania lunulæfolia, Dum. Syll. Jung., p. 61 (1831).

Cephalozia lunulæfolia, Dum. Recueil p. 18 (1835).

Cephalozia media, Lindb. Medd. af Soc. pro f. fl. Fenn. 6, p. 242 (1881).

Cephalozia multiflora, Spruce, On Ceph., p. 37 (1882).

Dioicous, densely depressed cæspitose, amongst *Sphagna* laxly creeping, eflagelliferous, small, of a pale green colour. Stem prostrate, subramose, sometimes subpinnate, subcompressed, above almost plane, below convex, cells 6 or 7 in diameter, cortical cells

12-14, large, pellucid, interior much smaller, subopaque. Leaves small, subimbricate—in the sterile plant often distant—subascending, rhomboid-rotund, antically decurrent, bifid to about $\frac{1}{3}$, sinus obtuse, rarely lunate, segments connivent, acute or subacuminate; cells of moderate size, leptodermous, pellucid, slightly chlorophyllose, quadrate-hexagonal, walls moderately thick, no trigones or thickened angles. Stipules wanting. Inflorescence cladocarpous. ♀ terminal on very short postical branches. Bracts usually about 3 pairs, tristichous, the innermost considerably larger than the leaves, delicate, oblong-rotund, bifid to the third, rarely trifid or twice bifid, segments acutate, entire; bracteole somewhat similar, often connate with the bracts. Perianth linear-fusiform, when young triplicate, when mature only towards the apex trigonous, mouth subconstricted, denticulate or setulose (setæ 1 or 2 cells long only), carnose, towards the base composed of 3 layers of cells, in the middle 2 and near the apex 1. Calyptra oval-globose, carnose, almost the whole length composed of 3 layers of cells. Capsule oblong-cylindrical, on a somewhat short pedicel. Spores of a beautiful cinnamon colour, smooth. Elaters bispiral, slightly darker in colour than the spores. Androecia on short postical branches, perigonial bracts smaller than the leaves, oval, to about a third bifid, canaliculate-concave; antheridia solitary, oval, shortly stipitate.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .1 mm. in diam., with leaves .5–.8 mm. wide; leaves .3 mm. \times .25 mm., .3 mm. \times .3 mm., .3 mm. \times .4 mm. sinus .175 mm.; cells .04 mm. \times .04 mm., .04 mm. \times .03 mm., .035 mm. \times .04 mm., .0275 mm. \times .04 mm., .035 mm. \times .03 mm.; bracts .7 mm. \times .6 mm. segments, .3 mm., .8 \times .65 mm., seg. .2 mm., .9 mm. \times .7 mm., seg. .3 mm., .5 mm. \times .4 mm. seg. .2 mm.; bracteole .7 mm. \times .5 mm. seg., 2 mm., .5 mm. \times .3 mm., seg., .15 mm.; perianth 1.25 mm. \times .4 mm., 1.25 mm. \times .6 mm., 2.1 mm. \times .7 mm.; teeth of the perianth .075 mm. long; pistillidia .2 mm. \times .05 mm.; capsule .45 mm. \times .2 mm.; spores .0125 mm.; elaters .15 mm. \times .015 mm.; perigonial bracts .225 mm. \times .125 mm., seg. .075 mm.; antheridia .11 mm. \times .09 mm.

HAB.—On shady heathy banks, chiefly in woods and on rotting trunks, more rarely on sandstone rocks, often fruiting luxuriantly,

also on *Sphagna* and other bog mosses where it is usually sterile Common.

2. Tunbridge Wells, Ardingley Rocks, Sussex, *G. Davies*, *E. M. Holmes*. 7. Barmouth, *Dr. Carrington*; Tyn-y-Groes, *W. H. P.* 8. Kinder Scout, Derbyshire, *J. Whitehead* and *G. A. Holt*. 9. Carrington Moss, Cheshire, *G. A. Holt*; Alderley, Cheshire, *Wild* and *Holt*. 10. Castle Howard, *Dr. Spruce*; Blaeberry Gill, Whitby, *M. B. Slater*; Esholt, *Dr. Carrington*, *W. West*. 12. Foulshaw Moss, Westmorland, *G. Stabler*; Borrowdale, Cumberland, *Dr. Carrington* and *W. H. P.* 13. Dumfries, *J. McAndrew*. 15. Forfar. 17a. Sutherland, *Dr. Greville*. I.

Found on the Continent and in North America.

OBS.—“*C. lunulifolia* may be distinguished from *C. bicuspidata* and *convivens*, and from most of their allies, by the dioicous inflorescence; the small leaves, obtusely cloven to only $\frac{1}{3}$ of their length, and rather more closely reticulate; the bracts far less deeply cloven, and rarely into more than two segments; but, above all, by the *fleshy perianth and calyptra*, the perianth being 3 cells thick below and 2 cells thick about the middle, and the calyptra 3 cells thick almost up to the very apex; whilst both these organs in *C. bicuspidata* and *convivens* consist throughout of but a single layer of cells. Moreover, the perianth is merely denticulate at the mouth, while that of *C. convivens* has the almost unique character, among European *Cephalozie*, of terminating in long cilia; the perianth of *C. catenulata* being merely ciliolate, or setose at the apex. The purple spores of *C. bicuspidata* afford an additional mark of distinction from *C. lunulifolia*.” R. S.

In 1893 I received the following interesting note from Dr. Spruce: “In writing for a set of my hepaticæ, C. Delogne (who has charge of the herbarium at the Brussels Bot. Garden) asked for specimens of some of my British *Cephalozie* and *Lejeuneæ*, which I sent him. I took the opportunity to ask if any specimens of Dumortier’s hepaticæ were accessible. It would seem that Dumortier left no herbarium of hepaticæ, and there are only a few specimens from him in the national herbarium, where, however, he occasionally worked and annotated some of the specimens. When I was studying the *Cephalozie* I wished very much for a

sight of some of Dumortier's originals, but in vain. Having convinced myself of the distinctness of *C. multiflora* (nob.) from *C. connivens*, I sought for some notice of the former in the works of previous authors, and it seemed to me possibly identical with *C. lunulæfolia* Dum. The name suited well enough—not so well the meagre diagnosis. The first question I asked M. Delogne was about this plant, and he has been good enough to send for my inspection two specimens from the herbarium, the one marked by Dumortier (in the earlier part of his career) *Jg. lunulata* Dum., the other *Ceph. lunulæfolia* Dum. The latter from the classic exsiccata of Moug. and Nestler is conclusive. I am glad of this, as it gets rid of two names, *multiflora* and *media*, which were likely to lead to a fight.”

DESCRIPTION OF PLATE LVI.—Fig. 1. Plants natural size. 2. Plant $\times 24$ (Moug. & Nestl. n. 432). 3. Portion of stem $\times 31$ (ditto). 4. Ditto $\times 64$ (ditto). 5. Portion of leaf $\times 290$ (ditto). 6–9. Bracts $\times 24$ (Blaeberry Gill, M. B. Slater, herb. Spruce). 10. Bracteole $\times 24$ (ditto). 11. Bracts and bracteole $\times 31$ (Carr. & Pears. Hep. Brit.). 12. Perianth $\times 31$ (Moug. & Nestl. n. 432). 13. Cross-section of perianth, upper half $\times 24$ (Carr. & Pears. Hep. Brit. Exs.). Portion of the mouth of the perianth $\times 85$ (Blaeberry Gill, M. B. Slater). 15. Perigonial bract $\times 85$ (Carr. & Pears. Hep. Brit. Exs.) 16. Antheridium $\times 85$ (ditto).

4. *Cephalozia bicuspidata* (L.), Dum.

Lichenastrum pinnulis acutissime bifidis minimum, Dill. Hist. musc., p. 488, t. 70, f. 13 (1741).

Jungermania bicuspidata, Linn. Sp. pl. 1589 (1753); Hook. Brit. Jung. n. 11 (1816).

Cephalozia bicuspidata, Dum. Recueil, p. 18 (1835).

Monoicous, cæspitose, flagelliferous, small to medium in size, pale green, dull white or rose coloured. Stem prostrate, or ascending, irregularly ramose, branches few, postical; flagella radiculose; rootlets few, more frequent on the fertile branches;

cortical cells about 10, large, pellucid, inner about 6 in diam., smaller subopaque. Lower leaves smaller and distant, upper larger and subimbricate, diagonal at base or where closer, almost transversely inserted, ovate-orbicular, bilobed to about the middle, concave, sometimes complicate, segments connivent or patent, ovate-lanceolate or subtriangular, postical acute, antical a little narrower, sub-acuminate, sometimes shortly apiculate; cells rather large, 4-, 5- and 6-sided, pellucid, no trigones or thickened angles. Stipules wanting, except rarely on the female flowers. Inflorescence clado-acrocarpous; branches ♀ very short, rarely more or less elongate. Bracts about 3 pairs, innermost almost 3 times longer than the leaves, partly free, to the middle bilobed, segments lanceolate acuminate, entire or towards the base 1-2 spinose, rarely sublaciniate; bracteole similar; sub-bracts smaller, roundish; sub-bracteoles also smaller, lanceolate, spinulose, rarely bifid, sometimes obsolete. Perianth 4 times longer than the leaves, linear, prismatic, or subfusiform, mouth constricted or rarely open, denticulate, setulose or ciliate; at first tricarinate at the base, when older subterete, above trigonous, areolation lax, pale green or white, sometimes below of a beautiful purple colour, apex canescent, the whole length (except at the very base, which is 2, 3 cells thick) composed of a single layer of cells, about 60 cells round. Calyptra small, delicate. Pistillidia about 12, small. Capsule cylindrical-oblong. Spores purple. Andrœcia spicate, perigonial bracts situated at the apex or middle of the branches, or occupying the whole length, very rarely immediately below the ♀ flowers, closely imbricate, ascending, similar to the leaves, but broader at the base, which is swollen, sometimes with a third, small, antical tooth. Antheridia oval, single.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .1 mm. in diam., with leaves .5 to .10 mm. wide; leaves .55 mm. \times .55 mm., .5 mm. \times .4 mm., .7 mm. \times .5 mm., segments, .35 mm., .6 mm. \times .4 mm., seg. .3 mm., .3 mm. \times .25 mm., seg. .15 mm.; cells .05 mm. \times .04 mm., .045 mm. \times .035 mm., .04 mm. \times .035 mm., .05 mm. \times .035 mm., .06 mm. \times .04 mm., .05 mm. \times .05 mm.; sub-bract .8 mm. \times .8 mm., seg. 5 mm.; bract 1.3 mm., 1.25 mm. \times .75 mm., seg. .75 mm., 1.5 mm.

× 1' mm., seg. '75 mm.; bracteole 1'25 mm. × 1' mm., seg. '6 mm.; perianth 2' mm. × '75 mm., 2'5 mm. × '85 mm., 3'5 mm. × 1' mm., 1'8 mm.—2'2 mm. × '5 mm.; teeth at mouth '05 mm., '075 mm., '1 mm.; pistillidia '15 mm. × '04 mm.; perigonal bracts '75 mm. × '5 mm., seg. '4 mm., '6 mm. × '6 mm., seg. '25 mm.; antheridia '125 mm. × '1 mm.

HAB.—Growing on damp stones, rocks, and earth, or amongst mosses in wet and shady places; rarer on rotting wood. Common.

1 to 17. I.

Found on the Continent and in North America.

Obs.—One of our commonest hepatics, varying extremely in size, colour and habit.

Distinguished from *C. connivens* (D.), which is also monoicous, by the presence of flagella; position, shape and texture of the leaves, and perianth not furnished with long cilia.

C. curvifolia (Dicks.), which is also monoicous, has no flagella; the leaves are remarkably concave, with long, incurved, hamate, cuspidate segments, and usually of a beautiful purple colour.

DESCRIPTION OF PLATE LVII.—Fig. 1. Plants natural size. 2. Portion of stem × 31 (Pass of Llanberis, G. A. Holt). 3. Ditto × 31 (Penzance, W. Curnow). 4. Leaf × 24 (Kinder Scout, Whitehead & Holt). 5, 6. Leaves × 24 (Tyn-y-Groes, W. H. P.). 7. Portion of leaf × 290 (ditto). 8, 9. Bracts × 24 (Pass of Llanberis, G. A. Holt). 10. Bracteole × 24 (ditto). 11. Subbract × 24 (ditto). 12. Bract × 24 (Kinder Scout, Whitehead & Holt). 13. Perianth × 16 (Festiniog, W. H. P.) 14. Cross-section of perianth × 16 (ditto). 15. Portion of the mouth of perianth × 85 (ditto). 16, 17. Perigonal bracts × 24 (ditto). 18. Antheridium × 85 (ditto).

5. *Cephalozia Lammersiana* (Hübner.), Spruce.

Jungermania Lammersiana, Hübener Hep. Germ. p. 165 (1834).

Jungermania bicuspidata y *uliginosa*, Nees Eur. Leberm. ii. 253 and (*ex parte*)
yy obliquata, Nees 1, c. 254.

Jungermania bicuspidata, Eng. Bot. t. 2239.

Cephalozia Lammersiana (Hübner.), Spruce, On Ceph., p. 43 (1882).

Dioicous, laxly caespitose, flagella none or very rare, medium to largish in size, pale green to pale dull brown in colour. Stems simple or with one or two short postical branches; slender, delicate; cortical cells large, about 10, inner 4, 5 diam. smaller; radiculose, rootlets few, white, delicate. Leaves distant or approximate, alternate, spreading, horizontal or patent-divergent, oval or oblong-oval, bilobed to below the middle, segments connivent or spreading, large, unequal, lanceolate, acuminate; texture lax, cells medium to rather large in size, quadrate or oblong-quadrate, walls delicate, no thickened angles or trigones. Stipules present on the male plant only, shorter than the leaves, subulate or ovate-lanceolate, mostly entire, rarely bidentate at the apex. Fertile branches elongate; bracts oblong-ovate-acute, bilobed to below the middle, segments lanceolate-subulate; entire or with a small tooth below the middle on one side; bracteole broadly ovate, coarsely unidentate on both sides; sub-bracts ovate-lanceolate, only slightly bifid, segments acuminate; 3rd sub-bract small, ovate, bilobed to about the middle. Perianth much exerted, large, linear-cylindrical, obtusely trigonous, composed of a single layer of cells down to the very base, about 70 cells round near the middle, mouth constricted, denticulate, teeth 1 or 2 cells long. Calyptra oval, delicate. Capsule reddish-brown. Spores reddish-brown; elaters same colour, bispiral, hardly as broad as the spores. Androecia on short or long postical branches; perigonial bracts closely imbricate, assurgent, broadly ovate, swollen at the base, bilobed to about the middle, segments acute; perigonial bracteoles (see stipules). Antheridia single, oval.

DIMENSIONS.—Stems 1 to 2 inches long, .125 mm. in diameter, with leaves .75 mm. to 1 mm. wide; leaves .4 mm. × .25 mm.,

segment $\cdot 2$ mm., $\cdot 45$ mm. \times $\cdot 225$ mm., seg. $\cdot 225$ mm., $\cdot 35$ mm. \times $\cdot 25$ mm., seg. $\cdot 175$ mm.; cells $\cdot 05$ mm. \times $\cdot 02$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 05$ mm. \times $\cdot 025$ mm.; bracts $1\cdot 4$ mm. \times $\cdot 6$ mm., seg. $\cdot 75$ mm.; bracteole $1\cdot 5$ mm. \times 1 mm., seg. $\cdot 45$ mm., $\cdot 75$ mm.; sub-bracts $1\cdot 25$ mm. \times $\cdot 45$ mm., seg. $\cdot 25$ mm., 3rd sub-bract $\cdot 5$ mm. \times $\cdot 35$ mm., seg. $\cdot 3$ mm.; perianth $2\cdot 75$ mm. \times $\cdot 5$ mm.; teeth at the mouth of perianth $\cdot 05$ mm., $\cdot 075$ mm.; spores $\cdot 015$ mm.; elaters $\cdot 15$ mm. \times $\cdot 01$ mm.

HAB.—Growing in wet places, in bogs, &c., and by the side of rivulets. Moderately common.

1. Marazion Marsh, Penzance, Cornwall, *W. Curnow*. 8, 9, 10. Eskdale, Yorkshire, *Dr. Spruce*, *M. B. Slater*; Maize Beck, Teesdale, *Dr. Spruce*; Randy Mere, Egton, Yorks., *M. B. Slater*. 12. Bogs near Morecambe Bay, *G. Stabler*; Grisedale, Cumberland, *G. Stabler*. 13. North of Black Crag, New Galloway, *J. McAndrew*; Barend Moss, Kirkcudbright, *J. McAndrew*. 16. Moidart, West Inverness, *S. M. Macvicar*. I. Connor Hill, Ireland, *Dr. D. Moore*.

Found on the Continent and in North America.

OBS.—Very similar to large bog forms of *C. bicuspidata* (L.), but distinguished from them by its dioicous inflorescence, the female flowers on long branches, absence of flagella, whitish or dull brown colour (never rose coloured), the large, unequal, acuminate leaf segments, presence of stipules on the male plants, the deeply divided bracts with entire margins.

DESCRIPTION OF PLATE LVIII.—Fig. 1. Plants natural size. 2. Portion of stem, postical view $\times 24$. 3-5. Leaves $\times 64$. 6. Portion of leaf $\times 290$. 7, 8. Bracts $\times 24$. 9. Bracteole $\times 24$. 10, 11. Sub-bracts $\times 24$. 12. Third sub-bract $\times 24$. 13. Perianth $\times 16$. 14. Cross-section of perianth $\times 24$. 15. Portion of mouth of perianth $\times 85$. (All Marazion, Cornwall, *W. Curnow*.)

6. *Cephalozia hibernica*, Spruce MS.

Cephalozia hibernica, Spruce MS. Pears. in "Irish Naturalist," Dec. (1894).

Dioicous, creeping amongst mosses, with few rooting flagella, small, of a whitish, crystalline or pale green colour. Stems stout, flexuose, ramose, procumbent or somewhat erect, plano-convex, antical aspect 3-4 cells wide, postical with a band of 4×5 much smaller cells; branches postical, irregular, sometimes attenuate and gemmiparous, gemmæ capitate; rootlets hyaline, on the lower part of the stem, or at the apices of the arcuate stolons. Leaves approximate or contiguous, alternate, almost horizontally inserted, decurrent at the base, subalate, plane, so that the stem appears bialate, bifid from a third to the middle of the length, sinus rounded, segments subconnivent or erect, sharply acuminate, apical cells 2-4 in single series, texture delicate, cells large, hyaline, 4-, 5- and 6-sided, surface pitted when dry as in *Ceph. connivens*, walls thick, trigones wanting. Stipules absent. Flowers ♀ terminal on very short postical branches, bracts oblong, divided to about two-thirds into two unequal lanceolate-acuminate segments, sub-bract smaller, divided to about the middle, sometimes with a third small segment on one side, segments acute; bracteole oblong, bifid to about the middle or entire, unidentate near the middle, segments lanceolate-acuminate; sub-bracteole oval, divided to about $\frac{1}{4}$, segments obtuse, third sub-bracteole small, slightly bifid. Immature perianths only met with, mouth fringed with long cilia, 12 to 15, each composed of 3 or 4 long single cells. Andrœcia on short postical branches, perigonial bracts 4-5 pairs, closely imbricate, complicate-concave, oval, bilobed to about one-third; antheridia single, oval.

DIMENSIONS.—Stems $\frac{1}{2}$ inch long, with leaves 1·25 mm. wide; diameter of stem ·2 mm.; leaves ·7 mm. \times ·45 mm., segments ·25 mm., ·2 mm., ·5 mm. \times ·3 mm., seg. ·2 mm., ·15 mm., ·55 mm. \times ·35 mm., seg. ·2 mm., ·175 mm.; branch leaves ·35 mm. \times ·2 mm.; seg. ·15 mm., ·1 mm.; cells ·04 mm. \times ·05 mm., ·05 mm. \times ·06 mm., ·04 mm. \times ·04 mm., seg. ·065 mm., ·02 mm.,

·05 mm. × ·03 mm.; bracts 1· mm. × ·35 mm., seg. ·6 mm., ·8 mm., 1·2 mm. × ·35 mm., seg. ·6 mm., ·9 mm., bracteole ·85 mm. × ·4 mm., seg. ·6 mm., 1· mm. × ·4 mm.; pistillidia ·125 mm. × ·04 mm.; perigonal bract ·275 mm. × ·2 mm.; explanate, seg. ·075 mm.

HAB.—Among *Plagiothecium Borrevianum*, Spruce, on banks, Killarney, Dr. David Moore, 1865. Killarney, Mr. Reginald W. Scully, 1889.

OBS.—Specimens were sent by Dr. David Moore to Dr. Carrington in 1865 as *Jung. connivens*, who, recognising it as distinct from that species, brought it under the notice of Dr. Gottsche of Altona. He referred it doubtfully to *Jung. crassifolia*, Lindenb. & Gottsch.. It would probably have remained unrecorded until fertile plants were found, had not a fragment of Moore's specimen been forwarded to Dr. Spruce, who at once referred it to *Cephalozia crassifolia* (L. & G.); since then he received further specimens from Killarney, collected in 1889 by Mr. Reginald Scully, and wrote to me some time before his death, that he was inclined to consider the species distinct, and proposed the MS. name of *Cephalozia hibernica*. I feel doubtful until fertile specimens have been found whether it can be separated from *Ceph. crassifolia*. In any case it is a distinct addition to our Flora.

There is a strong resemblance in habit, texture, and structure of this plant to the genus *Zoopsis*, its plano-convex stem, with the band of small cells running through it, giving it a vertebrate appearance, its remarkably plane leaves, the cells of which cross the stem unaltered. It is not difficult to trace the transition from the apparent simple ribbon-like frond of *Zoopsis argentea* (Tayl.) through *Z. setulosa* Leitg., with its claw-like leaves, to the more perfect leaf form of *Z. Leitgebiana* C. & P. and so to the distinctly foliose *Cephalozia crassifolia* and *Ceph. hibernica*.

It is distinguished from its nearest ally, *Ceph. connivens* (Dicks.) by its dioicous inflorescence, the longer segments of its leaves, which are composed of 2-4 single long cells, and other characters.

I am indebted to the late Dr. Carrington for assistance in the preparation of this description.

DESCRIPTION OF PLATE LIX.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 24$ (Killarney, Dr. Moore). 3. Cross-section of stem $\times 85$ (ditto). 4–6. Leaves $\times 64$ (ditto). 7. Branch leaf $\times 85$ (Killarney, R. Scully). 8. Portion of leaf $\times 290$ (Killarney, Dr. Moore). 9. Portion of segment of leaf $\times 290$ (ditto). 10, 11. Bracts $\times 31$ (ditto). 12, 13. Bracteoles $\times 31$ (ditto). 14. Portion of the mouth of an immature perianth $\times 31$ (ditto). 15. Portion of male stem, antical view $\times 31$ (Killarney, R. Scully). 16. Perigonial bract $\times 85$ (ditto).

7. *Cephalozia connivens* (Dicks.).

Jungermania connivens, Dickson, Pl. crypt. Brit. Fasc. iv. (1801); Hooker Brit.

Jung. t. 15 (1816); Eng. Bot. t. 2436.

Cephalozia connivens (Dicks.), Spruce, On Ceph., p. 46 (1882).

Blepharostoma connivens, Dum. Recueil, p. 18 (1835); Hep. Eur. p. 96 (1874).

Monoicous, loosely caespitose or creeping, flagelliferous, small, pale green, pellucid, fragile. Stems subramose, subcompressed, cortical cells about 8, interior moderately large, almost empty; radiculose, rootlets plentiful, long, white. Leaves lower and upper distinctly smaller, middle larger, subimbricate or approximate, almost horizontal, insertion sublongitudinal, antical, very decurrent, obliquely suborbiculate, from $\frac{1}{3}$ to the middle bifid, sinus obtuse or lunate, segments triangular-acuminate, connivent; cells moderately large, quadrate-hexagonal or oblong-quadrate, almost empty, walls thick, no trigones or thickened angles. Stipules none. Bracts 3 pairs, the innermost almost twice as long as the leaves, oval or broadly ovate or irregular in outline, deeply 3–5-fid (normally twice bifid), segments lanceolate-subulate, acuminate, margin entire or sub-spinulose; bracteoles almost free, deeply bifid, exterior margin 1, 2 teeth. Perianth projecting, pyriform-fusiform, terete, towards the apex obtusely trigonous, cells elongate, composed of a single layer, about 60 roundish cells near the middle, these giving the inner and the

outer surface a verruculose appearance, mouth sub-constricted, longiciliate, afterwards trilobed; cilia of the so-called lobe about 4, of about 5 cells long, usually of one series of cells, a few cilioles or teeth interspersed. Calyptra short, delicate. Pistillidia few, about 6, long, narrow. Capsule oblong-globose. Andrœcia conspicuous, occupying the whole branch or often only on the apex or base of it, perigonial bracts 8-10 pairs, a little smaller than the leaves, concave, to the middle bifid, often with a tooth or lobule added on the antical side; perigonial bracteoles more or less absent; antheridia oval, single.

DIMENSIONS.—Stems about an inch long, .2 mm. in diameter, with leaves 1 mm. wide; leaves .5 mm. × .5 mm., .4 mm. × .35 mm., segments .2 mm., .45 mm. × .45 mm., seg. .2 mm.; cells .075 mm., .07 mm. × .05 mm., .04 mm. × .04 mm., .07 mm. × .04 mm., .05 mm. × .05 mm.; sub-bracts .75 mm. × .7 mm., seg. .35 mm., .65 mm. × .55 mm., seg. .3 mm., .5 mm. × .4 mm., seg. .3 mm.; sub-bracteole .35 mm. × .2 mm., seg. .15 mm.; bracts .8 mm., 1 mm. × 1 mm., seg. .75 mm., 1.1 mm. × 1 mm., seg. .6 mm.; bracteole .6 mm. × .5 mm., seg. .4 mm.; perianth 2.5 mm.—.4 mm. × 1 mm., 3 mm. × .75 mm.; cilia .4 mm., .5 mm.; pistillidia .25 mm. × .04 mm.; capsule .5 mm. × .5 mm.; valve of capsule 1 mm. × .3 mm.; spores .015 mm.; elaters .2 mm. × .015 mm.; perigonial bracts .4 mm. × .35 mm., seg. .2 mm., .45 mm. × .45 mm., seg. .2 mm.; antheridia .125 mm. × .1 mm.

HAB.—Growing in loose tufts, thin patches, or creeping among *Sphagna* on wet moors or peat mosses. Somewhat rare.

1? 2. New Forest, Hampshire, *C. Lyell*. 4. Marshy place in wood near Holt, Norfolk, *Hooker*. 5? 7? 9. Chat Moss, Lanc., *W. H. P.* 10. Terrington Carr, *Dr. Spruce*; Goathland & Wheeldale, nr. Whitby, *M. B. Slater*. 12. 13. Glenlee Glen, New Galloway, *J. McAndrew*; Barend Moss, above Routen Bridge and Crichope Linn, Kirkcudbrightshire, *J. Cruickshank*. 14. Kelso, *A. Brotherston*. 15. Strachan, Aberdeen, *J. Sim*. 16. Moidart, West Inverness, *S. M. Macvicar*. I.

Found on the Continent and in North America, also a variety with flagella in South Africa.

Obs.—Distinguished from *C. bicuspidata* (L.) by the longitudinal or lateral insertion of the leaves, giving it a flat ribbon-like appearance, the very decurrent antical base, connivent segments, the larger cells, absence of flagella, and perianth with long cilia at the mouth.

C. lunulifolia Dum. is a smaller plant with dioicous inflorescence.

DESCRIPTION OF PLATE LX.—Fig. 1. Plant natural size. 2. Portion of stem $\times 24$. 3, 4. Leaves $\times 64$. 5. Portion of leaf $\times 290$. 6, 7. Bracts $\times 24$. 8. Bracteole $\times 24$. 9–11. Subbracts $\times 24$. 12. Sub-bracteole $\times 24$. 13. Perianth $\times 16$. 14. Cross-section of perianth $\times 16$. 15. Portion of mouth of perianth $\times 85$. 16, 17. Perigonial bracts $\times 64$. 18. Anthridium $\times 85$ (Terrington Carr, Yorks., Dr. Spruce).

8. *Cephalozia curvifolia* (Dicks.), Dum.

Jungermania curvifolia, Dicks. Pl. crypt. Brit. fasc. 11, 15, t. 5 (1790); Hook. Brit. Jung. t. 15 et Suppl. t. 1. *ex parte* (1816).

Jungermania Baueri, Mart. Fl. crypt. Erlang. p. 172, t. 6, f. 46 (1817).

Cephalozia curvifolia, Dum. Recueil p. 18 (1835).

Novellia curvifolia, Mitten in Godman's "Natural History of the Azores" (1870).

Monoicous and dioicous, densely depresso-caespitose, etlagelliferous, small, pale green, whitish-red or deep purple colour. Stems slender, pellucid, subterete; radiculose, rootlets somewhat thick, numerous; simple or slightly branched, branches few, ascending, postical; very rarely furcate; cortical cells 8, large, outer walls thick, inner 4 cells in diam., smaller. Leaves loosely imbricate, assurgent-subsecund, succubous, almost transversely inserted, oblique obovate, concave, antical margin almost straight, postical broadly semi-cordate at the base, with inflexed auricle, with margin appressed to the leaf, ventricose at the keel, bilobed to below the middle, sinus more or less broadly lunulate; segments incurved-hamate, capillaris-cuspidate, points consisting of 8–10 oblong-quadrangle uniseriate cells; cells smallish to medium in size.

quadrate or oblong-quadrate, guttulate, verruculose, walls thick, angles thickened. Axillary leaf (when stem furcate) acuminate entire, the other segment abortive. On some elongated stems and branches the leaves are more symmetrical, the inflexed auricle disappearing. Stipules none. Branches ♀ generally very short, postical. Bracts 3 pairs, tristichous, innermost erect, oblong, complicate-bilobed, segments subovate apiculate, partly free, all the margin, except towards the base, minutely, unequally spinulose-denticulate; bracteole similar; exterior bracts much smaller; all the bracts and bracteoles without auricles. Perianth large, often about the middle of a rosy-purple colour, apex white, linear, deeply triquetrous-prismatic, mouth broadly truncate, wide, rarely constricted, setulose, teeth 1-4 minute quadrate cells long; delicate texture, composed of one layer of cells, near the middle about 200 very small, roundish cells around. Pistillidia about 10, large. Calyptra very delicate. Capsule oblong-globose.

Andrœcia terminal or on short postical branches; perigonial bracts many, closely imbricate, somewhat similar to the leaves but broader; perigonial bracteoles subulate; antheridia single, oval.

DIMENSIONS.—Stems $\frac{1}{2}$ to $\frac{3}{4}$ inch long, diam. .15 mm.; leaves .65 mm. \times .4 mm.; lobule .3 mm., seg. .35 mm., .6 mm. \times .5 mm. lobule, .3 mm., seg. .3 mm., .75 mm. \times .5 mm.; lobule, .2 mm., seg. .4 mm.; cells .045 mm. \times .025 mm., .035 mm. \times .025 mm., .035 mm. \times .03 mm., .03 mm. \times .025 mm., .025 mm. \times .025 mm.; bracts 1.25 mm. \times .9 mm., seg. .5 mm.; bracteole 1.1 mm. \times .7 mm., seg. .4 mm.; sub-bract 1 mm. \times .6 mm., seg. .4 mm. sub-bract, .65 mm. \times .45 mm., seg. .25 mm.; sub-bracteole .5 mm. \times .3 mm.; perianth 2 mm. \times .6 mm.; teeth at the mouth .075 mm., 125 mm.; pistillidia .2 mm. \times .04 mm.; perigonial bracts .6 mm. \times .55 mm.; lobule, .25 mm., seg. .4 mm.; perigonial bracteole .3 mm. \times .05 mm.; antheridia .1 mm. \times .075 mm.

HAB.—Growing on rotting trunks of trees, soft sandstone rocks; and damp heathy moors in subalpine situations. Somewhat rare.

2. Tunbridge Wells, Sussex, *Dr. Spruce*. 5, 7. Cwm Idwal, Carnarvonshire, *C. J. Wild and W. H. P.* 9. Near Todmorden,

John Nowell. 10. Near Whitby, *G. Stabler.* 12. Naddle Forest, Westmorland, *G. Stabler.* Borrowdale, Cumberland, *Dr. Carrington and W. H. P.* Patterdale, Westmorland, *W. H. P.* 13. Dunveock Glen and near Garroch, New Galloway, *J. Mr. Andrew.* 15. Balmoral, *G. Stabler.* 16. Glen Finnan, *Dr. Carrington.* Moidart, West Inverness, *S. M. Maccicar.* I. About Killarney abundant.

Found on the Continent and in North America, also Mexico, Azores, and, according to "Syn. Hep.," in South Africa.

OBS.—A most beautiful species, usually of a rosy or deep purple colour; distinguished from all other British *Cephalozia* by the remarkable inflexed auricle or lobule on the lower side of the leaf.

Sometimes the stem is furcate, with a difform (unicural) leaf at the fork; this and the leaf auricle, I suppose, induced Mr. Mitten to make a separate genus of it; but, as Dr. Spruce points out, this rare feature is also seen in other *Cephalozia*, and the auricle disappears in some of the ordinary leaves, towards the apex of drawn-out stems and branches, and always in the bracts, thus rendering these characters not of sufficient value to separate it from true *Cephalozia*. I regret this, as I should have been glad to have followed Mr. Mitten in associating the name of Nowell with this elegant species.

John Nowell was a working-man botanist, who had a most intimate knowledge of the Hepaticæ, and who was one of the most modest and generous of collectors. My readers will, I trust, pardon me for inserting the following lines by his friend, Mr. Stansfield:—

"Nature to *him*

Was ever, ever blooming! Ah, to tell
The rapture that, even in winter's depth,
To him could yield each tiny, glistening moss,
Or lichen grey, clothing the barren rock!

What nook of these our vales
Hath he not peeped in—peeped, nay, closely scanned?
At what clear spring hath he not bent and drank?
Beside what stream, or through what clough, hath he

Not roved, at his own gentle pace, and there
 Ta'en note of plant-life in its tiniest forms?
 What hill or knoll hath he not clomb, early
 Or late, or at mid-day, in rain or shine?

Shine sweetly, Sun, upon this honoured grave!
 Tread softly ye upon his kindly mould!
 And raise a Tablet that the child may ask:
 'For whom?' and learn that *Truth* and *Gentleness* have
 lived!"

I have remarked upon the colour of the species. Whilst collecting, along with my friend Dr. Carrington, in the woods of Borrowdale, we noticed at some considerable distance a mass of rich reddish-purple which we could not make out. Judge our surprise, when we approached near, to find the huge trunk of a rotting tree covered with this species! We speedily made ourselves

“ Rich in the wealth, which is collected
 Among woods and fields.”

DESCRIPTION OF PLATE LXI.—Fig. I. Plants natural size.
 2. Portion of stem \times (Dr. Gottsche, in G. & R. Hep. Eur. n. 232). 3, 4. Leaves \times (ditto). 5–8. Leaves \times 24 (Naddle Forest, Westmorland, G. Stabler). 9. Portion of leaf \times 290 (ditto). 10. Bracts \times 24 (Patterdale, Cumberland, W. H. P.). 11. Bracteole \times 24 (ditto). 12. Sub-bract \times 24 (ditto). 13. Sub-bracteole \times 24 (ditto). 14. Sub-bract \times 24 (ditto). 15. Perianth \times 24 (ditto). 16. Cross-section of the same \times 24 (ditto). 17. Ditto \times ? (Dr. G. in G. & R. Hep. Eur. n. 232). 18. Portion of the mouth of the perianth \times 85 (Patterdale, W. H. P.). 19, 20. Perigonial bract \times 31 (ditto). 21. Leaf at the base of stem \times 31 (ditto). 22. Perigonial bracteole \times 85 (ditto). 23. Antheridium \times 85 (ditto).

9. *Cephalozia Francisci* (Hook.), Dum.

Jungermania Francisci, Hook. Brit. Jung. t. 49 (1816).

Cephalozia Francisci, Dum. Recueil, p. 18 (1835).

Dioicous, densely caespitose, flagelliferous, small, green to reddish-green at the ends of the stems. Stems filiform, yet proportionately thick, fleshy, procumbent, subramose, branches ascending, with few leaves near the base; radiculose, rootlets plentiful at the base, hyaline; cortical cells about 15, inner slightly larger, all opaque; flagella numerous, leafless or with minute leafy processes. Leaves patent-divergent or patent spreading or subsecund, distant or subimbricate, small, oval-orbiculate or broadly ovate, from $\frac{1}{6}$ th to $\frac{1}{3}$ rd bidentate, sinus acute or obtusate, segments acute or obtuse, lower one usually connivent; cells smallish, subquadrate, near the middle oblong, marginal cells small, quadrate; walls thick, no trigones or thickened angles. Stipules large, ovate-lanceolate, obtuse, entire, rarely oblong-quadrate, bidentulate. Inflorescence cladocarpous, ♀ bracts 3 pairs, innermost much larger than the leaves, ovate-oblong, bifid to about $\frac{1}{3}$ rd, segments lanceolate obtuse or acute, recurved, unidentate on the outside; bracteole free, ovate-oblong, bifid; sub-bracts oval, shortly bidentate, sinus obtuse, segments acute connivent; sub-bracteole broadly lanceolate bifid. Perianth twice as long as the bracts, projecting about half beyond them, narrowly ovate-fusiform, tricarinate almost to the base, mouth 6-plicate, entire, at the base 3 cells thick, at the middle 2 cells. Calyptra lower half 2 cells thick. Pistillidia 5-8. Capsule large, dark brown, almost black, oval-cylindrical, spores and elaters deep red colour.

Andrœcia on the middle or the ends of the stem or postical branches; perigonial bracts 3-7 pairs, closely imbricate, concave-canaliculate, ovate-orbicular, bifid, sinus and segments subacute; perigonial bracteole linear-lanceolate, acuminate. Antheridia single, large, oval.

Sometimes gemmiparous, gemmæ large, greenish to reddish-green, at the ends of the stems.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diam. $\cdot 15$ mm.; leaves $\cdot 3$ mm. \times $\cdot 325$ mm., segments $\cdot 1$ mm., $\cdot 35$ mm. \times $\cdot 325$ mm., seg. $\cdot 075$ mm., $\cdot 35$ mm. \times $\cdot 225$ mm., seg. $\cdot 075$ mm., $\cdot 4$ mm. \times $\cdot 35$ mm., $\cdot 35$ mm. \times $\cdot 35$ mm., $\cdot 25$ mm. \times $\cdot 15$ mm.; cells $\cdot 06$ mm. \times $\cdot 02$ mm., $\cdot 035$ mm. \times $\cdot 02$ mm., $\cdot 04$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 02$ mm., $\cdot 025$ mm. \times $\cdot 025$ mm.; marginal cells $\cdot 02$ mm. \times $\cdot 02$ mm.; stipules $\cdot 2$ mm. \times $\cdot 1$ mm., $\cdot 2$ mm. \times $\cdot 075$ mm., $\cdot 15$ mm. \times $\cdot 1$ mm., $\cdot 15$ mm. \times $\cdot 08$ mm., $\cdot 2$ mm. \times $\cdot 1$ mm.; sub-bract $\cdot 75$ mm. \times $\cdot 5$ mm.; sub-bracteole $\cdot 5$ mm. \times $\cdot 3$ mm.; bract $1\cdot 1$ mm. \times $\cdot 7$ mm., seg. $\cdot 4$ mm., $\cdot 9$ mm. \times $\cdot 55$ mm.; bracteole $\cdot 9$ mm. \times $\cdot 5$ mm., seg. $\cdot 1$ mm.; perianth $2\cdot$ mm. \times $\cdot 6$ mm., $2\cdot$ mm. \times $\cdot 55$ mm.; capsule $\cdot 5$ mm. \times $\cdot 4$ mm., $\cdot 65$ mm. \times $\cdot 35$ mm.; pedicel $\cdot 125$ mm. diam.; spores $\cdot 02$ mm. diam.; elaters $\cdot 15$ mm. \times $\cdot 02$ mm.; perigonial bracts $\cdot 3$ mm. \times $\cdot 25$ mm., seg. $\cdot 075$ mm.; perigonial bracteole $\cdot 225$ mm. \times $\cdot 1$ mm.; antheridia $\cdot 15$ mm. \times $\cdot 1$ mm.

HAB.—Growing by the sides of ditches in moist turfy soil on moors. Very rare.

2. New Forest, Hants, *C. Lyell*. 4. Holt & Edgefield Heaths, Norfolk, *Francis*. 9. Dale Ford, Delamere Forest, Cheshire, *W. Wilson*. 10. Moors near York, Stockton Forest. Langwith Moor, *Dr. Spruce*, Strensall Common, Yorks, *M. B. Slater* & *G. Stabler*. 11. Kildale Moor, Cleveland, *R. Mudd*. 13. Roadside between Rosehall and Brownhall, Dumfries, *Cruickshank*. 15. Baker Wells, Strachan, Aberdeen, *J. Sim*; Loch-na-gar, Aberdeen, *J. Sim*. Kinnordy, *C. Lyell*.

I. Bantry, *Miss Hutchins*.

Found on the Continent sparingly.

Obs.—Distinguished from the dioicous *C. lunulæfolia*, Dum. *C. catenulata* (Hüb.) and *C. divaricata* (Sm.), in addition to other characters, by the presence of large stipules along the whole length of the stem.

C. fluitans (N.) is a very different plant with large lax oblong leaves, segments obtuse, large cells. By some strange mistake this species is figured in "Eng. Bot.," t. 2569, as *Jung. Francisci*. Dr. Spruce remarks that in habit, presence of flagella, concave leaves, small cells, the erect branches with leaves gradually becom-

ing smaller at the ends and bearing rosy gemmæ, *C. Francisci* clearly has an affinity with *C. (Odonto.) denudata* (Mart.).

DESCRIPTION OF PLATE LXII.—Fig. 1. Plants natural size. 2. Portion of stem $\times 24$ (Herb. Taylor). 3, 4. Leaves $\times 85$ (ditto). 5, 6. Ditto $\times 85$ (New Forest, Lyell). 7, 8. Portions of leaf $\times 290$ (ditto). 9, 10. Stipules $\times 85$ (Herb. Taylor). 11. Stipule $\times 85$ (New Forest, Lyell). 12, 13. Stipules $\times 85$ (Strachan, Sim). 14. Sub-bract $\times 31$ (ditto). 15. Sub-bracteole $\times 31$ (ditto). 16. Bract $\times 31$ (ditto). 17. Bracteole $\times 31$ (ditto). 18. Perianth $\times 24$ (ditto). 19. Perigonial bract $\times 85$ (New Forest, Lyell). 20. Ditto, explanate $\times 85$ (ditto). 21. Perigonial bracteole $\times 85$ (ditto). 22. Antheridium $\times 85$ (ditto).

10. *Cephalozia fluitans* (Nees), Spruce.

Jungermania fluitans, Nees in Syll. Ratisb. (1823).

Jungermania fluitans, Funck Cr. Gew. no. 593.

Jungermania inflata δ *fluitans*, Nees Eur. Leber. (1833-36).

Jungermania inflata γ ** *lava ambigu*, G.L.N. Syn. Hep. (1844).

Jungermania Francisci, Eng. Bot. t. 2569.

Jungermania Schlaweyeri, Hüben. Hep. Germ. (1834).

Cephalozia obtusiloba, Lindb. Bot. Not. (1872).

Cephalozia fluitans (Nees), Spruce, On Ceph., p. 50 (1882).

Dioicous, loosely caespitose, flagelliferous, medium to large in size, light green to pale brown in colour. Stems elongate, laxly creeping, subramose, radiculose, rootlets plentiful, white; 8 cells in diam., cortical cells 14-16, chlorophyllose, opaque, inner slightly smaller, pellucid; flagella plentiful, radiculose, leafless or partly leafy. Leaves large, ascending, subsecund, distant, rarely subimbricate, obliquely inserted, suboblique oval-ovate or oblong, sometimes subcuneate at the base, slightly concave, bilobed to a third, rarely almost to the middle, sinus acute or obtusate, narrow, segments unequal, postical larger, lanceolate, apex subcucullate, obtusate, rarely subacute; cells medium to rather large, hexagonal, leptodermous, chlorophyllose, subopaque, basal cells a little larger, marginal ones subquadrate, walls somewhat delicate, angles slightly

thickened, no trigones. Stipules distant, appressed to the stem, linear, linear-lanceolate, subulate or bifid and irregular segments often unequal, 3-6 cells long, sometimes with 1 or 2 teeth at one or both sides. Inflorescence cladocarpous, ♀ branches postical, short, about 3 mm. long. Bracts lax, 3 pairs, tristichous, innermost about the size of the leaves, erect, ovate-oblong, canaliculate, from a third to nearly the middle bilobed, segments acute or subacuminate, towards the base 1, 2 dentate; cells elongate, subpellucid. Bracteole same as the bracts. Sub-bracts much smaller than the bracts, unequally bidentate, or falcate and entire. Perianth projecting 2 to 3 times its length beyond the bracts, linear-fusiform, cylindrical, trigonous only at the apex, mouth truncate-subconstricted, entire, composed of one layer of cells from the middle to apex, lower half 2 cells, at base 2 to 3 cells thick, near the middle about 90 cells round. Calyptra 2 to 3 times shorter, slightly narrower, oblong-pyriform, delicate, at the base 2 to 3 cells thick. Capsule purple, oblong or oblong-cylindrical; valves linear-lanceolate, composed of two layers of cells. Spores dark reddish-brown, broader than the elaters. Elaters bispiral, same colour as the spores.

Amenta ♂ postical, perigonial bracts few (3-6)-pairs, smaller than the leaves, oval or orbicular, concave, shortly bilobed, segments subacute, sometimes with a third, short, antical, incurved segment; bracteole linear or oval-lanceolate, entire or bifid; antheridia large, solitary, oval-globose.

DIMENSIONS.—Stems from 1 to 3 inches long, .2 mm. to .25 mm. in diam., with leaves 1.25 mm. to 1.75 mm. wide; leaves .9 mm. × .55 mm. segments, .2 mm., .6 mm. × .4 mm. seg., .175 mm., 1 mm. × .9 mm. seg., .3 mm., 1 mm. × .6 mm.; cells .045 mm. × .04 mm., .04 mm. × .03 mm., .035 mm. × .835 mm.; stipules .5 mm. × .08 mm., .35 mm. × .1 mm., .3 mm. × .1 mm., .275 mm. × .1 mm., .225 mm. × .075 mm.; sub-bracts .75 mm. × .4 mm. seg., .2 mm., .5 mm. × .3 mm. seg., .2 mm., .6 mm. × .3 mm. seg., .1 mm.; bracts 1 mm. × .6 mm. seg., .4 mm., 1.25 mm. × .6 mm. seg., .3 mm., 1.2 mm. × .5 mm.; bracteole .9 mm. × .5 mm.; perianth 3.3 mm. × .8 mm., 4 mm. × .75 mm.,

4 mm. \times 5 mm.; calyptra 1.6 mm.; capsule .85 mm. \times .5 mm., .8 mm. \times .3-4 mm.; valves .15-.35 mm. broad; spores .02 mm.; elaters .2 mm. \times .0125 mm.; amenta 2 mm. long; perigonal bracts .5 mm. \times .3 mm. seg., .1 mm.; perigonal bracteole .2 mm. \times .075 mm.; antheridia .175 mm. \times .15 mm.

HAB.—“In the wettest part of bogs, creeping upon *Sphagna* and other mosses, sometimes partly floating.” R. S. Somewhat rare.

2. New Forest, Hampshire, *C. Lyell*, 1813. 7. Glyder Vawr, Carnarvonshire, *G. A. Holt*. 9. Delamere Forest, Cheshire, *W. Wilson*. Abbots Moss, Cheshire, *G. A. Holt*. Carrington, Moss, Cheshire, *G. A. Holt*. Wybunbury Bog, Cheshire, *J. Whitehead*. Staley Brushes, Cheshire, *J. Whitehead*. Barton Moss, Lanc., *W. H. P.* 10. Far Wheeldale and Goathland Moor, Yorks., *Sam. Anderson*. 12. Foulshaw Moss, Westmorland, *G. Stabler*. 13. Barend Moss, nr. Castle Douglas, Kirkeudbrightshire, *J. McAndrew*. 16. Moidart, West Inverness, *S. M. Macvicar*. I. Kylemore, Co. Galway, *D. Moore*.

Found on the Continent and in North America.

OBS.—First discovered by Mr. Lyell in the New Forest in 1813, and published and figured in “Eng. Bot.” under the false name of *Jungermania Francisci*, from which it is quite distinct, as will be seen by reference to the description and figures of that species. Nees was the first to recognise it as a new and distinct species, but he appears afterwards to have doubted its claims to specific rank, for he reduced it to a variety of *Jungermania inflata* in his later works. As Dr. Spruce remarks, how such a consummate hepaticologist should have confounded them it is difficult to conceive, adding: “It may suffice to contrast their chief characters, which are, for *C. fluitans*, the stem rooting by numerous stout flagella; the branches, whether foliferous or floriferous, all postical; the longer, narrower, and more laxly-reticulate leaves; the constant presence of stipules; the cladocarpous inflorescence; the tristichous female bracts, toothed at the base, the innermost embracing the perianth; finally, the lineari-fusiform, trigonous, thin perianth. But in *Jungermania inflata* there are no flagella;

the branches arise variously from the mid axil of a leaf, or from its postical angle, and the female flowers are borne on the apex of the stem or of long leafy branches; there are no stipules at all, except very rarely a small subfloral one; the bracts are distichous, conformable to the leaves, and usually remote from the perianth (whence the species becomes the type of Dumortier's spurious genus *Gymnocolea*); and the perianth itself is pyriform, inflated, and obscurely 4-5-plicate, only at the very apex; it is besides composed of 2 strata of cells up to $\frac{1}{8}$ of its height."

DESCRIPTION OF PLATE LXIII.—Fig. 1. Plants ♀ and ♂ natural size. 2. Portion of fertile stem with perianth $\times 11$ (Foulshaw Moss, G. Stabler). 3. Portion of male stem $\times 16$ (ditto). 4. Portion of branch, antical view $\times 24$ (ditto). 5. Portion of leaf $\times 290$ (ditto). 6-8. Stipules $\times 85$ (Delamere Forest, W. Wilson). 9. Stipule $\times 85$ (Wheeldale, Sam. Anderson). 10, 11. Bracts $\times 24$ (Foulshaw Moss, G. Stabler). 12-14. Subbracts $\times 24$ (ditto). 15. Cross-section of perianth, near the base $\times 16$ (ditto). 16. Ditto, near the apex $\times 16$ (ditto). 17. Portion of mouth $\times 85$ (ditto). 18. Perigonial bract $\times 31$ (ditto). 19. Perigonial bracteole $\times 85$ (ditto). 20. Antheridium $\times 85$ (ditto).

11. *Cephalozia heterostipa*, Carr. et Spruce.

Cephalozia heterostipa, Carr. et Spruce. Spruce, On Ceph., p. 55 (1882).

Jungermania inflata, var. *heterostipa*, Lindb. in Arn. & Lindb. Musc. Asiæ bor. p. 47 (1888); Kaalaas Leverm. Norge, p. 290 (1893).

Dioicous, depresso-cæspitose, flagelliferous, from a reddish-brown to a dull brown or green, sometimes orange colour, fragile. Stems intricately flexuose, radiculose, rootlets produced the whole length of the stem, white; simple or twice dichotomously branched, with the young apex almost always bifurcate, sometimes, not always, producing radiculose, stoloniferous, postical branches partly leafy, rarely altogether leafless. Cells of the stem 7 or 8 in diameter, cortical 20-22, subquadrate, subopaque, inner somewhat smaller, more pellucid. Leaves diagonally inserted at the

base, lower ones distant, patulous, oblong or cuneate-oblong, to a third subacutely bilobed, segments obtusate or rotundate, often discoloured, upper ones approximate and more or less imbricated, and near the flowers, and where the stem bifurcates more deeply coloured, broader, cuneate, assurgent-concave, often to the middle bilobed, very often 3- and sometimes 4-lobed, angular or obsolete denticulate, lobes alone obtuse, sometimes subacute, subequal, or with the exterior one, now the antical, now the postical, smaller; cells small to smallish, 4-6 sided, subleptodermous, chlorophyllose, subopaque, lower ones slightly elongate, walls thick, angles not thickened, or only very slightly, no trigones. Axilliar antical leaf (at the fork of the stem) a little smaller than the others, ovate, entire, rarely with a tooth added at the base. Stipules small or minute, sometimes obsolete, rarely altogether wanting, coloured, linear or subulate, entire or bifid, segments erect, narrow, unequal. Sometimes between the normal stipules other abnormal ones are found equal in length to the leaves, falcate-lingulate or irregular. Flowers ♀ terminal on stem, pistillidia 10-16. Bracts 2-3 pairs, laxly imbricate, concave, broader than long, 3-4-lobed, lobes subacute, obtuse, or rotundate; bracteoles rather smaller than the bracts, oblique, ovate-lanceolate, entire, or deeply bilobed. Perianth projecting much beyond the bracts, green, pyriform, somewhat compressed, very indistinctly trigonous, mouth shortly 6-lobed, lobes 2-4 dentate, whole number of teeth about 18, shortly subulate, unequal; cells quadrate, opaque, pachydermous, composed of one layer of cells, except at its base and a very little higher up, where it is composed of two layers.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .2 mm. to .25 mm. in diameter, with leaves 1.5 mm. wide; leaves, lower .6 mm. \times .4 mm., .6 mm. \times .5 mm., segments .2 mm., .65 mm. \times .6 mm., seg. .25 mm., upper .75 mm. \times .55 mm., seg. .25 mm., .8 mm. \times .65 mm., .9 mm. \times .55 mm., seg. .25 mm., 1 mm. \times .75 mm., seg. .4 mm.; cells .02 mm. \times .02 mm., .03 mm. \times .025 mm., .0275 mm. \times .02 mm., .03 mm. \times .03 mm.; stipules .2 mm. \times .04 mm., .2 mm. \times .06 mm., .225 mm. \times .05 mm., .15 mm. \times .04 mm., .125 mm. \times .075 mm.; bracts .6 mm. \times .8 mm., .75 mm. \times .8 mm., .9 mm. \times .11 mm.;

bracteoles $\cdot 3$ mm. \times $\cdot 175$ mm., $\cdot 4$ mm. \times $\cdot 15$ mm., $\cdot 325$ mm. \times $\cdot 1$ mm.; perianth $3\cdot 1$ mm. \times $1\cdot 4$ mm., $2\cdot 75$ mm. \times $1\cdot 5$ mm.; pistillidia $\cdot 2$ mm. \times $\cdot 05$ mm.

HAB.—On wet rocks on mountains. 7. Glyders, North Wales, *E. M. Holmes*, 1876.

Extremely rare.

OBS.—Distinguished from *Ceph. fluitans* (Nees) by its smaller size, lurid colour, leaves more frequently trilobed, much smaller cell structure, in being acrocarpous, perianth with mouth laciniate-dentate.

From small forms of *Jung. inflata* Huds., in having postical, flagelliform branches, distinct polyphyllous involucre, constant presence of bracteole, perianth being visibly (although very obtusely) trigonous upwards and rather wide-mouthed.

DESCRIPTION OF PLATE LXIV.—Fig. 1. Plants natural size. 2. Portion of stem, postical view $\times 24$. 3–7. Leaves $\times 24$. 8. Portion of leaf $\times 290$. 9–13. Stipules $\times 85$. 14. Bract $\times 24$. 15–17. Bracteoles $\times 85$. 18. Perianth $\times 16$ (Glyders, *E. M. Holmes*).

Subgenus 2. *ODONTOSCHISMA*, *Dum.*

Odontoschisma, *Dum. Recueil*, p. 19 (1835) (genus).

Sphagnacetus, *Nees in G.L.N. Syn. Hep.* p. 148 (1845).

Jungermania, *Dicks. &c.*

Plants somewhat robust, green or lurid, sometimes rosy, rarely whitish, spreading, in closely intricate layers, or creeping upon mosses, very often densely caespitose. Stems firm, subterete, prostrate or repeatedly arcuate, with the flagelliferous branches rooting; leafy branches few, similar to the stem. Cells of the stem about 8 in diameter, cortical 20–22, about equal in size to the inner ones and of the same colour, sometimes more opaque. Leaves succubous, inserted at the base diagonally or almost longitudinally, broadly ovate or suborbiculate rotundate or retuse, rarely obcordate or emarginate-bidentate, more or less concave, entire; cells medium size or very small, equilateral, walls in some

species delicate, in others with the angles thickened, epidermis sometimes scaberulous. Stipules minute and everywhere obvious, or partly obsolete, sometimes none. Inflorescence for the most part dioicous, in a few monoicous; ♀ cladogenous. Fertile branches short. Bracts small, tristichous, sometimes bifid, rarely 3-4-fid. Perianth large, leptodermous, trigonous-fusiform, very often narrow, mouth ciliate or denticulate, sometimes closed and dividing at a lateral cleft. Calyptra leptodermous. Capsule cylindrical-oblong, in other respects similar to all *Cephalozia*. Andrœcia constantly on whitish small amentula, very rarely more robust and terminal; perigonal bracts minute; antheridia situated in their axils.

Often gemmiparous, gemmæ collected in heads upon the attenuated tips of the branches.

12. *Cephalozia Sphagni* (Dicks.), Spruce.

Jungermania Sphagni, Dicks. Crypt. Brit. (1785); Hook. Brit. Jung. t. 33 (*pro parte*) (1816).

Pleuroschisma (*Odontoschisma*) *Sphagni*, Dum. Syll. Jung. p. 68 (1831).

Odontoschisma Sphagni, Dum. Recueil, p. 19 (1835).

Sphagnocetis Sphagni, Nees in G.L.N. Syn. Hep. p. 148 (1845).

Cephalozia (*Odontoschisma*) *Sphagni* (Dicks.), Spruce, On *Cephalozia*, p. 60 (1882).

Dioicous, loosely caespitose or creeping sparsely among mosses, flagelliferous, largish in size, green or brownish-green in colour. Stems procumbent, elongate, arcuate, simple or with few postical branches, firm, flexuose, gemmiparous branches wanting, cortical cells 25-30, yellowish-brown, similar in size to the inner ones only with thicker walls, 10-12 cells in diameter, inner cells subopaque; flagella postical, stout, firm, covered with minute rootlets or short conical cells; radiculose, rootlets numerous, minute, simple hyaline, proceeding from the postical side of the stem. Leaves imbricate or approximate, alternate, bifarious, patent-divergent to patent, subobliquely or almost longitudinally inserted, secund, concave, never repand or undulate, very slightly decurrent anticlally, ovate-rotund, entire, rotundate, retuse or sometimes

emarginate, more or less distinctly margined, margin often brownish; texture firm, epidermis smooth; cells small to medium size, subopaque, roundish-quadrate or roundish-oblong-quadrate, walls thick, angles large, thickened, trigones rarely present, marginal cells usually quadrate with thicker walls. Stipules none or rarely present at the apex of stem or branches, very minute, ovate, entire or bifid. Inflorescence ♀ postical; sub-bracts small, oval, bidentate, concave; sub-bracteoles oblong, entire; bracts somewhat larger than the leaves and often very much more pellucid, somewhat recurved, cuneate-oblong, almost to the middle bifid, with 1, 2 or 3 smaller segments, which are apiculate or acute dentate, rarely entire; bracteole somewhat similar, but smaller. Perianth 3 to 6 times longer than the leaves, subulate-fusiform, cylindrical below, trigonous above, hyaline, near base 3 to 4 cells thick, upper portion composed of one layer of cells, mouth small through the folds, laciniate-ciliate, cilia very narrow, 2 cells long. Calyptra obovate, 1 to 2 cells thick near the base. Capsule spherical, dark brown, valves dividing to the base, thin texture. Spores small, smooth, dark reddish-brown. Elaters bispiral, rather broader than the spores, of the same colour. Androecia postical amentiform, catkins minute; perigonial bracts about 8 pairs, closely imbricate, concave-complicate, oval, bidentate, segments acute; bracteole oblong, entire or slightly emarginate; antheridia single, oval, stipitate.

Fruits April, May.

DIMENSIONS.—Stems 1 to 3 inches long, .15 mm. diameter; leaves .75 mm. × .6 mm., .7 × .6 mm., .7 mm. × .8 mm., .7 mm. × .7 mm., .65 mm. × .65 mm., .75 mm. × .75 mm.; cells .035 mm. × .02 mm., .025 mm. × .02 mm., .02 mm. × .02 mm., .03 mm. × .03 mm., .03 mm. × .02 mm.; sub-bracts .5 mm. × .4 mm. sinus, .1 mm., .5 × .35 mm., .3 mm. × .25 mm.; sub-bracteoles .3 mm. × .2 mm.; bracts 1.25 mm. × .75 mm. segments, .4 mm., .6 mm., 1.1 mm. × .65 mm. segments, .45 mm.; bracteole .75 mm. × .5 mm. segments, .25 mm.; perianth 4. mm. × .75 mm., 2.6 mm. × .6 mm.; teeth at the mouth .075 mm.; calyptra 1 mm. × .5 mm.; pistillidia .15 mm. × .025 mm.; capsule .6 mm. × .55 mm.; valves

·7 mm. × ·3 mm.; pedicel ·15 mm. diam.; spores ·008 mm. diam.; elaters ·1 mm. × ·01 mm.; perigonial bract, explanate, ·55 mm. × ·4 mm. sinus, ·15 mm., ·55 mm. × ·55 mm. sinus, ·2 mm.; perigonial bracteoles ·3 mm. × ·15 mm.; antheridia ·08 mm. × ·06 mm.

HAB.—Growing in dense patches on damp moors or in bogs, often straggling loosely amongst *Sphagna* and other mosses.

1, 2, 4, 7 to 17, I.

Found on the Continent and in North America.

Obs.—At once distinguished from all other round-leaved species by its postical trigonous perianth and postical amentiform andrœcia; when barren, by its arcuate stems and abundant stout flagella. From *C. (O.) denudata* (Mart.), see notes under that species.

Var. *alpina*, MS. is a small neat form of a reddish-brown colour with smaller cells, firm walls, with indistinctly thickened angles, perigonial bracts ovate-rotund, with a third, antical, basal tooth, found on the Scotch and Welsh mountains. I have not been able to observe other characters to enable me to separate it from the type.

DESCRIPTION OF PLATE LXV.—Fig. 1. Plants natural size. 2. Portion of stem × 16. 3–7. Leaves × 24. 8. Portion of leaf × 290. 9–12. Sub-bracts × 24. 13, 14. Sub-bracteoles × 24. 15, 16. Bracts × 24. 17. Bracteole × 24. 18. Perianth × 11. 19. Cross-section of perianth near the base × 16. 20. Ditto near the apex × 16. 21. Portion of the mouth of the perianth × 85. 23–26. Perigonial bracts × 24. 27, 28. Perigonial bracteoles × 24. 29. Antheridium × 85 (All, Foulshaw Moss, Westmorland, George Stabler).

13. *Cephalozia denudata* (Nees), Spruce.

Jungermania denudata, Nees in Mart. Crypt. Erlang. p. xiv. (1817).

Jungermania scalaris b *denudata*, Mart. Crypt. Erlang. p. 185, t. 6, f. 58, b. (1817).

Jungermania Sphagni, Hook. et al. ex p. (1816).

Pleuroschisma denudatum, Dum. Syll. Jung. 69 (1831).

Odontoschisma denudatum, Dum. Recueil, p. 19 (1835).

Sphagnacetis communis macrior, Nees in G.L.N. Syn. Hep. p. 149 (1844).

Sphagnacetis Huebneriana, Rabenh. Handb. ii. 5, p. 338 (1848).

Cephalozia denudata, Spruce, On *Cephalozia* (1882).

Dioicous, intricately cæspitose, flagelliferous, small, greenish-to reddish-brown in colour. Stems almost leafless at the base, rhizomatous, creeping, subramose, cortical cells about 40, similar to the inner, 10×8 cells in diameter; branches subfasciculate, erect, gemmiparous; radiculose, rootlets numerous on the creeping stems; flagella postical, few. Leaves imbricate, patent-divergent, never secund, concave, broadly ovate or oval, entire, sometimes retuse or emarginate, slightly decurrent antically, largest near the middle of the stem, becoming gradually smaller above and gemmiparous; texture firm; epidermis verruculose; cells small, roundish-quadrate, walls thick, angles thickened, no trigones. Stipules everywhere present, increasing in size on the gemmiparous branches and becoming equal in size to the terminal leaves, oblong-roundish-quadrate, broadly oval or lanceolate, entire, acute or subdenticulate. Inflorescence ♀ postical; sub-bracts oval or ovate, bidentate to about a sixth; sub-bracteole oblong, entire; bracts twice bifid, margin denticulate or rarely entire; bracteole lanceolate, acute, minutely bidentate. Perianth narrowly fusiform, cylindrical below, above obtusely trigonous, mouth small, denticulate or shortly fimbriate, at the base 3 cells thick, near the middle 2, upper half composed of a single layer of cells. Calyptra very delicate, composed of a single layer of cells. Pistillidia long, narrow, about 12. Andrœcia postical, amentiform, arcuate-decurved, perigonial bracts 3-8 pairs, deeply saccate, margin entire, emarginate or incised, segments obtuse or obtusate.

Fruits April, May.

DIMENSIONS.— $\frac{1}{2}$ to 1 inch long, diam. .2 mm.; leaves .9 mm. \times .5 mm., .7 mm. \times .7 mm., 1 mm. \times .9 mm., .6 mm. \times .5 mm., .7 mm. \times .6 mm., .8 mm. \times .6 mm.; cells .025 mm. \times .02 mm., .02 mm. \times .0172 mm., .02 mm. \times .02 mm.; stipules .4 mm. \times .25 mm., .35 mm. \times .25 mm., .5 mm. \times .2 mm.; sub-bracts .6 mm. \times .4 mm.; sinus .1 mm., .7 mm. \times .4 mm., .35 mm. \times .2 mm., .4 mm. \times .3 mm., .5 mm. \times .3 mm.; sub-bracteole .3 mm. \times .2 mm.; bract .75 mm. \times .9 mm., segments .3 mm.; bracteole .9 mm. \times .45 mm., sinus .05 mm.; perianth .2 mm. \times .6 mm.; pistillidia .2 mm. \times .03 mm. (androeia .5 mm. — 1.5 mm. long \times .25 mm. thick S.O.L.).

HAB.—Growing on rotting trunks of trees or dead vegetable matter, or on crumbling sandstone.

Somewhat rare; very rare in fruit.

2. On crumbling sand rock, Tunbridge Wells, *Dr. Spruce*; Ardingley Rocks, Sussex, *G. Davies*. 7. Tyn-y-Groes, Merioneth, *Wild & Holt*. 8. Stirrup Wood, Derbyshire, *G. A. Holt*. 9. Carrington Moss, Cheshire, *G. A. Holt*; Clifton Junction, Lanc., *C. J. Wild*. 12, 13. Burmurray, Balmaclellan, New Galloway, *J. McAndrew*. 16. Glen Finnan, *Dr. Carrington*; Moidart, *S. M. Macvicar*. I. Co. Mayo, *D. Moore*.

Found on the Continent, North America; also on the Andes of South America, *Dr. Spruce*.

Obs.—Differs from *Cephalozia (O.) Sphagni* (Dicks.) in its intricately branched leafless caudex, branches usually erect, attenuate, gemmiparous; leaves never secund, destitute of any distinct margin, epidermis verruculose, abundant presence of stipules everywhere.

Ceph. (O.) Sphagni (Dicks.) has stems often repeatedly arcuately branched, which are equally leaved throughout, often secund, with a distinct margin, stipules absent or few and extremely minute.

“*Ceph. (O.) denudata* is usually found growing on rotting wood or crumbling sandstone; *Ceph. (O.) Sphagni* on living *Sphagna* and other bog mosses.” R. S.

DESCRIPTION OF PLATE LXVI.—Fig. 1. Plants natural size. 2. Portion of stem (after Hooker). 3. Portion of stem, antical view $\times 24$ (Sweden, S. O. Lindberg, also the following). 4–9. Leaves $\times 24$. 10. Portion of leaf $\times 290$. 11–15. Stipules $\times 24$. 16–20. Sub-bracts $\times 24$. 21. Sub-bracteole $\times 24$. 22. Bract $\times 24$. 23. Bracteole $\times 24$. 24. Perianth $\times 24$. 25. Cross-section of perianth near the base $\times 24$. 26. Ditto, near the middle. 27. Ditto, near the apex.

Subgenus 3. *CEPHALOZIELLA*, *Spruce*.

Plants small or minute, often creeping amongst mosses or other hepatics, or densely cæspitose, sublurid. Stem for the size of the plant very often firm, generally at the base subrhizomatous, but flagella wanting; cortical cells 10–20, hardly different from the interior. Lower leaves distant subobliquely inserted (succubous); upper more crowded, or almost exactly transverse, the length (1–15 mm.) rarely exceeding the breadth of the stem, very often cuneate, to the middle or more bifid, carinate, segments subcomplicate or divergent, entire or in one species subdenticulate, rarely spinulose; cells small-minute (diam. $\frac{1}{50}$ – $\frac{1}{70}$ mm.) subquadrate or guttulate. Stipules very variable, sometimes in one and the same species everywhere present, now altogether obsolete; always (where present) small, narrow, entire or bifid. Inflorescence for the most part dioicous, in few monoicous; ♀ very often terminal on the chief stem, in other species cladogenous, or in various places. Bracts moderately large 3-pairs (or more) bilobed, tristichous, very often with the bracteole highly connate, lobes generally denticulate or spinulose. Perianth for the most part elongate and narrow, leptodermous, acutely prismatic, keels rarely reduced to 3, sometimes 3, 4, 5, and also 6 in the same species, mouth denticulate or ciliolate, rarely submuticous. Calyptra delicate. Capsule oblong-globose. Andrœcia in the middle or at the end of the chief stem or elongated branches, bracts not smaller than the leaves, very rarely produced on slender postical branches.

14. *Cephalozia divaricata* (Smith), Dum.

Jungermania divaricata, Sm. Eng. Bot. t. 719 (a. 1800) et t. 2463.

Jungermania byssacea, Roth. Tent. fl. Germ. i. p. 387 (1800); Hooker. Brit. Jung. t. 12 (1816), &c.

Jungermania confervoides, Raddi in Act. soc. Modena, p. 29, t. 4, f. 1. (1818).

Jungermania Starkii, Herb. Funck. Nees Nat. Eur. Leb. 11, 225 (1836).

Cephalozia divaricata (Sm.) Dum. Recueil (1835).

Dioicous, densely caespitose or creeping amongst mosses, flagelliferous, small, colour very various, namely, green, olive, sometimes reddish, rarely whitish or almost black. Stems prostrate or suberect, firm, 6–8 cells in diameter, cortical cells 14–20 scarcely different from the inner; simple or slightly branched; radiculose, rootlets white. Leaves small, distant on sterile stems, on fertile very often subimbricate, accrescent, subsuccubous or almost transverse, cuneate or rotund-quadrate, nearly to the middle bifid (rarely a little more), segments complicate or divergent, ovate triangular acute or subacuminate, rarely obtuse, entire, rarely with one or two teeth; cells from minute to small, subquadrate, leptodermous, pellucid or subopaque, walls firm, no trigones or thickened angles. Stipules lanceolate or ligulate, lower ones minute, entire, upper larger, apex often bifid (rarely trifid), sometimes wanting altogether or only present near the flowers. Flowers ♀ terminal on chief stem or elongated branches (rarely on short ones); bracts 3 pairs, tristichous, larger than the leaves, innermost sometimes more or less connate, rotund-quadrate, bilobed, segments acute, denticulate or subspinose; bracteole adnate to bract or free, ovate-quadrate, bilobed, rather smaller than the bracts. Perianth linear or narrowly fusiform, composed of one layer of cells, often bicolour, towards the base purple, apex white prismatic, with very rarely only 3 angles, usually 4, 5 or 6; mouth subconstricted, denticulate or subentire. Calyptra smaller, delicate. Pistillidia about 12. Capsule oblong-globose. Androecia on proper stems, variously situated on stem or branch, perigonial bracts several pairs, subimbricate, equal, incurvo-concave, bilobed, segments somewhat acute; antheridia single, oval.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, .05 to .07 mm. in diameter, with leaves .2 mm. wide; leaves .15 mm. \times .15 mm., seg. .075 mm., .175 mm. \times .175 mm., seg. .1 mm., .2 mm. \times .15 mm., seg. .075 mm.; cells .02 mm. \times .02 mm., .0225 mm. \times .0225 mm., .02 mm. \times .03 mm.; stipules .15 mm. \times .075 mm., .125 mm. \times .075 mm.; sub-bract .275 mm. \times .3 mm., seg. .1 mm.; sub-bracteole .175 mm. \times .125 mm., seg. .075 mm.; bracts .35 mm. \times .4 mm., seg. .225 mm., .5 mm. \times .5 mm., seg. .175 mm.; bracteole .225 mm. \times .15 mm., seg. .075 mm.; perianth .75 mm. \times .25 mm., .8 mm. \times .4 mm., 1 mm. \times .5 mm.; pistillidia .15 mm. \times .05 mm.; valve of capsule .325 mm. \times .125 mm.; antheridia .1 mm. \times .075 mm.

HAB.—Growing on somewhat damp rocks, stones, earth or rotting wood, exposed or shaded; on heaths, or creeping upon other hepatics or on mosses. Very common.

1 to 17. I.

Europe, Asia and North America.

Obs.—A common and variable species, which has stipules always near the bracts, but on other parts of the stems sometimes without and sometimes with. The type with stipules has been considered a distinct species (*Cephalozia Starkii*, Funck), but agreeing with Dr. Spruce, I find no other characters of sufficient value to make it worthy of specific rank.

C. divaricata is a small species with wiry stems distinguished from its nearest allies *Ceph. Jackii*, Limpr. and *Ceph. stellulifera* (Tayl.) by its dioicous inflorescence. -

Ceph. leucantha, Spruce, which is also dioicous, is of a much paler colour, stems more fragile, leaves more oblong, with segments parallel or connivent, not divergent, stipules always absent.

DESCRIPTION OF PLATE LXVII.—Fig. 1. Plants natural size. 2. Portion of sterile stem \times 85 (Sussex, E. N. Bloomfield). 3–5. Leaves \times 85 (Warmbrunn, Hb. Nees). 6–8. Ditto \times 85 (Glen Finnan, Dr. Carrington). 9, 10. Ditto \times 85 (Stockholm, S. O. Lindberg). 11. Ditto \times 85 (Altona, Dr. Gottsche). 12. Portion of leaf \times 290 (ditto). 13–15. Stipules \times 85 (ditto).

16. Sub-bract $\times 85$ (ditto). 17. Sub-bracteole $\times 85$ (Blankenberg, Hampe). 18. Bract $\times 85$ (Warnsbrunn, Hb. Nees). 19. Bracteole $\times 85$ (ditto). 20. Perianth $\times 64$ (Altona, Dr. Gottsche). 21. Mouth of perianth $\times 85$ (Alliers, Du Buysson). 22. Antheridium $\times 85$ (Llangollen, W. Wilson).

15. **Cephalozia stellulifera** (Tayl. MSS.)

Jungermania stellulifera, Tayl. MSS., G.L.N. Syn. Hep. p. 134 (1844).

Jungermania Starkii, var. *procerior*, Nees G. & R. Hep. Eur. n. 625.

Cephalozia divaricata (Sm.), var. *stellulifera*, Spruce, On Ceph. (1882).

Monoicous, acrocarpous or cladocarpous, densely caespitose, eflagelliferous, small, pale green or subolive to reddish-brown. Stems creeping or suberect, simple or slightly branched, flexuose, firm, sometimes thick and fleshy, cortical cells 15–25, similar to the inner, sometimes brown, sometimes hyaline 8–10 in diameter; radiculose, rootlets few, pellucid. Leaves distant or approximate, near the apex of fertile branches crowded, broader than the stem, patent-divergent, below concave-complicate or spreading, above widely spreading or almost squarrose, oval-quadrate, bifid to nearly the middle, sinus acute or obtusate, segments 5, 6 cells wide at the base, acute or obtusate, divergent or erect; cells small, 4-, 5- and 6-angled, subquadrate, walls firm, no trigones. Stipules distinct on some stems, lanceolate-acute, sometimes above (sub-bracteoles[?]), bifid, sometimes minute or wanting. Flowers ♀ on apex of main stem or on long or short branches. Bracts much larger than the stem leaves, ovate-quadrate, bifid to about $\frac{1}{3}$, sinus broad, acute or obtusate, segments narrowly triangular, acute, dentate; bracteole smaller than the bracts, oval or ovate, bifid to about $\frac{1}{4}$, or ovate-lanceolate and entire, margin dentate or denticulate; sub-bracts somewhat similar to the leaves but larger, denticulate or quite entire; sub-bracteole bidentate or entire, margin denticulate or quite entire. Perianth projecting much beyond the bracts, large in proportion to the size of the plant, oblong, or elongate-fusiform, unistratose, trigonous, angles acute, mouth hyaline, scariose and indistinctly crenulate. Pistillidia about 10.

Calyptra obovate, of a delicate texture. Capsule spherical, dark brown. Spores brown, elaters paler than the spores. Andrœcia on long or short branches proceeding often from below the perianth, catkins long or short, perigonal bracts 4–8 pairs, closely imbricate, roundish-quadrate when explanate, bifid to about $\frac{1}{3}$, sinus and segments acute, margin quite entire or dentate, complicate-concave, ventricose; antheridium solitary, oval.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .08 mm. in diameter, with leaves .35 mm. wide; leaves .2 mm. \times .16 mm., segments .1 mm., .175 mm. \times .125 mm., seg. .075 mm., .175 mm. \times .15 mm., seg. .075 mm., .225 mm. \times .175 mm., seg. .075 mm.; upper leaves .3 mm. \times .25 mm., seg. .125 mm.; cells .02 mm., .025 mm., .0175 mm.; sub-bracteole .2 mm. \times .14 mm.; bracts .425 mm. \times .325 mm., seg. .175 mm., .4 mm. \times .35 mm., seg. .15 mm.; bracteole .25 mm. \times .15 mm., seg. .1 mm., .075 mm., .325 mm. \times .2 mm.; perianth .8 mm. \times .3 mm., .9 mm. \times .35 mm.; pistillidia .1 mm. \times .04 mm.; spores .01 mm.; elaters .13 mm. \times .01 mm.; perigonal bracts .21 mm. \times .21 mm., seg. .075 mm.; antheridia .15 mm. \times .1 mm.

HAB.—On hedge banks, rocks and stones, rarely on rotting wood. Rare. 1. Hedge banks near Redruth, Cornwall, 1871, The Lizard, Cornwall 1883, *W. Curnow*. 5. ? 8. Crich, Derbyshire, *W. Wilson*, 1833. 12. Westmorland, *G. Stabler*; on dead trees, Rigmaden Park, Westmorland, *Peter Dreesen*. 15. Scottish Highlands, *Drummond*.

Found on the Continent (Schwartzwasser, Sudetia, Hb. Nees, as *Jug. Starkii*, var. *minima*).

OBS.—Differs from *C. dicaricata* (Sm.) in its monoicous inflorescence, leaves often very widely spreading, at the immature flower ends squarrose (hence I suppose Taylor's name), perianth always trigonous (not 4–6-angled), angles acute.

In the original specimens from Crich the perigonal bracts are dentate, in those from Cornwall and elsewhere they are quite entire.

DESCRIPTION OF PLATE LXVIII.—Fig. 1. Plants natural size.

2. Portion of fertile plant $\times 64$ (Cornwall, Curnow). 3. Portion of branch, postical view $\times 31$ (ditto). 4-8. Leaves $\times 85$ (ditto). 9. Leaf $\times 85$ (Westmorland, P. Dreesen). 10. Ditto $\times 85$ (Scotland, Drummond). 11-14. Leaves $\times 64$ (Crich, Wilson). 15. Upper leaf $\times 64$ (Cornwall, Curnow). 16. Portion of leaf $\times 290$ (ditto). 17, 18. Stipules $\times 64$ (ditto). 19. Subbracteole $\times 85$ (Scotland, Drummond). 20, 21. Bracts $\times 85$ (Crich, Wilson). 22. Bracteole $\times 85$ (Cornwall, Curnow). 23. Perigonal bract $\times 64$ (ditto). 24. Antheridium $\times 64$ (ditto).

16. *Cephalozia æraria*, Pearson.

Cephalozia æraria, Pears., Spruce, On Ceph. (1882).

Dioicous, cladocarpous, densely depressed cæspitose, eflagelliferous, minute, tawny or pale brown colour. Stems flexuose, extremely fine, rootlets closely intertwined, moderately strong, sparingly branched, branches subhyaline, foliose; cells of the stem 8 in diameter, cortical ones 10-15, slightly larger than the inner. Leaves dissituous-squarrose, almost patent, minute, subcuneate, obscurely carinate, deeply (to $\frac{3}{4}$ ths) bilobed, subentire, sinus acute or obtuse, segments ovate or lanceolate, at the base 2-4 cells broad, sub-acuminate, apical cell single, conical (twice as long as broad), very often incurved, apiculate; cells minute, oblong, pellucid, distinctly guttulate, walls at the angles thickened, epidermis rough. Stipules variable, lower ones often minute or obsolete, upper ones about half the length of the leaves, lanceolate, sometimes connate to the nearest leaf, forming a three-lobed one, the largest rarely bilobed and scarcely smaller than the leaves. Fertile branches very short; bracts 3 pairs, nearly twice as long as the leaves, in sterile flowers free, a little more than to the middle bilobed, lobes ovate, acuminate. Further organs not yet known.

DIMENSIONS.—Stems $\frac{1}{4}$ inch long, .05 mm. in diameter, with leaves .25 mm. wide; leaves .125 mm. \times .075 mm., segments .06 mm., .15 mm. \times .1 mm., seg. .1 mm., .175 mm. \times .1 mm., seg.

·075 mm., ·125–·15 mm. × ·125 mm.; cells ·015 mm., ·015 mm. × ·0175 mm., ·02 mm. × ·0175 mm., ·01 mm. × ·0125 mm., ·0125 mm. × 015 mm.; apical cell ·02 mm. × ·01 mm.; stipules ·1 mm. × ·02 mm. at base, ·1 mm. × ·03 mm., ·075 mm. × ·025 mm.; bracts ·2 mm. × ·125 mm., seg. ·075 mm., ·1 mm., ·25 mm. × ·15 mm.; bracteole ·1 mm. × ·06 mm., seg. ·04 mm.

HAB.—7. At the mouth and on the roof of an old copper mine between Dolgelly and Tyn-y-Groes, Merionethshire, *W. H. Pearson*, April 1877. Rhaidir Dhu, Tyn-y-Groes, *G. A. Holt*, July 1882. Mouth of copper mine, near Pistyl Cain, Tyn-y-Groes, *C. J. Wild*, July 1882. Extremely rare.

Obs.—“*Ceph. Macounii*, Aust., comes near to it, but is of a green colour, stems slender and much branched, leaves subimbricate, sinus sometimes lunate, apices of lobes not unguiculate, cells subquadrate, stipules none. *Ceph. divaricata* (Sm.) certainly distinct, flowers acrogenous; leaves distinctly carinate, rarely more than to the $\frac{1}{2}$ divided, exunguiculate, cells quadrate, reticulate (not guttulate). It differs essentially from *C. divaricata* in being still more minute, in the deeply bifid leaves whose narrow segments end in a clawlike apiculus, the guttulate areolation and especially in the cladogenous inflorescence which brings it near to *C. Macounii*.”—R. Spruce.

DESCRIPTION OF PLATE LXIX.—Fig. 1. Plants natural size. 2. Portion of stem × 85. 3–14. Leaves × 85. 15. Leaf with connate stipule × 85. 16. Portion of leaf × 290. 17–23. Stipules × 85. 24, 25. Bracts × 85. 26. Bracteole × 85 (Tyn-y-Groes, W. H. P., April 1877).

17. *Cephalozia Jackii*, *Limpricht MSS.*

Cephalozia Jackii, Limpr., MSS. Spruce, On Cephalozia, p. 67 (1882).

Paroicous, cæspitose, eflagelliferous, small, size of *Ceph. divaricata*, acro- and cladocarpous, pale green to reddish-green, with the flowering apices often purplish. Stems short, fragile, simple or with few branches, prostrate, radiculose, ends ascending, some branches elongate, with minute leaves. Lower leaves, chiefly

of the sterile branches, distant, minute, cuneate, upper near the ♀ flowers imbricate, cuneate-quadrate or subrotund, all subcarinate, almost or even to the middle acute bilobed, segments ovate-triangular, acute; cells very small to small, quadrate to subelongate, 4-, 5- and 6-sided, angles thickened, no trigones. Stipules half the size of the leaves, lower ones linear or lanceolate, upper ones ovate-lanceolate, rarely divided at the apex. Involucre ovate-juliform. Bracts 3–5 pairs, larger than the leaves, oblong-orbiculate, concave, less deeply bilobed, more or less denticulate, enclosing single antheridium, which is oval, the innermost bracts highly connate, forming with the smaller bracteole (with which both bracts are connate) a cuplike receptacle. Perianth twice as long as the bracts, projecting above half its length beyond them, oblong or ovate-oblong, obtusely 4–5-angled (very rarely trigonous), composed of a single layer of cells, about 80 round, near the middle, mouth scarious, truncate, repand, afterwards variously divided. Capsule oblong.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .1 to .15 mm. in diameter, with leaves .5 mm. wide; lower leaves .1 mm. \times .1 mm., .15 mm. \times .12 mm.; upper leaves .275 mm. \times .225 mm., segments .15 mm., .225 mm. \times .175 mm., seg. .1 mm., .3 mm. \times .275 mm., seg. .15 mm.; cells .02 mm., .015 mm. \times .0125 mm., .0175 mm. \times .0175 mm., .015 mm. \times .015 mm., .02 mm. \times .0175 mm.; stipules .15 mm. \times .075 mm., .175 mm. \times .06 mm.; sub-bracts .3 mm. \times .3 mm., seg. .1 mm., .3 mm. \times .25 mm., .35 mm. \times .325 mm., seg. .125 mm., .4 mm. \times .4 mm., seg. .175 mm.; sub-bracteole .225 mm. \times .15 mm.; bracts .4 mm. \times .3 mm., .55 mm. \times .425 mm., seg. .175 mm.; bracteole .4 mm. \times .175 mm.; antheridia .15 mm. \times .1 mm.; perianth 1.25 mm. \times .5 mm., .7 mm. \times .25 mm.

HAB.—On sandy paths or banks. Very rare.

1. Hayle, W. Cornwall, *W. Curnow*, April 1842, June 1883.
 9. "Four miles from Warrington, Cheshire, towards High Leigh, April 1841, *W. Wilson*, as *Jung. byssacea* (fruit)." *W. Wilson* in litt. ad R. Spruce. 12. Whitbarrow, *G. Stabler*.

Found on the Continent (Germany).

Obs.—Distinguished from *Ceph. divaricata* (Sm.) by its paroicous inflorescence, bracts more highly connate, entire bracteole, not bifid or ever free; remarkable at first sight by its swollen involucre.

DESCRIPTION OF PLATE LXX.—Fig. 1. Plants natural size. 2. Fertile stem with perianth $\times 24$ (nr. Warrington, W. Wilson). 3–5. Leaves $\times 85$ (ditto). 6. Leaf $\times 64$ (Custrin, Germany, Flotow, Hb. Limpricht). 7. Portion of leaf $\times 290$ (nr. Warrington, W. Wilson). 8, 9. Stipules $\times 85$ (ditto). 10. Sub-bract $\times 64$ (Custrin, Flotow). 11. 1st sub-bract $\times 64$ (nr. Warrington, W. Wilson). 12. 2nd sub-bract $\times 64$ (ditto). 13. 3rd sub-bract $\times 64$ (ditto). 14. Sub-bracteole $\times 64$ (Custrin, Flotow). 15. Antheridium $\times 85$ (ditto). 16. Bracts $\times 84$ (nr. Warrington, W. Wilson). 17. Cross-section of perianth near the base $\times 24$ (Cornwall, Curnow). 18. Ditto, near the middle (ditto).

18. *Cephalozia elachista* (Jack.), Lindb.

Jungermania elachista, Jack. in G. & R. Hep. Eur. no. 574 (1873); Limpr. Krypt. Schl. 1. p. 296 (1876).

Cephalozia elachista, Lindb. Hep. in Hib. p. 502 (1874); Spruce, On Cephalozia, p. 70 (1882).

Monoicous, clado- or acrocarpous, laxly cæspitose, small, pale green. Stem rooting at the base, rootlets few, distant, very delicate, prostrate, subaphyllous, with few branches. Leaves distant, subimbricate only towards the apices of the fertile branches; oval, deeply acutely bilobed, segments broadly subulate, acuminate, incurved, entire or furnished with one or two teeth; cells small, subquadrate or elongate, pellucid, sub-leptodermous, walls thin, no thickened angles or trigones. Stipules minute, entire or bifid, acuminate, sometimes wanting. Branches ♀ short or elongate, often innovantly proliferous; bracts much larger than the leaves, partly free, deeply bilobed, denticulate or subspinulose; segments finely acuminate. Bracteole similar. Perianth elongate, trigonous-

prismatic, mouth slightly denticulate, teeth few, incurved. Capsule oval. Spores and elaters reddish-brown, elatere bispiral. Amenta 3, terminal on stem or occupying almost the whole branch; perigonial bracts narrowly oval, deeply bilobed, denticulate, segments acuminate, above second; perigonial bracteole oblong, bifid, segments acute; antheridia small, oval.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diameter .02 mm., .03 mm.; leaves .175 mm. \times .125 mm., seg. .1 mm., .15 mm. \times .125 mm., seg. .11 mm., .135 mm. \times .11 mm., seg. .115 mm., .15 mm. \times .1 mm., seg. .06 mm.; cells .025 mm. \times .02 mm., .035 mm. \times .015 mm., .025 mm. \times .02 mm., .02 mm. \times .02 mm., .02 mm. \times .0175 mm.; stipules .13 mm. \times .05 mm., .1 mm. \times .03 mm., seg. .04; bracts .35 mm. \times .25 mm., seg. .2 mm.; perianth 1 mm. \times .4 mm., 1.3 mm. \times .3 mm., 1.5 mm. \times .4 mm.; perigonial bracts .2 mm. \times .175 mm., seg. .15 mm.; perigonial bracteoles .125 mm. \times .075 mm., seg. .05 mm.; antheridia .1 mm. \times .075 mm.; elaters .15 mm. \times .01 mm.

HAB.—Growing on damp rocks, I., near Lough Bray, *S. O. Lindberg*, 1873. Brandon Mt., &c., *D. Moore*.

Extremely rare.

Found on the Continent; Baden, *Jack*. Finland, *S. O. Lindberg*. Norway, *Bryhn*.

OBS.—Distinguished from all forms of *C. divaricata* (Sm.), and from *C. Jackii*, Limpr. by its monoicous inflorescence; it is remarkable for its very slender habit, distant, deeply bilobed leaves, which are either entire or slightly denticulate.

DESCRIPTION OF PLATE LXII.—Fig. 1. Plants natural size. 2, 3. Portions of stem \times 85. 4–9. Leaves \times 85. 10. Portion of leaf \times 290. 11, 12. Stipules \times 85. 13. Bract \times 85. 14–16. Segments of bracts \times 85. 17. Perianth \times 24. 18. Perigonial bract \times 85. 19. Perigonial bracteole \times 85. 20. Antheridium \times 85. (G. & R. Hep. Eur. no. 274, Salem, Baden, Germany, *Jack*.)

19. *Cephalozia leucantha*, Spruce.

Cephalozia leucantha, Spruce, On *Cephalozia*, p. 68 (1882).

Dioicous, almost always cladocarpous, sometimes acrocarpous, cæspitose, eflagelliferous, albescent, small, size of *Ceph. divaricata* (Sm.). Stems prostrate, with ♂ and ♀ often intricately entangled, slender, fragile, elongate, flexuose, simple or subramose, radiculose. Leaves small, distant, patulous or assurgent, oblong or quadrate-rotund, bifid to about the middle or more, sinus acute or obtuse, segments often unequal, broadly subulate (3-4 cells broad at the base), acute or subacuminate, parallel or connivent; cells very small, subquadrate, lower ones slightly elongate, walls firm, no trigones or thickened angles. Stipules wanting. Bracts 3 or 4 times larger than the lower leaves, more or less connate, orbiculate, subdenticulate, 2-3-lobed, segments short, acuminate. Perianth large for the size of the plant, 10 times longer than the lower leaves, ovate-lanceolate-fusiform or sublinear, white, leptodermous, above 3- (rarely 4-) angled, composed of a single layer of very small cells, about 100 round near the middle, mouth minute, often obsoletely setulose. Calyptra delicate. Capsule large, often equal to half the size of the perianth, oblong-cylindrical, badius. Andrœcia short, rarely occupying the whole of the branch, terminal or medial, julaceous; perigonial bracts closely imbricate, orbiculate, very concave, carinate, to a third or more bi-trilobed, monandrous; bracteole minute, linear-subulate; antheridia small, oval.

Fruits Spring and Autumn.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .075 mm. to .1 mm. in diameter, with leaves .2 mm. wide; leaves .2 mm. \times .13 mm., .125 mm. \times .15 mm., segments .075 mm., .06 mm., .175 mm. \times .175 mm., seg. .075 mm., .15 mm. \times .175 mm., seg. .075 mm., .2 mm. \times .25 mm., seg. .15 mm., .125 mm., .225 mm. \times .2 mm., seg. .125 mm., .075 mm.; upper leaves .275 mm. \times .25 mm., seg. .125 mm., .175 mm.; cells .0167 mm., .015 mm. \times .0175 mm., .02 mm. \times .02 mm., .015 mm. \times .015 mm., .0225 mm. \times .02 mm.; sub-bracts .3 mm. \times .25 mm., seg. .15 mm., .4 mm. \times .4 mm., seg.

·2 mm.; bracts ·75 mm., ·4 mm. × ·4 mm., seg. ·15 mm., ·35 mm. × ·3 mm., seg. ·15 mm.; bracteole ·45 mm. × ·25 mm.; perianth 2· mm. × ·5 mm., 1·25 mm. × ·35 mm.; pistillidia ·075 mm. × ·025 mm.; valve of capsule ·5 mm. × ·175 mm.; perigonial bracts ·25 mm., ·2 mm. × 2 mm., seg. ·125 mm.; antheridia ·075 mm. × ·06 mm.

HAB.—On rotting wood, in very fine fruit. 15. Portach, near Banchory, Aberdeenshire, along with *Ceph. catenulata* (Hüb.) and *Ceph. curvifolia* (Dicks.), *J. Sim.* Extremely rare.

Found on the Continent.

OBS.—*Ceph. catenulata* (Hüb.) is very different in its larger size and fulvous colour to *C. leucaantha*, leaves subimbricate, broader and more concave, when dry incurved and catenulate, cells larger, but chiefly by the deeply triplicate perianth, with mouth distinctly ciliate. *C. leucaantha* is also certainly very distinct from *Ceph. lunulifolia*, Dum., which has larger, rhomboid-rotund decurrent leaves, divided only to a third, sinus more or less lunate, cells larger; perianth (in comparison with the leaves) much shorter and like the calyptra fleshy (composed of several layers of cells), &c. &c. “R. S.”

DESCRIPTION OF PLATE LXXII.—Fig. 1. Plants natural size. 2. Portion of sterile stem × 64. 3–7. Leaves × 85. 8, 9. Upper stem leaves × 85. 10. Portion of leaf × 290. 11–13. Sub-bracts × 85. 14, 15. Bracts × 85. 16. Bracteole (?) × 85. 17. Pistillidium × 85. 18. Perianth × 31. 19. Cross-section of perianth × 31. 20, 21. Perigonial bracts × 85. 22. Antheridium × 85 (Portach, *J. Sim.*).

20. *Cephalozia dentata* (*Raddi*), *Lindb.*

Jungermania dentata, Raddi in Mem. della Soc. Ital. di Modena, xix. p. 32, tab. 4, Fig. 4 (1818).

Anthelia dentata, Dum. Hep. Eur. p. 99 (1874).

Cephalozia dentata (Raddi), Lindb. in Journ. Linn. Soc. xiii. (1872); Spruce, On Cephalozia, p. 71 (1882).

Monoicous, densely depresso-caespitose, eflagelliferous, minute, pale green when young, when older dark green to brown in colour.

Stems creeping, simple or with one, rarely two postical branches, proceeding from near the apex, 5 to 6 cells in diameter, cortical cells about 12, similar to inner, all hyaline; radiculose, rootlets plentiful, long, hyaline. Leaves subtransversely inserted, patent-divergent below 60° – 70° , above patent to erecto-patent 50° – 30° , approximate, larger, accrescent above, often capitate, below distant and smaller, oval, ovate-quadrate or roundish, concave or slightly complicate, bilobed to the middle or below, segments subincurved, acute, acuminate or mucronate, margin irregularly spinulose-dentate, or subdenticulate; texture delicate, epidermis smooth, cells minute to small, subquadrate, walls thin but firm, no trigones or thickened angles. Stipules everywhere present, minute below, lanceolate or subulate, mucronate, spinulose-dentate or denticulate. Bracts larger than the leaves, bilobed to a third, segments subspinose-dentate; bracteole of equal length, broadly subulate or ovate-lanceolate, entire or bilobed to $\frac{1}{3}$. Perianth projecting $\frac{2}{3}$ beyond the bracts, delicate, hyaline or with a reddish tinge or brown, subcylindrical, plicate above, mouth slightly or not at all contracted, denticulate; pistillidia few. Capsule dark brown, nearly smooth, as broad as the dark brown elaters. Andrœcia produced from the end of the chief stem on one or two very slender branches, catkinlike; perigonial bracts several, larger than the stem leaves, erect, concave, bilobed to about a third; antheridia large and round.

Fruits April.

DIMENSIONS.—Stem $\frac{1}{4}$ inch long, .05 mm. diam., with leaves .3 mm. wide; stem leaves .25 mm. \times .225 mm., segments .125 mm.; branch leaves .165 mm. \times .125 mm., seg. .1 mm., cells .0175 mm.; cells of marginal teeth .03 mm. \times .01 mm.; stipules .14 mm. \times .05 mm.

HAB.—On damp shady earth or rocks. Extremely rare.

1. Curbis Bay, near Penzance, *W. Mitten*, *W. Curnow*, *G. E. Davies*, *Mrs. Ella M. Tindall*. 2. Ashdown Forest, Sussex, coll. *G. E. Davies*, detected by *W. Mitten*.

Found on the Continent (Italy, France, Germany).

OBS.—Distinguished from *Ceph. elachista* (Jack.) by its less

slender habit, shorter stems, with closer upper leaves, which are not so deeply divided, margin spinulose-dentate, stipules larger and spinulose-denticulate.

From *Prionolobus Turneri* (Hook.) by absence of any lateral branches, presence of stipules and texture of leaves, which is not guttulate.

Dr. Spruce conjectured that the inflorescence might be dioicous, but Herr Limpricht has found copiously fertile plants which prove it to be monoicous.

All the specimens I have been able to examine were barren; the description of the fertile plant is taken from Limpricht.

DESCRIPTION OF PLATE LXXIII.—Fig. 1. Plants natural size. 2. Portion of stem, postical view $\times 85$ (Cornwall, Curnow and Davies). 3-5. Branch leaves $\times 85$ (ditto). 6-8. Leaves $\times 85$ (ditto). 9-12. Ditto $\times 64$ (Italy, Carestia). 13, 14. Ditto $\times 64$ (Gascony, Spruce). 15. Portion of leaf $\times 290$ (Cornwall, Curnow and Davies). 16-19. Stipules $\times 85$ (ditto). 20. Stipule $\times 64$ (Italy, Carestia). 21. Ditto $\times 64$ (Gascony, Spruce). 22. Ditto $\times 85$ (Ashdown Forest, G. E. Davies).

Genus 15. PRIONOLOBUS, *Spruce*.

Jungermania, Hooker, Brit. Jung. t. 29 (1816).

Anthelia, Dum. Recueil, p. 18 (1835).

Cephalozia, Lindb. in Journ. Linn. Soc. viii. (1873).

Prionolobus, Spruce, Hep. Am. et And. p. 508 (1885).

Acrocarpous, fertile branches sometimes abbreviate, often elongate. Branches all lateral, very rarely with an occasional postical one. Leaves dentate, complicate, pectinato-distichous.

Prionolobus Turneri (*Hook.*), *Spruce.*

Jungermania Turneri, Hook. Brit. Jung. t. 29 (1816).

Anthelia Turneri, Dum. Recueil, p. 18 (1835).

Cephalozia Turneri, Lindb. in Journ. Linn. Soc. xiii. (1873); Spruce, On Cephalozia, p. 71 (1882).

Prionolobus Turneri, Spruce, Hep. Am. et And. p. 508 (1885).

Monoicous and dioicous, acro- (rarely clado-) carpous, depresso-cæspitose, eflagelliferous, small, fragile, pale reddish colour, at the apices greenish. Stems prostrate at the base, subradiculose, assurgent, subramose, branches lateral, rarely postical, polyphyllous, terete. Cells of the stem pluristratose, very delicate, interior opaque, cortical similar, slightly larger, subpellucid. Leaves pectinate-distichous, close and equitant, to about the middle or more complicate-bilobed, the whole margin irregularly acutely dentate-serrate, often doubly so, lobes ovate or ovate-lanceolate, acute or apiculate, antical lobe erect and subparallel with the stem, postical (a little broader), patent at an angle of about 60° , cells small to minute, quadrate-hexagonal, plane, beautifully guttulate, walls and angles strongly thickened, no trigones, slightly endochronic. Stipules none. Flowers ♀ terminal, often on elongated branches, innovations wanting. Bracts 1-3 pairs, the innermost almost twice the size of the leaves, connate at the antical base, spinose-dentate, bilobed, lobes subacuminate, acute; bracteole highly connate with the adjoining bract, ovate, subacuminate, entire or bilobed, spinose-dentate. (Leaves next to the outer bracts a little larger than the others, free at the base, no folioles added.) Perianth projecting much beyond the bracts, delicate, composed of a single layer of cells, about 90 round the middle (except at the base and the angles, where there are sometimes two layers) linear (at the base a little narrow), pentagonal-prismatic, keels somewhat high, apex rotundate, mouth almost closed, obscurely ciliolate, ciliola very narrow, long, hyaline. Calyptra delicate. Capsule oval. Andrœcia on the same or often on different stems, occupying the middle of the branch; perigonial bracts assurgent, several pairs, somewhat similar to the leaves, sometimes larger; antheridia single, oval.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .06 mm. diam. with leaves .4 mm. wide; leaves .25 mm. \times .2 mm., segments .125 mm. to .15 mm.; cells .015 mm. to .03 mm.; bracts .45 mm. \times .7 mm., seg. .3 mm.; perianth 1.25 mm. \times .275 mm.; teeth at the mouth .02 mm. long; perigonal bracts .25 mm. \times .2 mm., seg. .075 mm. to .15 mm.; antheridia .09 mm. \times .07 mm.

HAB.—“Sandy or loamy situations, under shade of bushes or on ditch banks, nearly always associated with *Atrichum undulatum*, *Diplophyllum albicans*, and sometimes with *Nardia scalaris* and *Marsipella Funckii*.”

Very rare.

2. Tilgate and Ashdown Forest, Sussex, *E. Jenner*, 1842, *G. E. Davies*, 1879. 5. Wolford Wood, Warwick, *J. E. Bagnall*, 1891. 7. Dolgelly, Merioneth, *W. H. P.*, 1875.

I. By the side of a mountain rivulet near Bantry, Co. Cork, *Miss Hutchins*, with female flowers, in March 1811? On a wet sandy bank, Cromaglow, Co. Kerry, bearing autoicous perianths, July 23, 1873, *Prof. Lindberg*.

C. On a gravelly bank near the sea, Guernsey, *E. D. Marquand*, 1893.

Found on the Continent (France), Canary Islands, Northern Africa, and coast counties of California, North America.

Obs.—A very beautiful species, remarkable for its guttulate texture and dentate-serrate leaves.

Distinguished from *Cephalozia dentata* (Raddi) by its lateral branches and absence of stipules.

Although described by Spruce (whose description I follow) and others as polyoicous (monoicous and dioicous) I have never met with any but dioicous plants, the ♂ and ♀ sometimes growing entangled together, but on separate plants.

DESCRIPTION OF PLATE LXXIV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 85. 3, 4. Leaves \times 85. 5, 6. Ditto, explanate \times 85. 7. Antical lobe of leaf \times 85. 8. Postical lobe of leaf \times 85. 9. Portion of leaf \times 290. 10, 11. Bracts \times 64. 12. Perianth \times 31. 13. Cross-section of perianth \times 31.

14. Portion of mouth of perianth \times 85. 15, 16. Perigonal bracts \times 85. 17. Antheridium \times 85 (Killarney, S. O. Lindberg).

Genus 16. **PLEUROCLADA**, *Spruce*.

Jungermania, Hook. Brit. Jung. t. 72 (1816).

Cephalozia, Dum. Recueil, p. 18 (1835).

Pleuroclada, Spruce, On Cephalozia, p. 78 (1882).

Differs from its ally *Hygrobiella* by its glaucescent colour stems radiculose, all the length subæquifoliate, neither rhizomatous nor flagelliferous at the base, subpinnate; all branches lateral, at the base, near the stem-leaf difformed (monolobed); leaves very concave (hardly complicate); perianth very fleshy, below 8 cells thick, subfloral innovations wanting.

1. **Pleuroclada albescens** (*Hook.*), *Spruce*.

Jungermania albescens, Hook. Brit. Jung. t. 72 et suppl. t. 4 (1816).

Cephalozia albescens, Dum. Recueil, p. 18 (1835).

Pleuroclada albescens, Spruce, On Cephalozia, p. 78 (1882).

Dioicous, cæspitose, tufts depressed, eflagelliferous, small to medium in size, of a whitish or greenish colour, when dry with a bluish-white tinge. Stems procumbent, laxly subpinnate, sometimes subdichotomous, slightly radiculose, rooting up to apex of stem; firm oval-terete, composed of 5 concentric subequal layers of opaque cells, cortical about 25, slightly larger than the inner. Leaves somewhat distant or approximate, patulous, almost transversely inserted, slightly succubous, orbiculate, very concave, almost hemispherical, to about the third or a little more bilobed, segments ovate, triangular, connivent, acute, sinus narrow, acute or subobtuse; cells medium in size, quadrangle-hexagonal, 4-, 5- and 6-sided, thick but subleptodermous, almost smooth, slightly endochromic, subpellucid, walls firm, somewhat thick, angles only slightly thickened, no trigones. Axillary leaf produced partly from the stem and partly from the adnate branch, differs from the other leaves in being broadly ovate, subcordate at base, apex acute,

not bifid. Stipules subcontiguous, appressed, subplane, slightly shorter than the leaves, broadly ovate or ovate-lanceolate, acute or subacuminate, rarely obtuse, on one side above the base deeply unidentate, sometimes on both sides or wanting altogether. Flowers ♀ terminal on short or long branches; at the base, copiously radiculose. Bracts 3 pairs, appressed-convolute, subbracts a little larger than the leaves, bracts almost 3 times larger, free at the base or slightly connate, oblong-quadrate, bifid to the third, rarely trifid, segments subacuminate acute, bracteoles smaller, apex entire or bifid, on both sides near the base with 1-3 large teeth. Perianth highly exserted, 7 times longer than the stem leaves, clavate or linear-fusiform, deeply trigonous, mouth constricted, often scariose, afterwards lacerate and erose, texture firm, near the base 5-8 cells thick, near the middle 2-4 cells, at about $\frac{2}{3}$ high, 2 cells thick, near the apex composed of a single layer only; cells large, elongate, pellucid. Calyptra pyriform, delicate, only at the base 2 cells thick, where are situated about 8 sterile, somewhat short, lageniform pistillidia, upper portion 1 cell thick. Capsule 4-5 times smaller than the perianth, highly exserted, cylindrical-oblong; valves linear-lanceolate or oval, of a purplish-brown colour like the spores and elaters. Pedicel moderately thick, cells large, 4-5 times longer than broad, prismatic-cylindrical, cortical cells 8-9, inner of equal size. Elaters 4 times shorter than the capsule, filiform, obtuse at both ends, bispiral. Spores as broad as the elaters, globose, smooth. Androecia?

Fruits May, June.

DIMENSIONS.—Stem $\frac{1}{2}$ to 1 inch long, diameter .2 to .3 mm., with leaves 1 mm. wide; leaves explanate, .5 mm. × .5 mm., .65 mm. × .65 mm., .55 mm. × .65 mm., .3 mm. × .25 mm., segments .1 mm., .4 mm. × .35 mm., seg. .15 mm., .4 mm. × .35 mm., seg. .15 mm., .5 mm. × .45 mm., seg. .2 mm.; cells .025 mm. × .035 mm., .03 mm. × .03 mm., .03 mm. × .025 mm., .04 mm. × .025 mm., .033 mm.; stipules .6 mm. × .3 mm., .5 mm. × .38 mm., .55 mm. × .4 mm., .3 mm. × .175 mm., .5 mm. × .3 mm.; sub-bracts .6 mm. × .6 mm., seg. .2 mm., .75 mm. × .7 mm., 1 mm. × .7 mm., seg. .3 mm.; sub-bracteole .75 mm. × .6 mm.; bracts

1·3 mm. × ·9 mm., 1· mm. × ·8 mm., seg. ·3 mm.; bracteole 1· mm. × ·55 mm.; perianth 4· mm. × ·7–·85 mm.; pedicel 10·–15· mm.; capsule ·8 mm. × ·5 mm., valve ·7 mm. × ·275 mm.; spores ·0125 mm. diam.; elaters ·2–·25 mm. × ·0125 mm.

HAB.—On damp earth in alpine localities, rare.

15. Clova, *R. K. Greville*. Ben Mac Dhui, *G. E. Hunt, Thomas Rogers, G. Stabler*. Ben Lawers, *G. E. Hunt*. Head of Loch Avon, *A. Croall*. 16. Ben Nevis, *R. K. Greville*.

Found on the Continent and in North America.

Obs.—A very distinct species, and only found near the tops of the highest Scotch mountains; from any of the *Cephalozia* distinguished at once by the lateral branches; from *P. islandica* (Nees), see notes under that species.

DESCRIPTION OF PLATE LXXV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view × 16 (Clova, *R. K. Greville*). 3. Ditto, postical view × 24 (ditto). 4, 5. Leaves × 64 (Grimsel, *G. E. Davies*). 6. Portion of leaf × 290 (Clova, *Greville*). 7. Stipule × 64 (Grimsel, *Davies*). 8. Ditto × 85 (Clova, *Greville*). 9. 3rd sub-bract × 24 (Lapland, *Ångström*). 10. 2nd sub-bract × 24 (ditto). 11. Sub-bracteole × 24 (ditto). 12, 13. Bracts × 24 (ditto). 14. Bracteole × 24 (ditto). 15. Perianth × ? (*G. & R. Hep. Eur. n. 468*, drawn by *Dr. Gottsche*).

2. *Pleuroclada islandica* (*Nees*).

Jungermania islandica, *Nees Nat. Eur. Leb. 11, p. 29 (1836)*.

Cephalozia islandica, *Lindb. in Journ. Linn. Soc. xiii. p. 192 (1873)*.

Pleuroclada albescens, var. *islandica*, *Spruce, On Cephalozia, p. 79 (1882)*.

Dioicous, cæspitose, tufts depressed, eflagelliferous, small, pale green in colour, when dry with a bluish-white tinge. Stems simple or slightly branched, oval-terete, cortical cells about 20, similar to the inner, 8 cells in diameter; radiculose, rootlets few, white; branches lateral. Leaves imbricate, near the apex of stem approximate or somewhat distant below, patent to erecto-patent (40°), orbicular, complicate-concave, bifid to the middle or below, sinus obtuse, segments broadly lanceolate or triangular, acute,

connivent; texture somewhat thick, cells 4-, 5-, and 6-sided, smallish, walls thick, no trigones or thickened angles. Stipules large, as long as the leaves, ovate-lanceolate, entire. Flowers ♀ terminal on long branches. Bracts oblong or oblong-ovate, bifid to below the middle, segments lanceolate-acuminate, entire; bracteole free or aduate to one of the bracts, much smaller than the bracts, oblong-ovate or ovate, retuse, emarginate or entire; sub-bracts similar to the innermost, only smaller. Perianth projecting much beyond the bracts, linear or narrowly fusiform, cylindrical below, above deeply 4-5-plicate, folds obtuse, composed of a single layer of cells, near the middle about 80 cells round, mouth constricted, irregularly and slightly dentate. Calyptra delicate, composed of a single layer of cells. Fruit and male stems not yet known.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, diam. .175 to .2 mm., with leaves .5 to .75 mm. wide; leaves .3 mm. \times .25 mm., segments .125 mm., .275 mm. \times .25 mm., seg. .125 mm., .25 mm. \times .225 mm., seg. .15 mm., .4 mm. \times .3 mm., seg. .225 mm.; cells .02 mm. \times .025 mm., .0225 mm. \times .0225 mm., .03 mm. \times .025 mm., .02 mm. \times .02 mm.; stipules .3 mm. \times .125 mm., .35 mm. \times .15 mm., .25 mm. \times .1 mm., .275 mm. \times .15 mm.; sub-bracts .75 mm. \times .5 mm., seg. .4 mm., .9 mm. \times .45 mm., seg. .55 mm.; bracts 1. mm. \times .6 mm., seg. .6 mm.; perianth 2. mm. \times .5 mm., teeth at the mouth .04 mm.

HAB.—Moist rocks or earth in alpine situations. Extremely rare. 15. Loch-na-gar, Aberdeenshire, *J. Sim*, April 1878.

Found in Iceland, Northern Europe and Greenland.

OBS.—Differs from *P. albescens* (Hook.) in the more slender habit of the plant, closer, more erect leaves, which are usually narrower, with deeper sinus, much less concave, not hemispherical, but simply complicate-concave, stipules narrower with no basal tooth or teeth, bracts longer and narrower, deeply bifid to below the middle, segments lanceolate-acuminate, not to a third, with segments subacuminate-acute, bracteole retuse, emarginate or entire, with no basal teeth, perianth narrower, more plicate near the apex, composed of a single layer of cells, not several. Con-

sidered by Dr. Spruce as a variety of *P. albescens* (Hook.), but as it grows under similar conditions and at the same altitude, retaining the distinctive characters above mentioned, I look upon it as a distinct species.

DESCRIPTION OF PLATE LXXVI.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 31$ (Loch-na-gar, J. Sim). 3. Ditto, postical view $\times 64$ (ditto). 4–6. Leaves $\times 64$ (ditto). 7, 8. Ditto $\times 85$ (Lapland, Ångström). 9. Portion of leaf $\times 290$ (Loch-na-gar, J. Sim). 10, 11. Stipules $\times 85$ (Lapland, Ångström). 12–15. Ditto $\times 64$ (Loch-na-gar, J. Sim). 16–18. Sub-bracts $\times 31$ (Lapland, Ångström). 19, 20. Bracts $\times 31$ (ditto). 21. Bracteole $\times 31$ (ditto). 22. Perianth $\times 24$ (ditto). 23. Cross-section of perianth, near the base $\times 24$ (ditto). 24. Ditto, upper half of perianth $\times 24$ (ditto). 25. Portion of mouth of perianth $\times 85$ (ditto).

Genus 17. **HYGROBIELLA**, *Spruce*.

Jungermania, Hook. Brit. Jung. (1816).

Gymnocolea, Dum. Recueil (1835).

Cephalozia, Lindb. Musc. Scand. (1879).

Hygrobrella, Spruce, On Cephalozia (1882).

Plants small, cæspitose. Stems somewhat thick but fragile, transverse sections about 6 cells in diameter, cortical cells about 14, at the base rhizomatous and flagelliferous; rootlets very few or absent; above sparingly branched; branches lateral and axillary. Subfloral innovations lateral or postical, often repeatedly innovant and floriferous. Lower leaves minute, distant, upper larger and closer, all transverse, complicato-bilobed, lobes equal or antical slightly smaller; cells large and elongate. Stipules smaller than the leaves, somewhat similar or rarely entire. Inflorescence dioicous. ♀ terminal on stem or branch. Bracts few pairs, tristichous. Perianth large, subcarinose, fusiform, distinctly obtusely trigonous, mouth small, subentire. Calyptra narrow above. Capsule oblong, bistratose. Elaters bispiral. Spores

minute. Bracts ♂ terminal, few pairs, somewhat similar to the leaves, monandrous.

Obs.—The genus *Hygrobiella*, Spruce, originally contained three species, *Jung. laxifolia*, Hook., *Jung. myriocarpa*, Carr., and *Jung. nevicensis*, Carr.; later, Dr. Spruce, not being satisfied with the position of *Jung. myriocarpa* in the genus, removed it to an unpublished genus proposed by the late Prof. Lindberg, which Dr. Kaalaas has been kind enough to prepare.

Jung. nevicensis having been found in more perfect condition than when Drs. Carrington and Spruce had the opportunity of studying it, proves to be a *Marsipella*, where it has been placed.

Hygrobiella laxifolia (Hook.), Spruce.

Jungermania laxifolia, Hook. Brit. Jung. t. 59 (1816).

Gymnocolea laxifolia, Dum. Recueil, p. 17 (1835).

Cephalozia laxifolia, Lindb. Musc. Scand. (1879).

Hygrobiella laxifolia, Spruce, On Cephalozia, p. 72 (1882).

Dioicous, caespitose, flagelliferous, small, pale green to greenish-brown in colour. Stems suberect, almost round, cortical cells 14–20, large, inner 6–10 in diameter, smaller remarkably clear with very dark walls; often much branched at the base, some branches short, flagelliferous, denudate or microphyllous, others assurgent, fastigiate-corymbose below with few and distant leaves, above (chiefly fertile) leaves closer. Rootlets very few or absent, proceeding from the flagella or stem. Leaves transversely inserted, erect, lower ones minute, ovate-subulate, sometimes entire, upper accrescent, subimbricate, oval and oval-lanceolate, complicated-canaliculate and equitant, from $\frac{1}{4}$ to $\frac{1}{3}$ bifid, segments obtuse or acute, often unequal, sometimes only emarginate, very rarely with a third short segment near the middle. Texture lax; cells rather large, pellucid, leptodermous, rectangular-hexagonal, two to three times as long as broad, walls thin but firm, no thickened angles or trigones. Stipules similar to the leaves, usually a little smaller, below often entire or emarginate. Flowers ♀ terminal on stem or on long or short branches, often repeatedly innovant. Bracts

2-3 pairs, embracing the base of the perianth, or subremote, similar to stem leaves, but often much larger, shortly bifid, unequal, repand, from base to nearly the middle composed of two layers of cells; pistillidia few, small. Perianth large, lanceolate-fusiform when fruiting often elongate and almost linear, deeply trigonous, from base to near the apex usually composed of two layers of cells (at the keels and lower half often 3), near the middle a cross-section shows a double row of about 150 small cells, smaller perianths with 60-100 cells round, mouth contracted, narrow, with 10-15 short, hyaline, obtusely rounded marginal cells. Calyptra half the size of the perianth, lower half 2 cells thick, afterwards the apex unequally bivalved, surrounded at the base by the barren pistillidia. Pedicel more than twice the length of the perianth. Capsule oblong, reddish-brown, composed of two layers of cells. Spores globose, smoothish, broader than the elaters, pale reddish-brown. Elaters of a paler colour than the spores, bispiral, short, obtuse, about 12 turns of the spiral. Andrœcia terminal, short, rarely occupying the whole branch; perigonal bracts usually 5-7 pairs, closely imbricate, ovate, bifid, concave, swollen; perigonal bracteole oblong, entire or bifid; antheridia very large, single, oval, surrounded by leafy processes in the bracts.

Fruits May.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .1 mm. diam., with leaves near the apex 1.25 mm. wide; leaves 1 mm. \times .55 mm., segments .25 mm., .2 mm., .9 mm. \times .45 mm., seg. .3 mm., .25 mm., 1.1 mm. \times .5 mm., seg. .3 mm., .7 mm. \times .4 mm., seg. .25 mm., .5 mm. \times .3 mm., seg. .275 mm., .35 mm. \times .15 mm.; cells .06 mm. \times .02 mm., .08 mm. \times .02 mm., .05 mm. \times .02 mm., .05 mm. \times .03 mm.; stipules .8 mm. \times .5 mm., seg. .3 mm., 1.2 mm. \times .5 mm., seg. .3 mm., .25 mm., 1.1 mm. \times .5 mm., seg. .3 mm., .35 mm. \times .12 mm.; bracts 1.65 mm. \times .55 mm., 1.25 mm. \times .65 mm., seg. .3 mm.; bracteole 1.35 mm. \times .6 mm., seg. .3 mm.; perianth 2 mm. \times .5 mm., 2.25 mm. \times .65 mm.; pistillidia .13 mm. \times .04 mm.; capsule .6 mm. \times .35 mm.; spores .02 mm.; elaters .1 mm. \times .0125 mm.; perigonal bracts .6 mm. \times .45 mm.,

seg. .25 mm., .15 mm., .6 mm. × .5 mm., seg. .2 mm., .15 mm., .65 mm. × .6 mm., seg. .3 mm., .25 mm., .4 mm. × .3 mm., seg. .15 mm.; perigonial bracteole .4 mm. × .25 mm., .3 mm. × .25 mm.; antheridia .225 mm. × .15 mm.

HAB.—Growing on wet rocks by the margin of streams or in moist situations in hilly or subalpine districts.

Somewhat rare. 7. Llanberis, Carnarvon, *W. Wilson, W. H. P.* Cwm Idwal, Carnarvon, *W. H. P.* Glyder Vawr, Carnarvon, *W. H. P.* 10. Goathland Beck, Eskdale, Yorks, *Dr. Spruce, M. B. Slater.* High Force, Teesdale, *Dr. Spruce, M. B. Slater, G. Baker.* 12. Langdale, Westmorland, *G. Stabler.* Borrowdale, Cumberland, *W. H. P.* 15. Head of Loch Avon, *A. Croall.* Clockmaben, near Banchory, Aberdeenshire, *T. Sim.* Ben Venue, *Dr. Carrington.* Dalmally, *E. George.* 16. Glen Finnan, *Dr. Carrington.* Moidart, West Inverness, *S. M. Macvicar.* I. Kerry, *Dr. Taylor, Dr. Spruce, Dr. Carrington,* and others.

Found on the Continent (Norway, Sweden and North Germany), and in Greenland.

OBS.—“In specimens from Brandon Mt. (Ireland) and from Teesdale, Eskdale, &c., the branches mostly originate from the leafless lower portion of the stem, and (as there are no radicles to indicate the underside of the stem) it is difficult to ascertain on what face of the stem they are fixed; but where they do spring from a leafy part of it they are lateral, and axillary to the side-leaves. Scotch specimens are more leafy, and the branches are very distinctly lateral. Subfloral innovations are either lateral or postical, and are often repeatedly innovant and floriferous; as in *Hygrobrella myriocarpa.*” *Dr. Spruce.*

A very distinct species, at once separated from any other known British species by the almost equal tristichous leaves (the third postical-stipule) with elongate cells. Not long before he died *Dr. Spruce* wrote: “Ruminating instead of working, I have turned over some ancient guesses of mine on the classification of Hepaticæ. What think you,” for a change, “of *Isotachis laxifolia* (Hook.), *Hygrobrella* (Spruce), *pro parte?* There are the tristichous, nearly transversely inserted leaves; the elongated cells

(twice as long as broad); the fleshy perianth running to a narrow point often quite closed, &c. The way some genera touch many others, more or less closely, is very remarkable."

DESCRIPTION OF PLATE LXXVII.—Fig. 1. Plants natural size. 2. Fertile stem $\times 16$ (Dalmally, E. George). 3–7. Leaves $\times 24$ (ditto). 8. Portion of leaf $\times 290$ (ditto). 9–11. Stipules $\times 24$ (ditto). 12, 13. Bracts $\times 24$ (ditto). 14. Bracteole $\times 24$ (ditto). 15. Perianth $\times 24$ (ditto). 16. Cross-section of perianth, near the base $\times 24$ (ditto). 17. Ditto, near the middle $\times 24$ (ditto). 18. Portion of the mouth of perianth $\times 85$ (ditto). 19–22. Perigonal bracts $\times 24$ (Cwm Idwal, W.H.P.). 23. Perigonal bracteole $\times 24$ (ditto). 24. Antheridium $\times 85$ (ditto).

Genus 18. **EREMONOTUS**, *Lindb.* § *Kaalaus*.

Diplophyllum, Carr. in Carr. et Pears. Hep. Brit. Exsicc. n. 96 (1879).

Jungermania, Carr. in Trans. Bot. Soc. Edinb. p. 466 (1880).

Hygrobiella, Spruce, On Cephalozia, p. 75 (1882).

Plants small, with the habit of *Cephalozia divaricata*, reddish- or brownish-green, densely and intricately cæspitose. Stems very rigid, comparatively thick, fragile, at the base leafless, slightly radiculose, repeatedly ramose, most branches lateral or axillary, below leafless, above leafy, eradiculose, a few (chiefly the lower ones) postical, leafless, flagelliferous and radiculose. Leaves sub-transverse, lower ones distant, minute, appressed, upper gradually larger and closer, ovato-quadrate, complicate, to the middle or more acutely bifid, with acute segments; cells minute, sub-quadrate, walls thickened. Stipules absent. Inflorescence dioicous. Female flowers terminal on repeatedly innovant proliferous lateral (very rarely postical) branches. Bracts distichous, 2–3 pairs, innermost 3 to 4 times larger than the leaves, ovato-quadrate, from $\frac{1}{4}$ to $\frac{1}{3}$ bifid, lobes obtuse, rotundate. Perianth free, unistratose, relatively large, semiemersed, oblong, frontally compressed, antical deeply unisulcate, postical bisulcate, with a smaller obtuse keel between the furrows, apex broadly rotundate, mouth small, minutely denticulate or setulose. Andrœcia situated at

the end or middle of branches, amentiform; perigonial bracts monandrous, distichous, somewhat similar to the leaves, only broader and more concave, bifid to about $\frac{1}{3}$, segments obtuse.

Obs.—This new genus differs from *Cephalozia* in its branches being lateral, not postical, and from *Hygrobiella*, which is its nearest ally, by its frontally compressed, not distinctly trigonous perianth, absence of stipules, bracts of the female flowers being distichous and the very different cell structure of the leaves. B. Kaalaas in litt.

Eremonotus myriocarpus (*Carr.*), *Lindb. & Kaalaas.*

Diplophyllum myriocarpum, Carr. in Carr. et Pears. Hep. Brit. Exsicc. n. 96 (1879).

Jungermania myriocarpa, Carr. in Trans. Bot. Soc. Edinb. p. 466, t. 18, f. 4 (1880).

Hygrobiella myriocarpa, Spruce, On Cephalozia, p. 75 (1882).

Dioicous, densely caespitose, small, of a reddish-brown colour. Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, creeping at the base, rhizomatous shoots entangled, flexuose, resembling pale brown horsehair, terete, ascending, rigid, interrupted, repeatedly innovant, branches springing from one or both sides of the old axis, either barren and setaceous or fertile and with rapidly accrescent leaves, some branches (upper) lateral, others (lower) postical flagelliferous and rooting, rootlets sparse; cells of stem 6 or 7 in diameter, cortical 20, subquadrate, very little larger than the inner ones, at first large and pellucid, afterwards, when dry, opaque. Leaves on the lower portion of stem and branches distichous, approximate, erect, and appressed so close to the stem as to be readily overlooked, ovate, ovate-quadrate, complicate, carinate-concave, when explanate subcuneate, bifid to the middle, segments acute, sinus acute, texture thin, chitinous, polished; cells minute, punctate, subquadrate, leptodermous, subpellucid. No stipules. Flowers ♀ terminal, often on repeatedly innovant-proliferous branches, innovations lateral, rarely postical, sometimes two opposite, elongate. Bracts for the size of the plant large, 2-3 pairs, distichous, closely conduplicate and equitant, keel at an

angle of 45° , innermost large, 4 times larger than the stem leaves, quadrate-oblong, subcordate at the base, bifid to about the $\frac{1}{4}$ th, segments obtusate, rarely subacute, outer ones gradually becoming smaller and changing into stem leaves. Perianth half hidden by the bracts, subcompressed, very obtusely trigonous (third angle postical), antical deeply unisulcate, mouth small, denticulate or setulose, setæ 1-4 cells long. Capsule brown, oblong-globose, valves delicate, composed of two layers of cells. Elaters reddish-brown, bispiral. Spores pale brown.

Andrœcia on separate stems growing with the ♀, simply furcate, not repeatedly innovantly dichotomous as in the ♀; perigonial bracts several, terminal or along the stem, slightly imbricate, swollen at the base, bifid to about the $\frac{1}{3}$ rd, segments obtuse, antheridia solitary, oval.

Fruits May, June.

DIMENSIONS.—Stems about $\frac{1}{4}$ inch long, .75 mm. diam.; leaves .21 mm. \times .175 mm., .12 mm. \times .08 mm.; cells .015 mm. \times .01 mm., .0175 mm. \times .012 mm.; bracts .475 mm. \times .45 mm.; postical lobe .43 mm. \times .25 mm.; antical lobe .4 mm. \times .2 mm.; valves of capsule .4 mm. \times .175 mm.; pedicel .1 mm. diam., at apex .12 mm. diam.; elaters .1 mm. \times .01 mm.; spores .0175 mm.

HAB.—Creeping among spongy peat, along with *Jung. laxifolia* in crevices of moist rocks. Rare.

7. Clogwyn-du-Arddu, Snowdon, Carnarvonshire, August 1881, *W. H. P.* Pass of Llanberis, Carnarvonshire, May 1883, *W. H. P.* 10. Brown Ghyll, Langdale, Westmorland, May 11, 1881, *George Stabler* & *W. H. P.* Nan Beild, Westmorland, May 11, 1882, *George Stabler.* 15. Discovered by *Dr. Carrington*, July 1876, in the crevices of moist rocks, in a stream from Ben Venue, running in the direction of the Trossachs Hotel, Scotland. 16. Moidart, West Inverness, *S. M. Macvicar.*

Norway.

OBS.—“In size this resembles *Cephalozia divaricata*, but its true alliance is with *Jung. minuta*, of which it might be accounted a microscopic form. Owing to the rigid chitinous texture of *Jung. myriocarpa*, the stems and even perianths decay very slowly,

so that it is not uncommon to find five or six perianths, one above another, representing the growths of so many seasons. This give the plant a very characteristic appearance, when it is remembered the shoots are rarely more than from 2 to 4 lines in length. The same proliferous habit is not uncommon in *Jung. minuta*, and it shares with it other peculiarities, viz., the perianths were invariably abortive and the pistillidia barren and undeveloped. The young perianth looks like that of a *Frullania*; it is a point where the crests meet.

“From *Jung. rigida*, Lindb., which it also resembles in habit, it may be known by its much smaller size, fasciculate ramification, rapidly accrescent leaves, the lobes of which are equal, and the different form of the perianth; whereas in *Jung. rigida* the shoots are terete from the closely imbricated uniform leaves, the lobes of which are unequal.” Dr. Carrington.

“This curious little plant differs from *J. lavifolia* in the total absence of stipules and the dense reticulation; but in most other respects it is a miniature counterpart of that species; and they agree so perfectly in habit and in all essential characters that I can hardly doubt they should stand in the same genus. I have cut transverse sections of several perianths of *J. myriocarpa*, and have found them uniformly trigonous, with the third angle at the back, as in *J. lavifolia* and in all *Cephalozia*. The furrow along the middle of the upper face of the perianth, with a slight ridge or keel on each side of it, quite corresponds to what is seen in immature, or unfertilised perianths of several of the *Cephalozia*.” Dr. Spruce.

DESCRIPTION OF PLATE LXXVIII.—Fig. 1. Plants natural size. 2. Plant $\times 16$. 3–4. Portion of barren stems $\times 64$. 5, 6. Stem-leaves $\times 64$ (Ben Venue). 7–11. Ditto $\times 85$ (Clogwyn-du-Arddu). 12. Portion of stem and leaf $\times 200$. 13. Apex of leaf $\times 200$. 14. Portion of leaf $\times 290$ (Ben Venue). 15, 16. Bracts $\times 85$ (Clogwyn-du-Arddu). 17. Perianth with bracts $\times 64$. 18. Perianth $\times 64$ (Ben Venue). 19. Spores $\times 290$ (Brown Ghyll). 20. Perigonial bract $\times 85$. 21. Antheridium $\times 85$ (Clogwyn-du-Arddu).

Genus 19. **ADELANTHUS**, *Mitten.*

Jungermania, Hook. in Eng. Bot. t. 2567 (1813).

Radula, Dum. Syll. Jung. p. 43 (1831).

Plagiochila, G.L.N. Syn. Hep. p. 24 (1844).

Adelanthus, Mitt. in Journ. Linn. Soc. p. 264 (1864).

Sphagnocetis, Hartm. Skand. Fl. ed. 10, 2, p. 144 (1871).

Odontoschisma, Lindb. MSS. in Hartm. Skand. Fl. ed. 10, 2, p. 144 (1871).

Plants cæspitose, pale or dark green. Stems firm, caudex creeping, simple or slightly branched, radiculose, suberect, apex often decurved or subcircinnate, producing from near the base postical flagella which are minutely leaved and radiculose. Leaves succubous, moderately large, alternate, obliquely rotund or ovate, decurvo-secund, antical margin incurved, subentire, postical sub-plane, very often spinulose-dentate; cell rather large to minute, guttulate, pachydermous, trigones distinct, marginal cells minute, opaque. Stipules none or very rare and minute. Inflorescence dioicous, cladogenous, postical. Bracts ♀ tristichous, the innermost slightly smaller than the leaves, apex bifid or variously incised. Pistillidia 12–15. Perianth pyriform or fusiform, turgid, 3–5 angled, mouth denticulate. Calyptra a little smaller, carnosé, below the middle 3–5-stratose, sterile pistillidia surrounding it. Capsule oval, 4-valved, bistratose. Andrœcia amentiform; antheridia solitary, very rarely two.

Adelanthus decipiens (*Hook.*), *Mitt.*

Jungermania decipiens, Hook. in Eng. Bot. t. 2567 (1813); Brit. Jung. t. 50 (1816).

Radula decipiens, Dum. Syll. Jung. p. 43 (1831).

Plagiochila decipiens, Dum. Recueil, p. 15 (1835).

Gymnanthe decipiens, Mitt. Journ. Linn. Soc. 11, p. 166 (1863).

Adelanthus decipiens, Mitt. in Journ. Linn. Soc. p. 264 (1864).

Odontoschisma decipiens, Lindb. MSS. in Hartm. Skand. Fl. 11, p. 144; Lindb. Soc. Faun. et Fl. Fenn. 13, pp. 357–363 (1874).

Dioicous, densely cæspitose, flagelliferous, medium size, dark olive green when growing, below and when dry, dark brown in colour. Caudex prostrate, intricately branched below, producing

erect or ascending fastigate stems, stems blackish, firm, simple, rarely furcate or subramose, apices decurved; cortical cells 30-36, lurid, opaque, 10-12 cells in diameter, inner slightly smaller, subpellucid; flagella postical, few, only on the lower part of stem, with very minute, tristichous, distant, subquadrate-rotund, pellucid, rudimentary leaves, bearing fasciculate rootlets, tender, fragile, towards the ends of the flagella destitute of leaves, but producing numerous rootlets. Leaves incubous, lower smaller, subimbricate, appressed, upper larger, more crowded, decurvo-secund, rarely distichous-patulous, obliquely inserted, antical base long and gradually decurrent, subrhomboid or obliquely orbiculate, entire, apex rotundate retuse, apiculate or spinose, bi-tri-lobate, antical margin incurved, postical subplane or slightly concave. Texture thick, epidermis a little rough; cells medium to rather large in size, hexagonal, walls firm, angles thickened or trigones distinct, marginal cells distinct, thicker, subquadrate. Stipule on stem none or rudimentary. Inflorescence ♀ postical, on very short branches produced from near base of stem, rarely from middle. Bracts about 9, in threes, tristichous, outermost minute, scale-like, innermost a little shorter than the leaves, apex more or less deeply bifid, segments patulous, free or subconnate at the base, subentire; ♀ branches excavate, cavity pyriform. Perianth twice as long as the stem leaves, projecting far beyond the bracts, narrowly obovate, pyriform, turgid, above obtusely tri- (rarely 4-, 5-) gonous, mouth at first connivent, afterwards subtrifid, subdenticulate or ciliate. Calyptra a little smaller than the perianth, pyriform, firm texture, composed of 3 layers of cells, apex afterwards irregularly trifid, at base surrounded by few (about 12?) sterile pistillidia. Androecia postical, whitish, slender, julaceous or roundish, concinnate, produced from the whole length of stem, but chiefly from near the base; perigonal bracts 12 pairs or less, closely imbricate, subcymbiform or eucuculate, very concave and subsaccate, but scarcely complicate, slightly unequal, very often entire, rarely bidentulate, areolation very pellucid; antheridia solitary, shortly stipitate; perigonal bracteoles everywhere present 2-4 times smaller than the bracts, subrotund

or oblong, entire or angular, rarely connate at the base to the nearest upper leaf.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inch long, .2 mm. in diam., with leaves 2 mm., 2.5 mm. wide; leaves 2 mm. \times 2 mm., 2 mm. \times 1.75 mm., 1.75 mm. \times 1.5 mm., 1.4 mm. \times 1.2 mm.; cells .05 mm. \times .05 mm., .045 mm. \times .03 mm., .035 mm. \times .035 mm.; bract 1.5 mm. long; perianth 3.4 mm. \times 1.5 mm., 2 mm. \times .75 mm.; capsule .75 mm. \times .5 mm.; pedicel .2 mm; perigonial bracts .5 mm. \times .4 mm. (\times .75 mm. explanate); perigonial bracteole .25 mm. \times .125 mm., .13 mm. \times .13 mm.

HAB.—Growing on rocks or banks in woods or exposed places. Very rare, extremely so in fruit.

7. Tyn-y-Groes, Merioneth., *E. M. Holmes, Dr. Carrington & W. H. P., G. A. Holt*. 12. Borrowdale, Cumberland, *Dr. Carrington & W. H. P.* 16. Moidart, West Inverness, *S. M. Macvicar, 1898, W. H. P. 1899.*

I. Discovered by *Miss Hutchins* near Bantry. Kenmare Sound, Glengariff, *Dr. Carrington*. Rocks about the Upper Lake, *Prof. S. O. Lindberg*. Glenad, Leitrim, *Dr. D. Moore*.

Found on the Continent (Norway), in Cuba, and South America.

OBS.—A distinct species and the only British example of the genus. When in fruit the postical ♂ and ♀ would readily identify it, but ♂ has only been sparingly found by Dr. Carrington in Ireland, and no perianths have yet been discovered on British specimens. When barren, distinguished from *Plagiochila punctata* Tayl., which it resembles somewhat in size and habit, by its dark lurid green colour, leaves usually unispinose, antical margin incurved, and the large hexagonal cells.

The description is taken from Dr. Spruce's valuable notes in "Journ. of Bot." (1876).

DESCRIPTION OF PLATE LXXIX.—Fig. 1. Plants natural size. 2. Stem \times 11 (Killarney, Dr. Carrington). 3. Fertile stem \times 18 (G. & R. Hep. Eur. n. 474, from Cuba, drawn by Dr. Gottsche). 4–6. Leaves \times 16 (Killarney, Dr. Carrington). Leaf \times 16 (Canelos, South America, Dr. Spruce). 8. Portion of leaf \times 290,

(Killarney, Dr. Carrington). 9, 10. Bracts \times 18 (G. & R. Hep. Eur. n. 474). 11. Sub-bract \times 18 (ditto). 13. Andræcia (Killarney, Dr. Carrington, G. & R. Hep. Eur. n. 474, drawn by Dr. Gottsche).

Subtribe V. SCAPANIOIDEÆ.

Genus 20. **SCAPANIA**, *Dum.*

Jungermania, Mich. Nov. pl. gen. p. 6 (1729); L. Sp. pl. ed. 1, 2, p. 1132 (1753).

Martinellia, sect. a Gr. & B. Nat. Arr. Brit. Pl. 1. p. 691 (1821).

Radula, Dum. Comm. p. 112 (1823).

Radula, Dum. sect. 2, *Scapania*, Dum. Syll. Jung. Eur. p. 38 (1831).

Scapania, Dum. Recueil, 1, p. 14 (1835).

Plants usually robust, some large, others rather small, olive-green, reddish-brown or purple, growing in matted tufts or in large masses in streams. Stems firm; primary shoots creeping, perennial, naked, rhizomatous, entangled; secondary shoots foliose, ascending, decurved at the apex, simple or dichotomously branched; branches all exactly axillary to the leaves. Leaves distichodeclinate, alternate, conduplicate, unequally bilobed; postical lobe larger, convex; antical lobe incumbent; margins entire, dentate or ciliate. Stipules absent. Inflorescence dioicous, rarely paroicous, terminal. Bracts ♀ 2, free, resembling the leaves but more equally lobed. Perianth much longer than the bracts, frontally compressed, plane, not winged, mouth wide, truncate, bilabiate, entire or dentate, decurved. Calyptra free, included. Capsule ovate, of thick texture, divided to the base into 4 equal valves. Elaters attached to the centre of the valves, long, bispiral. Andræcia terminal or interrupted. Perigonial bracts smaller, ventricose at the base, the lobes shorter and nearly equal. Antheridia (3-12) axillary, oval, seated on a slender stipe.

1. *Scapania compacta* (Roth), Dum.

Jungermania compacta, Roth, Tent. Fl. Germ. 3, p. 375 (1800).

Jungermania resupinata, Web. et Mohr Crypt. Germ. p. 427 (1807); Hook. Brit. Jung. n. 23 (1816).

Radula resupinata, Dum. Comm. Bot. p. 112 (1823).

Scapania compacta, Dum. Recueil, p. 14 (1835).

Plagiochila compacta, M. et N. in Nees Nat. Eur. Leb. 111, p. 519 (1838).

Paroicous, loosely cæspitose, small, yellowish-brown. Stems firm, flexuose, simple or innovantly branched, suberect or prostrate, radiculose up to apex, rootlets dirty-white. Leaves subtransversely inserted, approximate, accrescent, shortly and subequally bilobed, antical lobe slightly smaller than the postical, lobes rotund or semi-oval, entire or rarely denticulate, texture firm, epidermis smooth, cells smallish to medium, subguttulate, walls somewhat thick, trigones large. Bracts similar to the leaves but larger, often denticulate. Perianth large, projecting much beyond the bracts, broadly obovate or turbinate, mouth wide, entire or irregularly denticulate. Antheridia (about 4 to 6 in each bract) oval, situated immediately below the perianth at the base of the bracts, which are slightly swollen.

Fruits April, May, June.

DIMENSIONS.—Stems $\frac{1}{2}$ inch long, .3 mm. to .4 mm. diam., with leaves 2 mm. wide; leaves, upper, antical lobe 1.5 mm. \times 1.25 mm., postical 1.75 mm. \times 1.25 mm., lower, antical lobe 1 mm. \times .75 mm., postical 1.25 mm. \times .75 mm.; cells .03 mm.; bracts, antical lobe 1.5 mm. \times 1 mm., postical 1.75 mm. \times 1 mm.; perianth 3 mm. \times 2 mm. wide at the mouth, 2.25 mm. \times 1.5 mm., antheridium .2 mm. \times .175 mm.

HAB.—Growing on clayey and sandy banks, and on mud-covered walls. Generally distributed.

1. Common, West Cornwall, *W. Currow*. 2. Isle of Wight, *G. E. Davies*. 3, 4. About Edgefield and Hempstead Hill, Norfolk, *Rev. R. B. Francis*. Norfolk and Suffolk, *Dr. W. J. Hooker*. 7. Penmaenpool, Merionethshire, *E. M. Holmes*, Dolgelly, Merionethshire, *W. H. P.* Festiniog, Carnarvonshire, *Dr. Car-*

rington & W. H. P. 10, 12. On rocks, Witherslack; in a wood near Staveley Church; Rayrigg Wood, Windermere; Oxenden, Great Langdale, Westmorland, *G. Stabler*. 13. Frequent, Kirkcudbrightshire and Dumfriesshire, *J. McAndrew*. 14, 15. Ben Lawers, *C. J. Wild*. Braemar, *R. Kidson*. Gateside, Strachan, *J. Sim*. 16. Frequent on rocks and boulders, Moidart, West Inverness, *S. M. Macvicar*.

I. Brandon, Co. Kerry, *Dr. D. Moore*.

Found on the Continent and Madeira.

Obs.—At once distinguished from any of the other known British *Scapania* by its paroicous inflorescence, the antheridia being found in the bracts immediately below the perianth, which is very rarely the case with any of this genus.

Apart from its inflorescence it is a very distinct species, its compact habit, almost equal lobes of leaves and bracts, its habitat, mud-covered walls and clayey banks in the plains, often near the coast, readily enable the student to identify it.

DESCRIPTION OF PLATE LXXX.—Fig. 1. Plants natural size. 2. Portion of fertile stem, antical view $\times 16$ (168 G. & R.). 3. Upper leaf, explanate $\times 16$ (ditto). 4, 5. Leaves $\times 24$ (Isle of Wight, G. E. Davies). 6. Portion of leaf $\times 290$ (168 G. & R.). 7. Bract, explanate $\times 24$ (Isle of Wight, G. E. Davies). 8, 9. Bracts $\times 24$ (ditto). 10. Perianth $\times 24$ (Cader Idris, W. H. P.). 11. Portion of mouth of perianth $\times 85$ (ditto). 12. Antheridium $\times 85$ (Isle of Wight, G. E. Davies).

2. *Scapania Bartlingii* (*Hampe*), *Nees*.

Jungermania Bartlingii, Hampe in Nees Nat. Eur. Leb. 11, p. 425 (1836).

Scapania Bartlingii, Nees in G.L.N. Syn. Hep. p. 64 (1844).

Jungermania cuspiduligera, Nees Nat. Eur. Leb. 1, p. 180 (1833).

Plagioclila Bartlingii, M. et N. in Nees Nat. Eur. Leb. 111, p. 520 (1838).

Jungermania rupestris, Schleich. Cat. Exs. (1821) ?

Scapania Carestiv. De Not. in Mem. Accad. Torin. (1858) ?

Diocious, loosely caespitose, small, of a pale green colour. Stems pale brown, somewhat tender, but proportionately thick

for the size of plant, frontally compressed, 20 cells \times 15, inner cells distinct, hyaline, two outer rows of cells brown; short, simple, or with 2-3 innovant branches produced from the axil of old bracts, suberect or creeping; radiculose, rootlets copious, of a dirty-white colour. Leaves transversely inserted or a little ascending, few, accrescent, bifarious, alternate, lower ones minute, scale-like, middle contiguous, upper closely imbricate, vaginate, unequally bilobed from about a fourth to a third, margin entire, sometimes erose, antical lobe about a third smaller, oblong, oval to subquadrate, apiculate, acute or obtuse, undulate, recurved or incurved, postical lobe oval, obtuse or rotundate; texture somewhat lax, epidermis smooth, cells near middle at the base elongate-quadrate, medium size, near the apex rather minute, subquadrate, cell-walls somewhat thin, angles a little thickened, no trigones. Bracts large, similar to upper leaves, lobes more equal. Perianth projecting about a third to half beyond the bracts, terminal, obovate, compressed, mouth truncate, wide, entire, a little uneven. Male stems with perigonial bracts terminal or at the middle, ventricose, antical lobe more erect, antheridia oval. Gemmiparous, gemmæ whitish-green to brown, bisepate, terminal, sometimes forming brownish-black spherical masses.

Fruits April, May.

DIMENSIONS.—Stems about $\frac{1}{2}$ in. long, .3 mm. to .4 mm. diam., with leaves 2.5 mm. to 2.75 mm. wide; leaves, antical lobe 1.2 mm. \times .65 mm., postical 1.5 mm. \times .75 mm., antical 1.1 mm. \times .5 mm., postical 1.5 mm. \times .75 mm., antical 1.3 mm. \times .75 mm., postical 1.5 mm. \times .75 mm.; upper leaves, antical lobe 1.75 mm. \times 1.25 mm., postical 2 mm. \times 1 mm.; cells, basal .06 mm. \times .025 mm., .04 mm. \times .02 mm., .04 mm. \times .025 mm., near apex of leaf .025 mm. \times .015 mm., .02 mm. \times .015 mm., .015 mm. \times .015 mm.; bracts, antical lobe 1.75 mm. \times 1 mm., postical 2 mm. \times 1 mm.; perianth 2.25 mm. \times 1.15 mm. at mouth, gemmæ .02 mm. \times .01 mm.

HAB.—Growing on damp, shady rocks by streams; very rare.

10. Near the "Strid," Bolton Woods, Yorkshire, *Dr.*

Carrington. 11. Egleston, Tees-side, *J. G. Baker.* Teesdale, *W. Mudd.*

Rare on the Continent.

Obs.—Distinguished from small forms of *S. aequiloba* by its smooth epidermis, from *S. curta* by its more equal lobes and distinctly accrescent habit.

DESCRIPTION OF PLATE LXXXI.—Fig. 1. Stems natural size. 2. Fertile stem $\times 16$ (Bolton Woods, Dr. Carrington). 3. Portion of sterile stem $\times 16$ (ditto). 4. Cross-section of stem $\times 24$ (ditto). 5–7. Leaves flattened out $\times 16$ (ditto). 8. Upper leaf $\times 16$ (ditto). 9. Ditto flattened out (ditto). 10. Portion of leaf, middle basilar cells $\times 290$ (ditto). 11. Ditto, near marginal apex (ditto). 12. Bract, flattened out $\times 16$ (ditto). 13. Perianth $\times 16$ (ditto). 14. Portion of the mouth of perianth $\times 85$ (ditto). 15, 16. Perigonial bracts $\times 24$ (Switzerland, Jack). 17, 18. Gemmæ $\times 290$ (Bolton Woods, Dr. Carrington).

3. *Scapania subalpina* (Nees), Dum.

Jungermania subalpina, Nees in Syn. Hep. Eur. p. 55 (1829).

Scapania subalpina, Dum. Recueil, p. 14 (1835).

Dioicous, cæspitose, small, pale green to brown in colour. Stems reddish, simple or slightly branched, innovant branches (2, 3 or 4) produced from the postical base of old perianth, erect, rootlets few, hyaline. Leaves patent (50°), imbricate, divided almost to the middle into two subequal lobes, appressed, closely incumbent, rotundate or slightly apiculate, antical lobe a little smaller than the postical, subrotund to subquadrate, entire or very slightly denticulate, postical lobe subrotund or broadly rotund, denticulate or rarely entire; texture delicate, lax, epidermis smooth, cells smallish, 4-, 5- and 6-sided, walls thin, trigones none. Bracts similar to leaves. Perianth oblong, truncate, mouth entire. Perigonial stems with the σ in the middle or terminal, bracts little different from the leaves.

Fruits May, June.

HAB.—On sandy soil or amongst mosses in subalpine or alpine districts. Rare.

7. Near Bettws-y-Coed, Carnarvonshire, *M. B. Slater*. 15. Ben Lawers, *C. J. Wild*, August 1878. Ben Mac Dhui, *John Whitehead*, July 1876. Ben Nevis, *W. West*, 1880. Glen Tilt, *W. West*, 1880. Moray, *A. Croall*, April 1848. Glencoe, *S. M. Macvicar*, 1899. 16. Resipol, Sunart, *S. M. Macvicar* & *W. H. P.*, 1899. I. Lugnaquilla Mountain, Co. Wicklow, *Dr. D. Moore*. Nephinbeg, Co. Mayo, *Dr. D. Moore*.

Found on the Continent.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ in. long, .2 mm. to .3mm. diam., with leaves 1.5 mm. to 2 mm. wide; leaves, antical lobe 1.25 mm. \times .75 mm., postical lobe 1.5 mm. \times 1.25 mm., 1.25 mm. \times 1 mm.; cells .025 mm.; perianth 2.25 mm. \times 1 mm.

Obs.—This peculiarly alpine and subalpine species may be distinguished from *S. undulata* by its neat habit, equal-sized, closely imbricate, appressed, almost entire leaves and the mouth of the perianth being entire.

Nearly all the specimens I have examined of this species have the lower portion of the stems thickly matted with earth.

DESCRIPTION OF PLATE LXXXII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 24 (Glen Tilt, West). 3. Portion of stem, antical view \times 24 (Finland, S.O.L.). 4, 5. Leaves \times 24 (Sweden, S.O.L.). 6. Postical lobe of leaf \times 24 (ditto). 7. Portion of leaf \times 290 (ditto). 8. Perianth \times 24 (Glen Tilt, West). 9. Perigonal bract \times 24 (Sweden, S.O.L.).

4. *Scapania æquiloba* (*Schwaeg.*), *Dum.*

Jungermania æquiloba, Schwaeg. Prod. p. 24 (1814).

Jungermania montana, Mart. Fl. Crypt. Erlang. p. 155, t. 4, f. 31 (1817).

Radhula æquiloba, Dum. Syll. Jung. Eur. p. 39 (1831).

Scapania æquiloba, Dum. Recueil, p. 14 (1835).

Jungermania tyrolensis, Nees Hep. Eur. 11, p. 440 (1836).

Plagiochila tyrolensis, M. et N. Nees Hep. Eur. iv. p. xxxvii. n. 17 (1838).

Scapania tyrolensis, G.L.N. Syn. Hep. p. 69 (1844).

Martinellia æquiloba, Lindb. Hep. in Hib. p. 521 (1874). Exsicc. G. & R. Hep. Eur. n. 89, 404, 408.

Dioicous; calcicolous, growing in densely matted tufts, medium size, of a dark olive green to dark brown colour. Stems simple

or slightly branched, black, suberect or erect; radiculose, rootlets moderately plentiful, hyaline. Leaves horizontally inserted, slightly ascending, closely imbricate, regular, of almost equal size, somewhat pectinate, bilobed barely to the middle, lobes subequal or the antical about a third smaller, convex, ovate or trapezoid, acute or sometimes apiculate, crossing the stem, entire or slightly dentate, postical lobe broadly oval or obovate, acute or sometimes apiculate, subentire, texture firm, epidermis very finely verruculose, cells small, roundish-subquadrangle, walls thick, angles thickened, trigones wanting. Bracts similar to upper leaves or slightly larger, lobes subequal, subentire. Perianth projecting considerably beyond the bracts, oblong-obovate, compressed, mouth wide, lacinate, irregularly spinose-dentate. Capsule small, oval; spores light brown; elaters short, bispiral, dark brown.

Male stems more slender than the others, perigonial bracts terminal or at the middle, little different from ordinary, smaller, ventricose; antheridia 2, oval, with long bearers, along with several leafy paraphyses. Sometimes gemmiparous, gemmæ greenish-white in colour, terminal on the upper leaves of sterile stem.

Fruits April, May, June.

DIMENSIONS.—Stems 1 to 2 inches long, .3 mm. to .4 mm. diam., with leaves from 2.5 mm. to 3.5 mm. wide; leaves, antical lobe 1.5 mm. \times 1 mm., postical 1.5 mm. \times 1 mm., antical 1.25 mm. \times .75 mm., postical 1.75 mm. \times 1 mm., antical 1.5 mm. \times .75 mm., postical 1.75 mm. \times 1.25 mm.; cells .015 mm., .02 mm., .0275 mm. \times .015 mm.; bracts, antical lobe 1.75 mm. \times 1 mm., postical 2 mm. \times 1 mm.; perianth 2.75 mm. \times 1.1 mm., laciniae at mouth of perianth .275 mm., cilia ditto .125 mm.; spores .0125 mm.; perigonial bracts, antical lobe .75 mm. \times .6 mm., postical 1.25 mm. \times .75 mm.; antheridia .15 mm. \times .125 mm.

HAB.—Growing usually on limestone rocks. Rare. 8. Lover's Leap, near Buxton, *C. J. Wild.* Miller's Dale, Derbyshire, *W. H. P.* 10. Winch Bridge, Teesdale, *Dr. Spruce*, July 1843. Wharfedale, *Dr. Spruce*, Dec. 1841. Linton, *G. A. Holt*. 16. On sandy banks, near the sea, Moidart, West Inverness, *S. M. Macvicar*.

Found on the Continent.

Obs.—Distinguished from all other *Scapania* (except *S. aspera*, M. & B., which see) by the leaves and perianth being minutely verruculose, in addition to other characters.

The best method to observe this feature is to detach a leaf and bend it between the slide and cover glass in water; with a $\frac{1}{4}$ inch, numerous *minute* warts are observed on the surface of each cell. Its neat habit, regular leaves, not deeply divided, with the dense cells, separate it from allied species.

From an exhaustive study of every specimen I have had the opportunity of examining, I am only able to give the few stations above recorded for this species, all the others I have to refer to *Scapania aspera*, M. et Bern.; the type seems to be better represented in the male stems, which are more regular and neater in habit.

DESCRIPTION OF PLATE LXXXIII.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 16$ (Moidart, Macvicar). 3. Leaves $\times 16$ (ditto). 4, 5. Leaves $\times 24$ (Winch Bridge, R. Spruce). 6. Portion of leaf $\times 290$ (ditto). 7. Bract, explanate $\times 16$ (Austria, Jack). 8. Portion of stem with perianth $\times 16$ (ditto). 9. Portion of mouth of perianth $\times 85$ (ditto). 10. Perigonial bracts $\times 16$ (404 G. & R.). 11. Antheridium $\times 85$ (ditto).

5. *Scapania aspera*, Müller & Bernet.

Scapania aspera, M. & B., Henri Bernet, Catalogue Hep. du Sud-Ouest de la Suisse et de la Haute-Savoie (1888).

Exsicc. G. & R. Hep. Eur. n. 92 (as *Scapania nemorosa*), n. 334 (as *Scapania nemorosa*), n. 602 (as *Scapania aquiloba forma dentata*), Massal. Hep. It. Ven. n. 62 (as *Scapania aquiloba*, var. *dentata*).

Dioicous, loosely depresso-cæspitose, of a reddish- or olive-brown colour. Stems tallish, simple or slightly branched, firm, blackish, recurved at the apex, denudate at the base; radiculose, rootlets few, whitish. Leaves transversely inserted, somewhat smaller and distant below, contiguous or imbricate above, subsecund, unequally bilobed to about the middle, margin ciliate-dentate; postical lobe more distinctly ciliate, about 25 cilia around the margin; antical lobe with rather more distant teeth or cilia; about half the size of

the postical, convex, oval-triangular, rotundate, appressed to the stem, or upper margin slightly reflexed; postical lobe oval-oblong, rotundate, reflexed; texture somewhat firm, epidermis verruculose, several minute papillæ on each cell; cells small to rather minute, subquadrate, walls thick, angles thickened, no trigones. Bracts rather larger than the upper leaves, lobes more equal, antical lobe rotundate. Perianth projecting half beyond the bracts, compressed, mouth wide, truncate, spinose-ciliate. Male stems more slender, perigonial bracts enclosing leafy paraphyses with the antheridia. Sometimes gemmiparous.

Fruits April, May, June.

DIMENSIONS.—Stems 1 to 2 inches long, $\cdot 5$ mm. diam., with leaves $5\cdot$ mm. wide; branches $\cdot 25$ mm. diam., with leaves $2\cdot 75$ mm. wide; leaves, antical lobe $1\cdot 5$ mm. \times $1\cdot$ mm.; postical lobe $2\cdot 5$ mm. \times $1\cdot 75$ mm., antical $1\cdot 5$ mm. \times $1\cdot$ mm., postical $2\cdot 5$ mm. \times $1\cdot 5$ mm., antical $1\cdot 75$ mm. \times $1\cdot 25$ mm., postical $2\cdot 25$ mm. \times $1\cdot 25$ mm.; cells $\cdot 02$ mm., $\cdot 0175$ mm.; cilia of postical lobe $\cdot 05$ mm.; bracts, antical lobe $2\cdot$ mm. \times $1\cdot 5$ mm., postical $2\cdot 5$ mm. \times $1\cdot 5$ mm.; perianth $3\cdot 5$ mm. \times $2\cdot$ mm. wide at the mouth, lacinia of the mouth $\cdot 275$ mm., cilia of the same $\cdot 1$ mm.

HAB.—Growing on limestone rocks. Somewhat rare. 2. Hill above Studland, Dorset, *E. M. Holmes*, 26th April 1884. 7. Near Aber, Carnarvonshire, *G. E. Hunt*, May 1868 (Herb. Spruce). Tower Hill, Abergele, Denbighshire, *W. H. P.*, August 1892. Llandulas, Denbighshire, *W. H. P.*, 1899. 9. Locally abundant on limestone rocks in Lanc. Silverdale, *J. A. Wheldon*, July 1898. Over Kellet, *A. Wilson*. 10. Bolton Woods, Yorkshire, *Dr. Carrington*, July 1877. 12. Yewbarrow, Westmorland, *George Stabler*, Nov. 1869. 16. Moidart, West Inverness, *S. M. Macvicar*, 1899. Roshven, West Inverness, *S. M. Macvicar*, 1899.

I. Hill of Howth; Co. Cavan; Killarney; *vide D. McArdle*.

Found on the Continent (Sweden, Norway, Switzerland, Germany, Austria, Italy).

Obs.—In habit and general appearance similar to *Scapania nemorosa* (L.), but in this latter species the leaves, both antical and postical lobes, are usually rounder and margin ciliate or more

finely dentate, but the most important distinctions of *Scapania aspera* are the closer texture of the leaves and the epidermis being verruculose; this latter character separates it from all the other British *Scapania*, with the exception of *Scapania aquiloba* (Schwaeg.).

Scapania aquiloba (Schwaeg.), of which it was considered a variety by such good authorities as Gottsche and Lindberg, is undoubtedly its nearest ally, although strikingly different in habit and smaller in size, and generally of a darker olive-green colour; the leaves are regularly inserted and almost equal in size the whole length of the stem, and although the lobes are by no means equal, as the name would imply, they are more so than in *Scapania aspera*, are more quadrate, with the apex more acute. This character is also observable in the bracts; in *Scapania aspera* the perianth is usually wider at the mouth, but the margin is exactly the same.

The male plant of *Scapania aspera* approaches nearer to *S. aquiloba* than the barren or fertile one.

The founders of the species say, "It has nothing in common with *Scapania aquiloba* except in the tuberculose cuticle." This statement will probably be questioned by students who have the opportunity of examining a large series of specimens.

Scapania crassiretis, Bryhn (found in Norway), is another allied species, which has not yet been met with in our country.

I find the species with which it is most generally mistaken for, even by some expert students, is *Scapania resupinata* (L.), with which it agrees somewhat in the shape and margin of leaves, but the latter species is usually of a pale olive-brown colour, narrower and more equal leaves, the antical lobe is also more or less reflexed on some portion of the stem, the epidermis is also quite smooth.

DESCRIPTION OF PLATE LXXXIV.—Fig. 1. Plants natural size. 2. Portion of young branch $\times 16$ (Yewbarrow, G. Stabler). 3. Leaf $\times 11$ (G. & R. n. 602). 4. Ditto, explanate (ditto). 5. 6. Leaves $\times 11$ (Sweden, Kindberg). 7. Leaf $\times 11$ (G. & R. n. 602). 8. Margin of leaf, postical lobe $\times 85$ (ditto). 9. Portion of leaf $\times 290$ (ditto). 10. Bract $\times 11$ (Yewbarrow, G.

Stabler). 11. Ditto, explanate (ditto). 12. Perianth \times 11 (Sweden, Kindberg). 13. Portion of mouth of perianth \times 85 (Yewbarrow, G. Stabler).

6. *Scapania resupinata* (L.), Dum.

Lichenastrum auriculatum, *pinnulis rotundis, crispum*, Dill. Hist. Musc. p. 491, t. 71, f. 19 (1741).

Jungermania resupinata, Linn. Sp. pl. 1599, fide Dillenii (1753); Huds. Fl. Ang. p. 512 (1798); With. Arr. Br. pl. 3, ed. 111, p. 875 (1796); Eng. Bot. t. 2437.

Radula dentata, Dum. Syll. Jung. p. 40 (1831).

Scapania dentata, Dum. Recueil, p. 14 (1835).

Scapania resupinata, Dum. Recueil, p. 14 (1835).

Martinellia gracilis, Lindb. Manip. Musc. Secund. p. 365 (1874).

Dioicous, growing in dense tufts of a yellowish-brown or olive colour, pale below, closely entangled with long hyaline rootlets, which are produced from the underside of the stem. Stem ligneous, simple or sparingly branched. Leaves crowded at the apex, equal in size, from about $\frac{1}{3}$ to the $\frac{1}{2}$ bifid, closely conduplicate, antical lobe crossing the stem, appressed, somewhat erectopate, convex, yet upper margin frequently reflexed, obliquely reniform-rotund, apex rotundate-obtuse, with distant large teeth, teeth broad at the base, the apical ones generally the largest, postical lobe about twice as large, very convex, upper margin remarkably reflexed and decurrent, obliquely oval-obovate, rotundato-obtuse, dentato-serrate, apical teeth scarcely larger; epidermis smooth, cells small, quadrato-rotund or quadrate, angles thickened, walls firm. Bracts a little larger than the leaves, antical lobe proportionately larger. Perianth prominent, obconical, plano-compressed, mouth often decurved, truncate, wide, inciso-dentate, usually with about 6 segments, finely dentate, capsule oval, projecting a little. Perigonial spikes usually terminal, bracts closely imbricate, lobes almost equal, ventricose at the base, antheridia oval. Upper leaves often gemmiparous, gemmæ oval, usually bisepitate.

Var. *minor*. Small, rarely more than $\frac{1}{2}$ in. long, more delicate than the ordinary form, and although it is very constant in size

and habit, I see no character by which it can be separated from the type.

DIMENSIONS.—Stems $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, .3 mm. diam., with leaves 2· mm. to 3· mm. wide, leaves, antical lobe .7 mm. \times .5 mm., .9 mm. \times .7 mm., 1·1 mm. \times .8 mm., postical 1· mm. \times .7 mm., 1·7 mm. \times .9 mm., 1·7 mm. \times 1· mm., cells .02 mm., perianth 2·2 mm. long \times 1·7 mm. wide at the mouth, gemmæ .03 mm. \times .015 mm.

HAB.—On shady rocks and walls, more rarely base of trees, generally in subalpine districts. Moderately common.

1. Penzance, *W. Currow*. 2. Eridge Rocks, *Dr. Spruce*. 3, 7. Common in Merionethshire and Carnarvonshire, *W. H. P.* 10. Ilkley, *Dr. Carrington, G. Stabler, G. Webster*. Malham Moor, *Dr. Carrington*. 11, 12. Frequent in Westmorland and Cumberland, *G. Stabler, Dr. Carrington, W. H. P.* 13. Frequent on the hills in Kirkeudbrightshire and Dumfriesshire, *J. McAndrew*. 14, 15, 16. Very common, Moidart, West Inverness, *S. M. Macvicar*.

I. Very common and widely distributed in Ireland, *Dr. D. Moore*. Killarney, *McArdle & Lett*. Co. Cavan, *D. McArdle*.

Found on the Continent, Teneriffe.

OBS.—Distinguished at once from any of the forms of *Scapania undulata* by its brownish-olive colour, from *Scapania nemorosa* by the coarser teeth of the leaves, and from *Scapania aquiloba* and *Scapania aspera* by the smooth epidermis.

The frequently reflexed antical lobe is also a good character to distinguish it from other species; this feature is somewhat inconstant, but is usually found on some portion of the stem.

Linnaeus founded his *Jung. resupinata* on the plant described and figured by Dillenius in his *Hist. Musc.* p. 491, t. 71, f. 19, which, according to Lindberg, comprises two species, one of which he named *Martinellia gracilis*. This, however, so agrees with the description "*acutissime crenatos margines*" as well as with the figure h, that I follow Dr. Carrington in considering it the true *Jung. resupinata*. *Scapania resupinata*, recorded from several stations in Staffordshire by Mr. J. E. Bagnall ("*Journ. of Bot.*," March 1896), all refer to *Scapania aspera*, Müll. et B.

DESCRIPTION OF PLATE LXXXV.—Fig. 1. Plants natural size. 2. Portion of stem $\times 24$ (Scotland, Sim). 3–5. Leaves $\times 24$ (G. & R. n. 225). 6–8. Leaves of var. *minor* $\times 24$ (Ardingley, Davies). 9. Portion of leaf $\times 290$ (New Galloway, J. McAndrew). 10. Perianth $\times 16$ (ditto). 11. Portion of the mouth of perianth $\times 85$ (ditto). 12. Gemmæ $\times 290$ (Ardingley, Davies).

7. *Scapania ornithopodioides* (Dill. Wither.), Pears.

Lichenastrum auriculatum, *Ornithopodii pinnatis ciliatis*, Dill. Hist. Musc. p. 493, n. 21 (1741).

Jungermania ornithopodioides, Withering, Botanical Arrangement, vol. ii. p. 695, n. 14 (1776).

Jungermania planifolia, Hook. Brit. Jung. t. 67 (1816).

Scapania planifolia, (Hook.) Dum. Recueil, p. 14 (1835).

Dioicous (?), forming erect crowded tufts or straggling amongst other mosses and hepatics; very large; of a dark brown colour. Stems simple or furcate, ligneous, a cross-section showing it to be oval, the outer layer consisting of one or two rows of dark-red ligneous cells, inner cells white, somewhat homogeneous; radicle, rootlets short, pale, produced from the postical side of stem. Leaves distichous, imbricate or approximate, divided to the base or almost into two unequal lobes, the antical one about half the size of the postical, erecto-patent to patent (40°), cordate, obtuse or acute, ciliate-dentate, crossing the stem, slightly convex; postical lobe patent-divergent to horizontal (80°), plane or slightly deflexed, ovate, ciliate-dentate; at the suture one or two large cilia are often found, 3 to 4 cells long, 2 cells broad at the base; epidermis smooth, cells small, roundish, guttulate, cell-walls thick, angles thickened.

σ and ♀ unknown.

DIMENSIONS.—Stems 3 to 4 inches long, 4 mm. \times 3 mm. diam., with leaves 4 mm. wide; leaves, antical lobe 1.5 mm. \times 1 mm., 1.4 mm. \times 1.25 mm., 1.25 mm. \times 1 mm., postical 2.2 mm. \times 1.3 mm., 2.1 mm. \times 1.5 mm., 1.9 mm. \times 1.3 mm.; cells .03 mm. \times .02 mm., .025 mm. \times .02 mm., .0225 mm. \times .02 mm.; cilia .04 mm. \times .0175 mm. broad at the base.

HAB.—On damp rocks or growing amongst mosses in wet places in mountainous districts. Very rare.

7. Snowdon, *Dillenius*, 1740. Snowdon, below Clogwyn du Arddu, ascent from Beddgelert, August 1840, *Ralfs*. Cwm Idwal, Carnarvonshire, *W. Wilson*. 12. Honister Pass, Cumberland, *Dr. Carrington & W. H. P.*, 1890. 15. Ben na Bord, *George Donn*, 1812. Ben Avon, *G. Donn*, 1812; *John Nowell*, 1847. Ben Voirlich, *W. Gourlie*, 1842. Ben Mac Dhui, *G. Stabler*, 1884. 16. On rock-ledges in several places on the hills from 1200 ft.—1800 ft., frequently associated with *Mastigophora*, Moidart, West Inverness, *S. M. Macvicar*, 1898; *S. M. Macvicar & W. H. P.*, 1899.

I. Brandon Mountain, *Dr. Taylor, W. Wilson*.

Found on the Continent (Norway), Sandwich Islands, East Indies (*vide Mitten*).

Obs.—A very rare and distinct species, first collected by Dillenius on Snowdon in 1740; its brown colour, shape and position of the antical lobe of leaf readily distinguish it from any of the ciliate *Scapania*, with the exception of *S. nimbose*, which see.

I am averse to changing any well-established and appropriate specific name, but as Dillenius described and figured so accurately and Withering published the species so many years before Hooker, who evidently was not aware the species was already published, I feel compelled to adopt the earlier one.

DESCRIPTION OF PLATE LXXXVI.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 16$. 3–5. Antical leaf-lobes $\times 24$. 6, 7. Postical leaf-lobes $\times 24$. 8. Portion of leaf $\times 290$. 9. Cilia $\times 290$ (Ben Voirlich, Gourlie).

8. *Scapania nimbose*, *Taylor*.

Scapania nimbose, Tayl. in Lehm. Pugill. Plant. 8 (1844). Trans. Bot. Soc. of Edin. 11, p. 115; G.L.N. Syn. Hep. Suppl. p. 662 (1847).

Loosely cæspitose, somewhat large, reddish-brown colour to rosy red near the apex. Stems firm, ligneous, blackish, suberect or flexuose, simple or sparingly branched, innovant branches produced from the postical side, rootlets near the base, few, long, very

delicate, hyaline. Leaves patent, inserted at an angle of from 40° to 60° , imbricate, amplexicaul, complicate, divided almost to the base into two subequal lobes, margin ciliate-dentate, cilia frequently uncinatè, antical lobe slightly concave or undulate, crossing the stem, a little smaller than the postical, oblong-ovate, apex somewhat rotundate or lanceolate; postical lobe obliquely ovate, convex, slightly recurved at the upper margin, suture short, thick, ligneous; epidermis smooth, cells small, roundish-quadrate, cell-walls thick, trigones distinct, δ and η unknown.

DIMENSIONS.—Stems 1 to 3 inches long, diam. $\cdot 25$ mm., with leaves $2\cdot 25$ mm. wide; leaves, antical lobe $1\cdot 25$ mm. \times $\cdot 95$ mm., postical lobe $1\cdot 4$ mm. \times 1 mm.; cells $\cdot 02$ mm., cell-walls $\cdot 0075$ mm., cilia $\cdot 1$ mm. long.

HAB.—On moist rocky ledges in alpine situations. Discovered by *Dr. Taylor* near the summit of Brandon Mountain, Co. Kerry, Ireland, in 1813, growing with *Scapania ornithopodioides*, *Junc. orcadensis*, *Hypnum loreum* and *Racomitrium lanuginosum*. *W. Mitten*, 18—?

16. Moidart, West Inverness, *S. M. Macvicar*, 1898; *S. M. Macvicar* & *W. H. Pearson*, 1899.

These are the only two known stations.

Obs.—The rarest, and one of the most beautiful and finest of our British Hepaticæ, discovered on Brandon Mountain, South of Ireland, by *Dr. Taylor* in 1813, and although repeated attempts have been made by other botanists, no one, except *Dr. Taylor* and *Mr. Mitten*, has been so fortunate as to meet with it in Ireland; and as only few specimens were known to exist in herbaria, most botanists had to be content with the description, and say with the late *Dr. D. Moore* in his Report on the Irish Hepaticæ: “I know nothing of this plant further than the quotations transcribed testify.”

However, in 1898 *Mr. Symers M. Macvicar* found the plant in Scotland, and in the following year I had the good fortune of being taken to its habitat by him.

I add the following notes from his interesting Hepaticæ of Moidart, “*Journ. of Bot.*” Aug. 1899: “Liable to be overlooked

when growing with *S. ornithopodioides* (With.) (*S. planifolia*, Hook.), but is distinguished from it by being rather more slender, more erect, and not in layers, as that species usually is; lower lobe smaller, recurved, whilst in *S. ornithopodioides* it is flat and spreading, giving this latter plant a compressed appearance. Under the lens the long irregularly spinous cilia at once distinguish it, for, although the cilia vary in size in *S. ornithopodioides* on different stems, they are always regular and straight, never curved, as they frequently are in *S. nimbosea*. The upper lobe is concave from the sides being inflexed, with the point incurved; it is not appressed to the stem, nor should I consider the lower lobe so much deflexed as to give the shoots a squarrose appearance, as they have been described."

DESCRIPTION OF PLATE LXXXVII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 16$. 3. Portion of stem, postical view $\times 24$. 4. Leaf, antical lobe $\times 24$. 5. Leaf, postical lobe $\times 24$. 6. Portion of leaf $\times 290$. (All Brandon Mt., Dr. Taylor, 1813.)

9. *Scapania nemorosa* (L.), Dum.

Jungermania nemorosa, *foliis acutioribus, auritis, tenuissime denticulatis*, Mich. Nov. pl. gen. p. 7, t. 5, f. 8 (1729).

Lichenastrum auriculatum, *pinnis minoribus, crenatis*, Dill. Hist. Musc. p. 490, t. 71, f. 18 (1741).

Jungermania nemorosa, Linn. Sp. pl. 1 ed. p. 1132 (1753).

Martinellius nemorosa, Gr. & B. Nat. Arr. Brit. pl. 1, p. 692 (1821).

Radula nemorosa, Dum. Comm. Bot. p. 112 (1823).

Scapania nemorosa, Dum. Recueil, p. 14 (1835).

Dioicous, laxly cæspitose, medium size, green to greenish-brown colour. Stems simple or sparingly branched, ascending or erect; radiculose, rootlets few, hyaline; firm, red to dark brown, outer layer of cells dark brown, inner white. Leaves transversely inserted, slightly ascending, lower leaves somewhat distant or contiguous, upper imbricate, bifarious, alternate, margin ciliate-dentate, unequally bilobed to about the middle, antical lobe about half the size of the postical, cordate, acute, incumbent, postical

ovate, rotundate, convex, reflexed; epidermis smooth, cells subquadrate, walls rather thick, no trigones. Bracts similar to leaves. Perianth terminal, projecting high beyond the bracts, obovate, frontally compressed, composed of a single layer of cells, mouth wide, truncate, ciliate-dentate. Capsule roundish, reddish-brown. Spores minute, round, light brown. Elaters bispiral. Male stems similar to others, only perigonial bracts more crowded. terminal or in the middle of the stem, antical lobe rounder, ventricose at base, 3-6 antheridia enclosed, which are oval, with long bearers. Stems sometimes gemmiparous, gemmæ at apex of stem or terminal leaves, dark brown.

Fruits April, May, June.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inch long, .5 mm. diam., with leaves 4 mm. broad; leaves, antical lobe 2.5 mm. \times 1.75 mm., postical 2.75 mm. \times 2 mm., marginal teeth .075 mm.; cells .03 mm., .04 mm. \times .02 mm., .025 mm.; bracts, antical lobe 2.25 mm. \times 1.5 mm., postical 3 mm. \times 2 mm.; perianth 3.75 mm. \times 2 mm., teeth of mouth .075 mm., .1 mm.; perigonial bract, antical lobe 2 mm. \times 2.25 mm., postical 3 mm. \times 2.5 mm.; antheridia .25 mm. \times .175 mm.

HAB.—Grows in woods and shady places on rocks or rotting wood. Generally distributed.

1. West Cornwall, frequent, *W. Curnow*. 2. New Forest, Hants, *C. Lyell*. Cadnam Bog, *C. Lyell*. 3. North Frith Wood, *Howse*. Swancombe Wood; King's Wood, near Maidstone, Kent, *E. M. Holmes*. 4, 5. Cloud, *R. Garner*. Seckley Wood; Arley Wood; Mayfield; Ordesley Brook; Leek, Staffordshire, *J. E. Bagnall*. 6, 7. Dolgelly, Merionethshire, *Dr. Carrington and W. H. P.* 8. Stirrup Wood, Derbyshire, *G. A. Holt*. 9. Banford Wood; Clifton Junction, Lanc., *G. A. Holt*. 10. Aireyholme Wood and Bilsdale, *W. Mudd*; Bolton Woods, *Dr. Carrington*. Teesdale, *Dr. Spruce*. Clapdale, *Dr. Carrington*, *George Stabler*. Dentdale, *Dr. F. A. Lees*. Whernside, *Dr. F. A. Lees*. Ribblesdale, *Dr. F. A. Lees*. Arncliffe, *W. West*. Ilkley, *Dr. Carrington*. Shipley Glen, *Dr. Carrington*. Todmorden, *A. Stansfield*. 12. Westmorland, *Hudson*. Stock Ghyll, *G. Stabler*. Staveley, *G. Stabler*.

Kentmere, *G. Stabler*. 13. Frequent, Kirkcudbrightshire, Dumfriesshire, *J. McAndrew*. 15, 16. Uncommon, Moidart, West Inverness, *S. M. Maccicar*.

I. Killarney, *Dr. Carrington, D. McArdle*. Kylemore, Co. Galway, *Dr. D. Moore*. Cromaglow; Tore Waterfall, *Prof. Lindberg*.

C. Jersey, *Mrs. McKenzie*.

Europe, North and South America, Java.

Obs.—The only species with which this can be confused are *Scapania aspera*, M. & B., and *Scapania purpurescens*, which see.

The other two species with ciliate leaves (*Scapania ornithopodioides*, Dill., and *Scapania nimbosea*) are remarkably distinct.

DESCRIPTION OF PLATE LXXXVIII.—Fig. 1. Stems natural size. 2. Stem $\times 11$. 3. Antical lobe of leaf $\times 11$. 4. Postical lobe of leaf $\times 11$. 5. Margin of leaf $\times 85$. 6. Portion of leaf $\times 290$. 7. Bract $\times 11$. 8. Perianth $\times 11$. 9. Cross-section of perianth $\times 11$. 10. Portion of mouth of perianth $\times 85$ (*Dolgelly, W. H. P.*). 11. Perigonial bract $\times 11$. 12. Antheridium $\times 64$ (Sweden, *Herb. Lindb.*).

10. *Scapania undulata* (L.), *Dum.*

Hepatica saxatilis undulata seminifera, Vaill. Bot. par., p. 98, t. 19, f. 6.

Lichenastrum pinnulis auriculatis majoribus et non crenatis, Dill. Hist. Musc. p. 490, tab. 71, fig. 17 (1741).

Jungermania undulata, Linn. Sp. pl. 1598 (1753); Hook. Brit. Jung. t. 22 (1816).

Radula undulata, Dum. Comm. Bot. p. 112 (1823).

Scapania undulata, Dum. Recueil, p. 14 (1835).

Martinellius undulata, Gr. & B. Nat. Arr. Brit. Pl. p. 691 (1821).

Dioicous; cæspitose, of a green, brown, or reddish-brown colour. Stem variable in length, erect, simple or subdivided. Leaves transversely inserted, approximate or imbricate, divided to about the middle into two unequal lobes, entire, denticulate, dentate or ciliate-dentate, broader than long, undulate when dry; antical lobe from half the size to subequal with the postical, convex, subrotund, trapezoid or subreniform, rotundate, postical lobe

subrotund, trapezoid, rotundate, epidermis smooth; cells smallish, 5-6-sided, walls firm. Bracts with lobes subequal. Perianth oblong-obovate, mouth entire or denticulate.

Male stems somewhat similar to the others: androecia middle or near the apex; perigonal bracts rather smaller and more closely imbricate, lobes subequal; antheridia several in each bract, roundish-oval, pedicel long.

Fruits April, May, June.

DIMENSIONS.—Stems $\frac{1}{4}$ inch to 6 inches long, diam. .3 mm. to .4 mm., with leaves 4 mm. wide; leaves, antical lobe 1.5 mm. \times 1 mm., postical lobe 2 mm. \times 1.5 mm.; cells .02 mm., .025 mm.; perianth 3 mm. \times 1.25 mm.

HAB.—On rocks or stones in or by streams or in wet places; generally distributed throughout the British Isles; most abundant in subalpine localities, ascending to the top of our highest mountains.

1, 3-5, 7-18, I.

Found on the Continent, Canaries, North America.

Obs.—This is the most common and variable type of British *Scapania*; it varies in height from $\frac{1}{4}$ inch to 5 and 6 inches, and assumes many forms, which varieties are described at length by Nees in his "Eur. Leber." The notes under species likely to be confounded with it will enable the student to distinguish it.

DESCRIPTION OF PLATE LXXXIX.—Fig. 1. Plants natural size. 2, 3. Portion of stems \times 16 (Herb. Mougeot). 4. Perigonal bract \times 24 (Tyn-y-Groes). 5. Portion of leaf \times 290 (Mougeot & Nest. Exsicc.). 6. Perianth \times 16 (Balcombe, G. Davies).

11. *Scapania purpurascens* (Hook.), Tayl. MSS.

Jungermania nemorosa, var. *purpurascens*, Hook. Brit. Jung. t. 21, f. 16 (1816).

Diocious, caespitose, medium size, rosy to deep purple, rarely greenish in colour. Stems erect or procumbent, rigid, dark brown or purple, simple or with one or two branches proceeding from near the base; radiculose, rootlets few, whitish. Leaves imbricate

above, approximate or distant below, horizontally inserted, unequally bilobed, antical lobe about half the size of the postical, crossing the stem or nearly so, convex, subquadrate, longer than broad or roundish, free angle subacute or rotundate, margin denticulate, postical lobe broadly oval or orbicular, often rotundate, reflexed, margin denticulate; epidermis smooth, cells rather minute to small, roundish-quadrate, walls firm, no trigones or thickened angles. Bracts larger than the leaves, unequally bilobed, antical lobe about half the size of the postical, oblong-subquadrate, free angle obtuse or rotundate, margin denticulate, postical lobe oval, rotundate, margin denticulate. Perianth projecting more than half beyond the bracts, campanulate, oblong-ovate, with a narrow base, mouth wide, denticulate.

Andrœcia terminal on separate stems; perigonal bracts 4, 5 pairs, smaller than the leaves, closely imbricate, unequally bilobed, antical lobe about half the size of the postical, very convex, oval or orbicular, margin denticulate, postical oval; antheridia orbicular, pedicel long.

Fruits April, May, June.

DIMENSIONS.—Stems 1 to 2 inches long, diam. $\cdot 25$ mm., with leaves $3\cdot$ mm. wide; leaves, antical lobe $1\cdot 25$ mm. \times $\cdot 75$ mm., postical $2\cdot$ mm. \times $1\cdot 5$ mm., antical $1\cdot 1$ mm. \times $\cdot 75$ mm., postical $1\cdot 75$ mm. \times $1\cdot 1$ mm.; cells $\cdot 02$ mm. \times $\cdot 02$ mm., $\cdot 015$ mm., $\cdot 02$ mm. \times $\cdot 015$ mm.; teeth of leaves $\cdot 02$ mm. \times $\cdot 02$ mm. at base; bracts, antical lobe $1\cdot 25$ mm. \times $\cdot 75$ mm., postical $2\cdot$ mm. \times $1\cdot 1$ mm.; perianth $3\cdot 5$ mm. \times $1\cdot 75$ mm., marginal teeth $\cdot 03$ mm.; perigonal bracts, antical lobe $\cdot 9$ mm. \times $\cdot 6$ mm., postical $1\cdot 25$ mm. \times $\cdot 75$ mm.; antheridia $\cdot 2$ mm. \times $\cdot 175$ mm.

HAB.—On wet rocks and stones by the side and in streams. Not uncommon; usually in subalpine districts.

1. Banks of the Tamar, Devon, *W. Curnow*. 7. Tyn-y-Groes, Merionethshire, *G. A. Holt*. Cader Idris, Merionethshire, *John Whitehead, W. H. P.* 8. Castleton, *G. A. Holt*. Kinder Scout, Derbyshire, *G. A. Holt*. 9. Crowden, Cheshire, *G. A. Holt*. Longridge Fell, Lanc., *Wheldon*. Hindburn, Lanc., *A. Wilson*. Clougha and Udale, Lanc., *Wheldon*. 10. Arncliffe Wood, Esk-

dale, *M. B. Slater*. Wheeldale, *M. B. Slater & W. H. P.*
 12. Glen Helen, Isle of Man, *G. A. Holt*. Grisedale, *Slater &*
Stabler. Langdale, *Stabler & W. H. P.* Long Sleddale, *G. Stabler*.
 Sea Fell Pike, *G. Stabler*. 13. Occasionally on the hills, Kirkcud-
 brightshire and Dumfriesshire, *J. McAndrew*. 15. Ben Lawers,
C. J. Wild. 16. Banks of Loch Long, *W. Gourlie*. Common,
 Moidart, West Inverness, *S. M. Macvicar*.

I. *Dr. Taylor* and others. Common in Co. Kerry, *Dr. D. Moore*.
 Found on the Continent.

Obs.—Since Hooker's time there has been considerable doubt
 as to whether this form should rank as a species or not. In his
 "Brit. Jung." it is published as a variety of *S. nemorosa*, but from
 this it is distinguished by the shape of its leaves, which are also
 only denticulate, not ciliate, in many respects approaching
S. undulata. Dr. Gottsche, writing to Dr. Carrington many
 years ago, said: "I cannot yet define the limits of these species
 (*S. nemorosa* and *S. undulata*), and if I believe myself for a time in
 order with the genus, new forms confuse me again."

It appears to occupy the same position between *S. undulata* and
S. nemorosa as *S. intermedia*, Husn., does between *S. purpurascens*
 and *S. umbrosa*.

DESCRIPTION OF PLATE XC.—Fig. 1. Plants natural size.
 2. Stem with perianth, antical view $\times 11$. 3. Leaf, antical view
 $\times 11$. 4–8. Leaves, antical view $\times 16$. 9. Portion of leaf
 $\times 290$. 10, 11. Bracts $\times 16$. 12. Portion of mouth of perianth
 $\times 85$. 13, 14. Perigonial bracts $\times 16$ (Arncliffe, Yorks,
M. B. Slater).

12. *Scapania intermedia*, Husnot.

Scapania intermedia, Husnot, Hep. Gall. pl. 111, fig. 23 (1875).

Scapania nemorosa, var. *intermedia*, Husnot, Hep. Gall. p. 22 (1876). Exsicc
 Husnot, Hep. Gall. n. 65, as *Scapania nemorosa*, var. *intermedia*.

Dioicous, densely caespitose, small, rosy or greenish-brown in
 colour. Stems intricately entangled at the base, simple or slightly
 branched, flexuose, of rather firm texture, cortical cells about 50
 in circumference, the 3 to 4 outer layers of cells smaller and

narrower than the centre ones and deep purple in colour, inner hyaline 10-12 cells in diameter, all very small; procumbent or somewhat erect. Leaves imbricate or approximate, horizontal to patent-divergent, somewhat regular, unequally bilobed, margins spinose-ciliate or denticulate, antical lobe about half the size of the postical, nearly or not quite crossing the stem, convex, subquadrate, acute; postical lobe obovate or broadly oval, rotundate; epidermis smooth; cells small, roundish-quadrate or roundish-oblong-quadrate, guttulate; walls and angles thickened. Bracts much larger than the leaves, unequally bilobed, antical lobe about $\frac{1}{3}$ smaller than the postical, oblong-quadrate, rotundate, obtuse, margin spinose-ciliate or denticulate; postical similar to the leaf lobe. Perianth projecting $\frac{2}{3}$ beyond the bracts, oblong, mouth wide, distantly denticulate or shortly ciliate. Capsule dark reddish-brown, thick texture. Spores smooth, pale reddish-brown. Elaters reddish-brown, bispiral. Androecia terminal on stems; perigonial bracts 2, 3 pairs, unequally bilobed, antical lobe smaller than the postical, ovate-orbicular; postical obovate. Antheridia 3 in each bract, very large, oval.

Fruits April, May, June.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .2 mm. diam., with leaves 1.75 mm. wide; leaves, antical lobe .8 mm. \times .4 mm., postical 1.1 mm. \times .7 mm., antical .7 mm. \times .6 mm., postical 1.2 mm. \times .7 mm., antical .6 mm. \times .5 mm., postical 1.1 mm. \times .7 mm.; cells .02 mm., .02 mm. \times .015 mm., .02 mm. \times .01 mm., .02 mm. \times .025 mm.; bract, antical lobe 1.5 mm. \times .9 mm., postical 2. mm. \times 1.2 mm.; perianth 4. mm. \times 1.25 mm.; pedicel .2 mm. diam.; valves of capsule 1.25 mm. \times .55 mm.; spores .015 mm.; elaters .08 mm. \times .01 mm.; perigonial bract, antical lobe 1. mm. \times .9 mm., postical 1.5 mm. \times .9 mm.; antheridia .24 mm. \times .16 mm.

HAB.—On shaded rocks, Littlebeck, Eskdale, Yorkshire, *M. B. Slater*.

Found on the Continent, Mont-Dore, France, *E. Lamy*.

OBS.—Mr. Slater collected this species many years ago, and detected with his usual acuteness the characters which separated it from *S. nemorosa* on the one hand and *S. umbrosa* on the other.

Specimens were submitted to his friend, the late Dr. Spruce, who gave it a MS. name which, however, was never published.

In Part I. of Husnot's "Hep. Gall." p. 22, it is published as *S. nemorosa*, var. *intermedia*, and on Plate 111, Fig. 23, given as *S. intermedia*.

Abbé Lamy, in "Revue Bryol." p. 54 (1876), says he has observed this species growing in several ravines about Mont-Dore under different conditions, where it retains a perfect conformity of aspect and character, distinguishing it no less from *S. umbrosa* than from *S. nemorosa*, and he considers it well deserving of specific rank, and approves of the name *intermedia*.

The acute antical lobe separates it from *S. nemorosa* and the rotundate postical lobe from *S. umbrosa* at once.

Note on *Scapania intermedia*, Husn., by Mr. M. B. Slater :

"*Scapania intermedia*, Husn., approaches in some of its characters to *S. purpurascens* (Hook.); it is, however, a smaller plant, and resembles more a broad-leaved *S. umbrosa*; in cell structure and shape of leaf lobes it much resembles *S. purpurascens*.

"It is generally of a pale rosy colour, often whitish, and never assumes the fine purple colour of some of the forms of *S. purpurascens*.

"The latter plant grows very abundantly in the tributary streams of the Esk and other moorland rivulets on the North Yorkshire moors, growing on stones by the stream sides, which are often inundated during flood times, and it grows most luxuriantly on stones where the water is constantly trickling over its roots, assuming fine rosy and purple hues in places exposed to sunlight, becoming greener under the shade of the stream banks or under trees.

"*S. intermedia* always grows on drier rocks out of the stream, often in company with *S. umbrosa*, *Diplophyllum albicans*, and *Harpanthus scotatus*. The name is very appropriate to the plant, indicating its intermediate character between *S. umbrosa* and *purpurascens*."

DESCRIPTION OF PLATE XCI.—Fig. 1. Plants natural size. 2. Stem, antical view $\times 16$. 3-7. Leaves $\times 24$. 8. Portion

of the margin of leaf $\times 85$. 9. Portion of leaf $\times 290$. 10. Bract $\times 16$. 11. Perianth and bract $\times 11$. 12. Perigonial bract, explanate $\times 24$ (Littlebeck, Eskdale, M. B. Slater).

13. *Scapania irrigua* (Nees), Dum.

Jungermania irrigua, Nees, Nat. Eur. Leb. 1, p. 193 (1833).

Scapania irrigua, Dum. Recueil, p. 15 (1835).

Dioicous; in spreading tufts or creeping loosely amongst *Sphagna*, medium size, of a pale green or brownish colour. Stems ascending or prostrate, lax, rooting up to the apex, simple or slightly branched. Leaves horizontally inserted, distant or approximate, lax, divided unequally to about the middle into two lobes, entire, or the upper leaves sometimes distantly denticulate; antical lobe about half the size of the postical, convex, subquadrate or sub-rotund, acute or sub-mucronate; postical lobe subquadrate to sub-rotund, acute or sub-mucronate; texture delicate, cells smallish to moderate in size, roundish, angles slightly thickened. Perianth obovate to oval, mouth dentate. Perigonial stems with bracts subimbricate, ventricose at the base; antheridia numerous, sometimes 4 in each bract.

The plant is sometimes gemmiparous; gemmæ small, greenish, at the margin of the upper leaves.

Fruits April, May.

DIMENSIONS.—Stems from $\frac{1}{2}$ to 1 inch long, .3 mm. diam., with leaves 2 mm. to 3 mm. broad; leaves, antical lobe 1 mm. \times 1.2 mm., .7 mm. \times 1 mm., .6 mm. \times .8 mm.; postical lobe 1.4 mm. \times 1.8 mm., 1 mm. \times 1.3 mm.; cells .025 mm. \times .03 mm., .025 mm. \times .025 mm.; perianth 2 mm. long \times 1.3 mm. broad, 1.6 mm. \times .9 mm.

HAB.—Growing in swampy places or on wet banks. Somewhat rare.

1. Marazion Marsh; Trungle Moor; Chyanhal; Tremethick Moor, West Cornwall, *W. Cornow* (as *Scapania uliginosa*, Trans. Penz. N. H. Soc. 1881–82). 2. New Forest, *C. Lyell*. Guestling near Hastings, *Rev. E. N. Bloomfield*. 5. Shirley Heath,

Warwickshire, *J. E. Bagnall*. Gospel End; Newborough; Abbot's Bromley; Arley Wood; Swynnerton; Leek; Cloud, Staffordshire, *J. E. Bagnall*. 7, 8. Kinder Scout, Derbyshire, *Holt & Whitehead*. 9. Morley Common; Walton Swamp, *W. Wilson*. Oakmere, *G. A. Holt*. 10. Strensall Common, Yorks, *G. Stabler*. 12. Foulshaw Moss, *J. M. Barnes & G. Stabler*. Staveley, Westmorland, *G. Stabler*. Injebreck, Isle of Man, *G. A. Holt*. 13. Barend Moss, Castle-Douglas, *J. McAndrew*. 15, 16. Moidart, West Inverness, *S. M. Maccicar*.

I. Cromaglow; Benbulbin, Co. Sligo; Loch Bray, *Dr. D. Moore*.

Found on the Continent.

Obs.—This species, which appears to be more peculiar to low-lying localities, is distinguished from *S. undulata* by its subquadrate, acute leaf-lobes. A small form, growing in drier stations than the normal form, may be confounded with *S. curta*, but it may be separated by its stouter habit and the more quadrate shape of the leaf lobes.

DESCRIPTION OF PLATE XCII.—Fig. 1. Plants natural size. 2. Stem $\times 16$ (G. & R. n. 507). 3. Portion of stem $\times 16$ (Thed. Ex. n. 147, as *Jung. uliginosa*). 4. Male stem $\times 24$ (Cheshire, Wilson). 5. Stem $\times 16$ (Essex). 6. Perigonal bract with antheridia $\times 24$ (Foulshaw Moss, Barnes). 7. Leaf $\times 16$ (Husn., Hep. Gall. n. 102). 8. Perianth $\times 24$ (G. & R. n. 319). 9. Mouth of perianth $\times 31$ (Cheshire, Wilson). 10. Portion of leaf $\times 290$ (G. & R. n. 319).

14. *Scapania uliginosa* (*Swartz*), *Dum.*

Jungermania uliginosa, Sw. in Lindenb. Syn. Hep. p. 59 (1829).

Radula uliginosa, Dum. Syll. Jung. p. 40 (1831).

Scapania uliginosa, Dum. Recueil, p. 14 (1835); Nees in G. L. N. Syn. Hep. p. 67 (1844).

Plagiochila uliginosa, M. & N. in Nees, Hep. Eur. 111, p. 522 (1838).

Dioicous; in loose tufts or often floating in boggy places, large, brown to reddish olive green in colour, when dry dark

brown. Stems simple or slightly branched; leaves regular, sub-transversely inserted, distant to approximate, deeply divided into two lobes, margin entire or rarely minutely and distantly denticulate, antical lobe about $\frac{1}{3}$ rd smaller, reniform, arched, decurrent, incumbent, convex, postical lobe subrotund, a little reflexed; cells rather large, sometimes elongate, hexagonal, walls thin. Bracts similar to the leaves. Perianth obovate, mouth wide, entire, rarely minutely denticulate; spores smooth, pale brown; elaters reddish-brown. Male stems somewhat similar to others; perigonial bracts imbricate, ventricose, lobes more equal.

Fruits May, June.

DIMENSIONS.—Stems 2 to 4 inches long, .2 mm. to .4 mm. diam., with leaves 2.5 mm. to 3.5 mm. broad; leaves, antical lobe .9 mm. \times .9 mm., .7 mm. \times .7 mm., .4 mm. \times .6 mm., postical 1.9 mm. \times 2.2 mm., 1.9 mm. \times 1.75 mm., 1.5 mm. \times 1.25 mm.; cells .05 mm. \times .03 mm., .04 mm. \times .035 mm.; perianth 3.5 mm. \times 1.75 mm., 1.5 mm. \times 1 mm.; valves of capsule 1.4 mm. \times .65 mm.; spores .02 mm.; elaters .08 mm. long \times .01 mm. broad.

HAB.—Grows on wet rocks and in swampy places in subalpine and alpine districts. Rare.

7. Clogwyn du Arddu, Snowdon, Carnarvonshire, *G. A. Holt*, 1883. Nant Francon, Carnarvonshire, *Dr. Carrington & W. H. P.*, 1886. 10. Bog, south of Ingleboro', Yorks, *Dr. Carrington*, 1857. 15. Ben Mac Dhui, *A. Croall, W. West, T. Rogers*. Ben Lawers, *G. A. Holt, W. West*. 16. Loch Rannoch, *Dr. Carrington*. Moidart, West Inverness, *S. M. Maccicar*.

I. Knockavoila, *Dr. Taylor*. Lough Bray, *Dr. D. Moore*. Near the Hunting Tower, Cromaglow, *Dr. D. Moore*. Connor Hill, Co. Kerry, *Dr. D. Moore*.

Found on the Continent.

OBS.—A few fine teeth are to be observed on the leaves and at the mouth of the perianth of some specimens when highly magnified. The only species with which *S. uliginosa* can be confounded are *S. undulata* and *S. irrigua*, and from the former it may be distinguished by its very reniform antical lobe, which

retains, all the length of the stem, its relatively small size; in *S. undulata* the two lobes usually become more equal near the apex, the cells are usually larger and the leaves more delicate; in *S. irrigua* the postical lobe is more or less acute, the antical never reniform, and the lobes are more equal in size.

DESCRIPTION OF PLATE XCIII.—Fig. 1. Plants natural size.
 2. Portion of stem, antical view $\times 24$ (Lapland, S. O. L.).
 3. Portion of stem, postical view $\times 24$ (Ben Lawers, West).
 4. Portion of leaf $\times 290$. 5. Perianth $\times 31$ (510, G. & R.).

15. *Scapania rosacea* (Corda), Dum.

Jungermania rosacea, Corda in Sturm, Deutschl. Fl. 11, xxli.–xxliii. p. 96, f. 29 (1832).

Scapania rosacea, Dum. Recueil. p. 14 (1835).

Plagiochila rosacea, M. & N. in Nees, Nat. Eur. Leberm. 111, p. 525 (1838).

Scapania curta, var. *rosacea*, Carr. Brit. Hep. p. 87 (1874–76).

Dioicous; caespitose; small; claret coloured. Stems simple or rarely sparsely innovant, erect or erecto-decumbent, somewhat tender and fleshy; radiculose, rootlets dirty-white. Leaves approximate, patent-divergent, distichous, unequally bilobed, postical lobe obliquely obovate, cultriform, shortly cuspidate or apiculate, plane or slightly concave, antical lobe much smaller, subquadrate, obliquely ovate to cuneiform, acute, ascending; margin quite entire; epidermis smooth, texture somewhat lax; cells small, roundish, walls and angles thickened, no trigones. Bracts rather larger than the leaves, with apices of the lobes more rounded. Perianth projecting about half way beyond the bracts, ovate-oblong, compressed, subplicate, mouth truncate, entire or slightly irregular. Male stems rather smaller; perigonal bracts on the upper half, approximate or imbricate, erecto-patent, more equally bilobed than the leaves, lobes more rounded, swollen at the base; antheridia large, roundish-oval.

Fruits March, April, May.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, 3 mm. thick, with leaves 1.5 mm. to 2 mm. broad; leaves, antical lobe .6 mm. long

by $\cdot 4$ mm. broad, postical $\cdot 8$ mm. \times $\cdot 4$ mm., antical $\cdot 6$ mm. \times $\cdot 3$ mm., postical $\cdot 9$ mm. \times $\cdot 5$ mm.; cells $\cdot 02$ mm.; bracts, antical lobe $\cdot 7$ mm. \times $\cdot 5$ mm., postical $\cdot 9$ mm. \times $\cdot 6$ mm.; perianth $1\cdot 75$ mm. long by $\cdot 75$ mm. broad; pistillidia $\cdot 75$ mm. \times $\cdot 3$ mm.; perigonal bract, antical lobe $\cdot 6$ mm. \times $\cdot 4$ mm., postical $\cdot 8$ mm. \times $\cdot 5$ mm.; antheridia $\cdot 2$ mm.

HAB.—On damp shady rocks. Rare.

9. By the side of a stream, Woodhead, Cheshire, *J. Whitehead* & *W. H. P.*, July 1880. Alderley Edge, Cheshire, *G. A. Holt*, March 1883. 12. Kentmere, Westmorland, *Rev. H. W. Lett*, August 1899. 13. New Galloway, *J. McAndrew*. 15. Sculty, near Strachan, *J. Sim*, March 1886. 16. Moidart, West Inverness, *S. M. Maccicar*, 1898.

Found on the Continent.

Obs.—This is a pretty little species and quite distinct from *S. curta* (Mart.). Whether it is the true *Jung. rosacea* of Corda is doubtful, for it does not agree with the figure given in Sturm's *Deutschl. Flora*, which seems to represent some small form of *S. undulata*.

S. rosacea is at once distinguished from *S. curta* by its rather larger size and beautiful rosy or claret-coloured foliage. The stems are somewhat succulent and tender, which character alone separates it from any of the small forms of the other British *Scapania*.

DESCRIPTION OF PLATE XCIV.—Fig. 1. Plants natural size. 2. Portion of stem $\times 31$ (Woodhead, Cheshire). 3. Leaf $\times 31$ (ditto). 4, 5. Leaves, explanate (ditto). 6. Portion of leaf $\times 290$ (Helsingfors, S. O. Lindberg). 7. Bract $\times 31$ (Woodhead, Cheshire). 8. Bract, explanate $\times 31$ (ditto). 9. Perianth $\times 31$ (ditto).

16. *Scapania curta* (Mart.), Dum.

Jungermania curta, Mart. Fl. Crypt. Germ. 1, p. 148, t. iv. f. 24 (1817).

Jungermania nemorosa, var. *denudata*, Hook. Brit. Jung. t. xxi. ff. 17-19 (1816).

Radula curta, Dum. Syll. Jung. p. 40 (1831).

Scapania curta, Dum. Recueil, p. 14 (1835).

Plagiochila curta, M. et N. in Nees Nat. Eur. Leberm. iii. p. 525 (1838).

Dioicous, loosely caespitose, minute, yellowish-green to light-brown. Stems procumbent, simple or subramose, radiculose. Leaves from patent to patent-divergent, 50° to 70° , approximate, subimbricate, accrescent, entire or slightly dentate, to about the middle unequally bilobed, complicate, postical lobe much larger than antical, oblong-oval, acute, antical lobe usually more erect, longer than broad, suboblong-quadrate, acute; cells small, roundish, angles of cells thickened, trigones distinct, epidermis smooth. Bracts similar to leaves, only larger. Perianth longish obovate, slightly folded above, mouth irregularly dentate. Antheridia terminal on separate stems, perigonial bracts 4-6 pairs, lobes subequal, antheridia oval.

Fruits April, May. Capsules extremely rare.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, diam. $\cdot 2$ mm., with leaves $2\cdot$ mm. broad; leaves, antical lobe $\cdot 8$ mm. broad \times $\cdot 4$ mm. high, $\cdot 9$ mm. \times $\cdot 4$ mm., $\cdot 6$ mm. \times $\cdot 3$ mm., postical lobe $1\cdot 1$ mm. broad \times $\cdot 6$ mm. high, $1\cdot 2$ mm. \times $\cdot 6$ mm., $\cdot 9$ mm. \times $\cdot 5$ mm.; cells $1\cdot 50$ mm. \times $\cdot 02$ mm.; bract, antical lobe $1\cdot$ mm. broad \times $\cdot 6$ mm. high, postical lobe $1\cdot 2$ mm. \times $\cdot 8$ mm.; perianth $3\cdot 5$ mm. long \times $1\cdot 5$ mm. broad.

HAB.—Grows on beaten paths and shady banks in woods, &c. Generally distributed.

2. Sussex, *W. Mitten*. Ardingley Rocks, Sussex, *G. E. Davies*.
 3. Epping Forest, *E. M. Holmes*. 5. Gospel End Common; Seekley Wood, Staffordshire, *J. E. Bagnall*. 7. Cader Idris, Merionethshire, *C. J. Wild* & *G. A. Holt*. Tyn-y-Groes, Merionethshire, *W. H. P.* Snowdon, Carnarvonshire, *G. E. Hunt*.
 8. Near Woodhead, Derbyshire, *G. A. Holt*. 9. Staley Brushes, Cheshire, *W. Stanley* & *C. J. Wild*. Barton Moss, Lanc., *Dr*

Carrington. Easegill, West Lanc., *J. A. Wheldon*. 10. Rigton Hill, *Dr. F. A. Lees*. Idle Woods, *Dr. Carrington*. Yeadon, *Dr. Carrington*. Shipley Glen, *W. West*. Near Bingley, *W. West*. Newsholme Dean, *W. West*. 12. By the highway side, Staveley, Westmorland, *G. Stabler*. 14, 15. Trossachs, *J. Cruickshank*. Near Stirling, *Dr. Greville*. Ben Mac Dhui, *A. C. Black*. Forfar Burn, *A. Croall*. 16. Moidart, West Inverness, very little seen, *S. M. Maccicar*.

I. Sillaghbraes and Sleemish Mountain, Co. Antrim; Gleniff, Co. Leitrim; Benbulbin Range, Sligo; Cromaglowm; near Letterfrack, Co. Galway, *Dr. D. Moore*. Slieve Glah, Co. Cavan, *D. McArdle*.

Found on the Continent and in North America.

OBS.—A pretty little species, the smallest of our British *Scapania*; it can be confused only with immature forms of other species, and if found with either ♂ or ♀ can be easily identified by the description.

Jungermania Conradi Corda, according to original specimens, is a small imperfect form of this species.

DESCRIPTION OF PLATE XCV.—Fig. 1. Plants natural size. 2. Stem × 24 (Sweden, Lindb.). 3. Stem × 24 (G. & R. 651). 4–8. Leaves × 24 (ditto). 9. Portion of leaf × 290 (Sweden, Lindb.). 10. Bract × 24 (G. & R. 651). 11. Perianth × 11 (Sweden, Lindb.).

17. *Scapania umbrosa* (*Schrad.*), *Dum.*

Jungermania convexa, Scopoli, Flora Carnolica, 2nd ed. p. 349, sp. 1348 (1772) (?).

Jungermania umbrosa, Schrad. Syst. Samml. Krypt. Gew. 2, p. 5 (1797); Hook. Brit. Jung. t. 24 (1816).

Radula umbrosa, Dum. Comm. Bot. p. 112 (1823).

Scapania umbrosa, Dum. Recueil, p. 14 (1835); Howe, Hep. & Antho. California, Mem. Torrey Bot. Club, vol. vii. p. 153 (1899).

Plagiochila umbrosa, Mont. et Nees in Nees Eur. Leberm. iii. p. 525 (1838).

Martinellia convexa, Lindb. Musci. Scand. (1879).

Scapania convexa (Scop.), Pears. List. Can. Hep. 15 (1890).

Dioicous, cæspitose, of a yellowish or dark green to brown

colour. Stems ascending, subramose above, branches subfalcate, radiculose. Leaves imbricate or approximate, patent to patent-divergent (60°), complicate, unequally bilobed to about the middle serrate to the upper half, antical lobe $\frac{1}{3}$ to $\frac{1}{2}$ smaller, roundish, ovate, acute, erect, incumbent, postical lobe oval or obovate, acute, convex, subsecund, epidermis smooth, cells guttulate, smallish, roundish or roundish-oblong, cell-walls thick, trigones distinct. Bracts similar, only larger. Perianth oblong, truncate, mouth entire. Capsule oval, dark reddish-brown. Spores pale brown, minute. Elaters short, thick, dark reddish-brown. Perigonial stems with leaves closely imbricate, lobes smaller, more equal, slightly ventricose, antheridia oval.

Fruits April, May.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, diam. $\cdot 3$ mm., with leaves $1\cdot 5$ mm. broad; leaves, antical lobe $\cdot 85$ mm. \times $\cdot 45$ mm., $1\cdot 2$ mm. \times $\cdot 575$ mm.; cells $\cdot 03$ mm. \times $\cdot 02$ mm.; walls $\cdot 005$ mm. thick; bracts, antical lobe $1\cdot 05$ mm. \times $\cdot 5$ mm., postical $1\cdot 3$ mm. \times $\cdot 7$ mm.; perianth $1\cdot 6$ mm. \times $\cdot 65$ mm.; pistillidia $\cdot 2$ mm. \times $\cdot 04$ mm.; capsule $\cdot 7$ mm. \times $\cdot 55$ mm.; spores $\cdot 015$ mm. diam.; elater $\cdot 08$ mm. \times $\cdot 015$ mm.; antheridia $\cdot 09$ mm. \times $\cdot 06$ mm.

HAB.—Grows on rocks and rotting wood in shady woods and by the sides of streams. Rare.

1, 2, 5. Ordesley Wood; Mayfield; Dimmings Dale, Staffordshire, *J. E. Bagnall*. 7. Dolgelly, Merionethshire, *C. J. Wild & W. H. P.* Festiniog, Merionethshire, *Dr. Carrington & W. H. P.* 8. Woodhead, Derbyshire, *J. Whitehead & W. H. P.* 10. Bolton Woods, *Dr. Carrington & G. A. Holt, W. H. P.* Goathland, *M. B. Slater & W. H. P.* 12. On decaying trees, Naddle Forest, Mardale, Westmorland, *G. Stabler*. 16. Moidart, West Inverness, common on partly buried rocks and on stumps in ravines and shady woods; this pretty species is very fine in this district, *S. M. Macvicar*.

I. Nr. Dublin, *Dr. Taylor*. Loeh Bray, Wicklow; Kylemore, Co. Galway; Killarney Woods, frequent; Brandon, Co. Kerry, *Dr. D. Moore*. Killarney, *Dr. Carrington*.

Found on the Continent and in North America.

Obs.—One of the most distinct species of this genus, smaller than most of them, but more robust than *S. curta*; its colour and the acute serrated leaf-lobes distinguish it from them all.

The late Prof. Lindberg, in his "Musc. Scand." (1879), stated that the *Jung. umbrosa* of Schrader (1797) was without doubt the same as the *Jung. convexa* of Scopoli (1772), so along with others I adopted the older name. Prof. Howe, in his admirable "Hepaticæ and Anthocerotæ of California," says, "it is very probable that it may be so, yet, as Scopoli describes the perianth as oval and dentate at the apex, while those of *S. umbrosa* are oblong and entire at the mouth, we prefer to retain for this species a name concerning the correct application of which we can have no doubt," so I gladly follow my friend Prof. Howe in retaining this very characteristic one.

DESCRIPTION OF PLATE XCVI.—Fig. 1. Plants natural size. 2. Stem \times 31 (15, Austin, Amer. Hep.). 3–7. Leaves \times 24 (20, C. & P. Hep. Brit.). 8. Portion of leaf \times 290 (Woodhead, Whitehead & W. H. P.). 9. Bract \times 31 (Husn., Hep. Gall. n. 66). 10. Perianth \times 24 (Goathland, W. H. P.). 11. Pistillidia \times 85 (Husn. Hep. Gall. n. 66). 10. Perigonial bract \times 31 (Woodhead, Whitehead & W. H. P.). 13. Antheridium \times 85 (ditto).

Genus 21. **DIPLOPHYLLUM**, *Dum.*

Jungermania, Mich. Nov. Pl. Gen. p. 8, tab. 5, fig. 9 (1729); Linn. Fl. Suec.

1st ed. p. 335 (1745); Hook. Brit. Jung. (1816).

Diplophyllum, Dum. Recueil, 1, p. 15 (1835).

Scapania, Mitt. in Hook. Fl. Tasm. 2, p. 233 (1858).

Branches axillary, proceeding from the inner base of the leaves. Leaves conduplicate, unequally bilobed, the antical lobe smallest. Stipules absent. Involucral bracts small, similar to the leaves. Bracteole absent. Perianth free, sessile, erect, terete, subcylindrical, pluriplicate, mouth denticulate. Capsule coriaceous, 4-valved.

1. *Diplophyllum albicans* (L.), Dum.

Hepaticoides albescens foliis pinnatis, Vaill. Bot. Par., p. 100, t. 19, f. 5 (1723).

Jungermania repens foliis cordatis carinatis, Mich. Nov. pl. gen. p. 8, t. 15, f. 9 (1729).

Lichenastrum auriculatum, pinnulis angustis planis recurvis, Dill. Hist. Musc., p. 492, t. 71, f. 20 (1741).

Jungermania albicans, Linn. Sp. pl. p. 1599 (1753), Hook. Brit. Jung. t. 25 (1816).

Diplophyllum albicans, Dum. Recueil, p. 16 (1835).

Dioicous ; growing in loose or matted tufts, medium size, of a green, greenish-brown, or often reddish-brown colour, as if singed. Stems simple or subramose, ascending ; radiculose, rootlets short, close, dirty-white, ascending to apex of stem. Leaves bifarious, contiguous, conduplicate, unequally divided to about the $\frac{1}{4}$, vittate, margin entire or subdenticulate, often erose ; antical lobe half the size of the postical, incumbent, 30° – 40° , lanceolate, acute or rounded ; postical lobe slightly ascending 60° – 80° , lanceolate or ovate-lanceolate, acute or rounded, cells subquadrate, small or rather minute, cell-walls thick, no trigones. Bracts similar to leaves, only larger. Perianth terminal, obovate, 5-plicate at the upper portion, mouth contracted, laciniate-dentate, hyaline.

Perigonal bracts in the middle or at the end of the stem, usually 4 to 6 pairs, often a little smaller, more erect ; antheridia 1 or 2 in the swollen base of the antical lobe, oval, very large.

Fruits March, April.

DIMENSIONS.—Stems from $\frac{1}{4}$ inch to 2 inches long, diam. $\cdot 2$ mm. to $\cdot 5$ mm. ; leaves, antical lobe $1\cdot 5$ mm. \times $\cdot 5$ mm., postical $1\cdot 75$ mm. \times $\cdot 75$ mm., antical $\cdot 6$ mm. \times $\cdot 25$ mm., postical $\cdot 9$ mm. \times $\cdot 4$ mm. ; cells $\cdot 0175$ mm., $\cdot 02$ mm. ; bract, antical lobe $1\cdot 25$ mm. \times $\cdot 5$ mm., postical $1\cdot 7$ mm. \times $\cdot 75$ mm. ; perianth $2\cdot 5$ mm. \times $1\cdot 5$ mm. ; perigonal bract, antical lobe $\cdot 75$ mm. \times $\cdot 5$ mm. ; postical lobe $1\cdot 24$ mm. \times $\cdot 5$ mm. ; antheridia $\cdot 3$ mm. \times $\cdot 2$ mm.

HAB.—Grows everywhere, on rocks and banks in shady woods or by roadsides, on the ground or walls ; very common, from the lowlands to considerable heights. 1 to 18. I. C.

Found on the Continent, Madeira, North and South America,

Obs.—This is the commonest species known, being at once recognised by the presence in the antical and postical lobes of a pseudo-nerve, which is often colourless, and consists of a series of from 4 to 6 elongated cells, a cross-section of the leaf showing the cells to be of equal diameter with others, the outer wall only thickened considerably.

DESCRIPTION OF PLATE XCVII.—Fig. 1. Plant natural size. 2. Stem \times 24 (Nova Scotia, Macoun). 3, 4. Leaves \times 16 (Killarney, Lindberg). 5. Portion of leaf \times 290 (ditto). 6. Cross-section of leaf \times 85 (France, Du Buysson). 7. Bract \times 24 (ditto). 8. Perianth \times 24 (ditto). 9. Portion of mouth of perianth \times 85 (C. & P. Hep. Brit. Ex. n. 220). 10. Perigonial stem \times 60 (ditto). 11. Perigonial bract \times 24 (ditto).

2. *Diplophyllum taxifolium* (Wahlenb.), Dum.

Jungermania taxifolia, Wahlenb. Fl. Lapp. p. 383, t. 25, f. A–C. (1812).

Jungermania albicans, var. *taxifolia*, Nees, Nat. Eur. Leb. 1, p. 228 (1833).

Diplophyllum taxifolium, Dum. Recueil, p. 16 (1835).

Dioicous; growing in dense, depressed tufts, small to medium size, of a greenish to reddish-brown colour. Stems simple or ramose, sub-erect to erect, radiculose. Leaves bifarious, a little distant or contiguous, conduplicate, unequally divided to below the middle, margin entire or minutely denticulate, antical lobe about $\frac{1}{2}$ to $\frac{1}{3}$ the size of the postical, incumbent, patent to patent-divergent, 40° – 60° , oblong-oval to ovate, rotundate; postical lobe spreading at right angles or slightly ascending, divergent or horizontal, 80° – 90° , oblong-oval to lanceolate; cells minute to rather minute, subquadrate, cell-walls thick, no trigones. Bracts similar to the leaves, larger. Perianth terminal, obovate, upper portion 5-plicate, mouth contracted, laciniate-denticulate. Pistillidia about 20.

The male plant I have not seen.

Fruits May, June.

DIMENSIONS.—Stems from $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diameter $\cdot 3$ mm.; leaves, antical lobe 1 mm. \times $\cdot 4$ mm., postical 1 \cdot 25 mm. \times $\cdot 5$ mm.,

antical $\cdot 7$ mm. \times $\cdot 35$ mm., postical $1\cdot 1$ mm. \times $\cdot 4$ mm.; cells $\cdot 015$ mm. bracts, antical lobe $1\cdot 1$ mm. \times $\cdot 6$ mm., postical $1\cdot 4$ mm. \times $\cdot 6$ mm.; perianth $1\cdot 75$ mm. \times $\cdot 9$ mm., $2\cdot 25$ mm. \times $1\cdot 25$ mm.; pistillidia $\cdot 2$ mm. \times $\cdot 05$ mm.

HAB.—On rocks in alpine situations.

7. The Glyders, Carnarvonshire, *W. Wilson*, 1844. 15. Ben Lawers, Perthshire, *Rev. C. H. Binstead*, identified and comm. by *G. A. Holl*. 16. Moidart, West Inverness, *S. M. Maccicar*.

In similar localities on the Continent, in North America and Canada.

Obs.—This species has usually been considered a variety of the previous one, but Prof. Lindberg regarded it as distinct, its neater habit, generally smaller and more graceful form, the direction of the postical lobe being more horizontal, the lobes generally more rounded, the absence of the pseudo-nerve—although traces are sometimes observable—sustain this view.

DESCRIPTION OF PLATE XCVIII.—Fig. 1. Plants natural size. 2. Stem $\times 16$ (Thed. 197). 3. Portion of stem $\times 31$ (Norway, Lindberg). 4. Leaf $\times 24$ (ditto). 5. Portion of leaf $\times 290$ (ditto). 6, 7. Bracts $\times 24$ (ditto). 8. Perianth $\times 24$ (ditto). 9. Portion of mouth of perianth $\times 85$ (ditto). 10. Pistillidium $\times 85$ (ditto).

3. *Diplophyllum obtusifolium* (Hook.), Dum.

Jungermania obtusifolia, Hook. Brit. Jung. t. 26 (1816).

Diplophyllum obtusifolium, Dum. Recueil, p. 16 (1835).

Paroicous or monoicous, densely cæspitose, small, green, greenish-brown or brown in colour. Stems simple or innovantly branched, postical side of stem often of a reddish tinge, sub-erect or ascending; radiculose up to apex, rootlets thick, dense, long, hyaline. Leaves accrescent, bifarious, imbricate, conduplicate, unequally bifid to about the middle, margin minutely denticulate or entire, antical lobes 2 or 3 times smaller than the postical, incumbent, erect or erect-patent (10° – 20°), ovate or oblong, obtuse or acute, postical lobe horizontal or slightly ascending (90° – 80°),

concave, slightly undulate, subaciniciform or oblong, obtuse or sometimes slightly apiculate; cells small, quadrate, guttulate, near base in postical lobe elongate, cell-walls thick, no trigones. Bracts somewhat similar to the leaves, but larger. Perianth projecting from about $\frac{1}{3}$ to $\frac{1}{2}$ beyond the bracts, terminal, obovate or oblong-ovate, upper portion 5-plicate, mouth contracted, laciniate, irregularly dentate or denticulate. Capsule oval; spores reddish-brown; elaters bispiral, same colour. Antheridia situated in the base of the bracts or on branches proceeding from base of perianth, small, one or two in each bract.

Fruits April, May.

DIMENSIONS.—Stems about $\frac{1}{4}$ inch long, diameter $\cdot 15$ mm. to $\cdot 175$ mm.; upper leaves, antical lobe $\cdot 6$ mm. \times $\cdot 4$ mm., postical lobe $1\cdot$ mm. \times $\cdot 5$ mm., antical $\cdot 5$ mm. \times $\cdot 3$ mm., postical $\cdot 9$ mm. \times $\cdot 4$ mm.; lower leaves, antical lobe $\cdot 4$ mm. \times $\cdot 25$ mm., postical $\cdot 7$ mm. \times $\cdot 3$ mm.; cells $\cdot 015$ mm. \times $\cdot 02$ mm., $\cdot 025$ mm., basal cells $\cdot 05$ mm. \times $\cdot 02$ mm., $\cdot 04$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 02$ mm.; bracts, antical lobe $1\cdot$ mm. \times $\cdot 6$ mm., postical $1\cdot 3$ mm. \times $\cdot 7$ mm.; perianth $2\cdot$ mm. \times $1\cdot$ mm.; capsule $\cdot 9$ mm. \times $\cdot 6$ mm.; spores $\cdot 01$ mm. diam.; elaters $\cdot 1$ mm. \times $\cdot 01$ mm.; perigonal bracts, antical lobe $\cdot 5$ mm. \times $\cdot 4$ mm., postical $\cdot 9$ mm. \times $\cdot 5$ mm.

HAB.—Grows on shady banks and in old quarries, in company with *Scapania rosacea* and *Jung. bicrenata*. Rare.

7. Tyn-y-Groes, Merionethshire, *G. A. Holt*, May 1885. 9. Delamere, Cheshire, *Wilson & Carrington*. 10, 11. Near Heddon on the Wall, Northumberland, *Mr. Thornhill*. 15. Gate-side, Strachan, Perthshire, *J. Sim*, June 1879. 16. Glen Finnan, *Dr. Carrington*, July 1876. Moidart, West Inverness, *S. M. Macvicar & W. H. P.*, 1899.

I. Near Bantry, Co. Cork, *Miss Hutchins*. Near Dunkerron, Co. Kerry, *Dr. Taylor*; Dunscome's Wood, near Cork, *W. Wilson*.

Generally distributed on the Continent. North America.

Obs.—Although *Dr. Hooker* had an impression that the species was dioicous, it is truly paroicous or monoicous, and this character, along with its small size, distinguishes it from any form of *Diplo-*

phyllum taxifolium, for which it has been mistaken by Austin and others.

DESCRIPTION OF PLATE XCIX.—Fig. 1. Plants natural size (Eng. Bot. 2511). 2. Portion of stem \times 24 (Glen Finnan, Dr. Carrington). 3. Portion of stem \times 31 (ditto). 4. Portion of fertile stem \times 24 (Delamere, Wilson & Carrington). 5. Upper leaf \times 24 (Tyn-y-Groes, Holt). 6. Upper leaf \times 24 (Hb. Tayl.). 7, 8. Lower leaves flattened out \times 24 (ditto). 9. Portion of leaf \times 290 (Delamere, W. & C.). 10. Portion of leaf, near base \times 290 (ditto). 11, 12. Bracts \times 24 (Hb. Tayl.). 13. Perianth \times 24 (ditto). 14. Portion of mouth of perianth \times 85 (ditto). 15. Spores \times 290 (ditto). 16. Perigonial bract \times 24 (Tyn-y-Groes, Holt).

4. *Diplophyllum Dicksoni* (Hook.), Dum.

Jungermania ovata, Dicks. Pl. Crypt. Brit. iii. p. 11, t. 8, f. 6 (1793);? Lindb.

Musci Scand. p. 7 (1879).

Jungermania Dicksoni, Hook. Brit. Jung. t. 48 (1816).

Diplophyllum Dicksoni, Dum. Recueil, p. 16 (1835).

Dioicous, growing in loose patches or amongst mosses, small, of a pale yellowish-brown colour. Stems simple or rarely branched, innovant branches arising from base of bracts, apparently subpostical; radiculose, rootlets ascending to apex of stems, hyaline, long, delicate, stem slightly channelled antically, cortical cells about 40, more distinct than the inner, walls firmer, inner soft, and somewhat indistinct. Leaves transversely inserted or slightly ascending, antical lobe more erect, sometimes erect to erect-patent, equitant, contiguous or imbricate, to below the middle unequally bilobed, complicate, lobes lanceolate, acuminate, antical lobe smaller than the postical, margin entire, upper leaves slightly serrulate; cells smallish to medium, subquadrate or roundish, filled with nucleate bodies, cell-walls delicate, hyaline, trigones small. Bracts ovate, bifid to about the middle, segments lanceolate acuminate or obtuse, margin serrate. Perianth projecting about $\frac{1}{3}$ to $\frac{1}{2}$ beyond the bracts, oval fusiform, deeply

8-plicate to almost the base, composed of a single layer of cells, about 250 round, mouth slightly contracted, laciniate-ciliate. Perigonial bracts usually situated at the middle of the stem, little different from the ordinary; antheridia 2 at the base, oval.

Fruits April, May.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diameter .25 mm.; upper leaves, antical lobe 1.1 mm. \times .4 mm., postical lobe 1.6 mm. \times .6 mm.; lower leaves, antical lobe .8 mm. \times .4 mm., postical 1.1 mm. \times .4 mm., antical 1. mm. \times .35 mm., postical 1.1 mm. \times .4 mm.; cells .025 mm., .03 mm.; bracts 1.75 mm. \times 1.25 mm., 1.6 mm. \times 1.25 mm., segments 1.1 mm., .75 mm., .5 mm.; perianth 2. mm. \times 1.1 mm., lacinia of mouth .5 mm. long; pistillidia .15 mm. \times .05 mm.; perigonial bracts, antical lobe .9 mm. \times .3 mm., postical 1.1 mm. \times .5 mm.

HAB.—Grows in crevices of rocks and on the earth in shady, usually subalpine situations. Rare.

1. Dartmoor, *E. M. Holmes*. 7. Cwm Bychan, Merionethshire, *E. George*, *E. M. Holmes*. Tyn-y-Groes, Merionethshire, *C. J. Wild*. 9. Kinder Scout, Derbyshire, *J. Whitehead* & *G. A. Holt*. 10, 12. Staveley; Mardale; Little Langdale, Westmorland, *G. Stabler*. Isle of Man, *G. A. Holt*. “Found many years since in Scotland by Mr. Dickson” (*Hook. Brit. Jung.* 1816). 13. New Galloway, *J. McAndrew*. 15. Kinnordy, *C. Lyell*. Strachan, *J. Sim*. 16. Moidart, West Inverness, *S. M. Macvicar*.

I. Near Dublin, *Dr. Taylor*. Shauslieve, Mourne Mts., *Rev. H. W. Lett*, 1898.

Found on the Continent and in North America.

OBS.—*Dr. Hooker* wrote in his “*Brit. Jung.*”: “There are few naturalists to whom Cryptogamic botany is more indebted than to Mr. Dickson. In the genus *Juigermania* his numerous additions to the list of British species are well known. The present is one of many collected since the publication of the fourth fasciculus of his *Plantæ Cryptogamicæ* in the Highland mountains of Scotland, which he kindly communicated to me; and I have great pleasure in distinguishing it by his name.”

Prof. Lindberg states in "Mus. Scand." p. 7 that Dickson's original specimens of *Jung. ovata* Pl. Crypt. Brit. Fasci, 3, p. 11, t. 8, fig. 6 (1793) are identical, but evidently, from the above note by Dr. Hooker, neither he nor Dickson considered them the same, and as the description of Dickson is short and unsatisfactory, and the figure poor, I retain Hooker's name. *Diplophyllum Dicksoni* is a very distinct species, no other British one approaching it. *Diplophyllum argenteum* (Tayl.), Spruce, a North American species, is its nearest congener, but is distinguished by its serrate leaves, 12-plicate perianth, &c.

DESCRIPTION OF PLATE C.—Fig. 1. Plants natural size. 2. Portion of stem $\times 16$ (Dartmoor, E. M. Holmes). 3. Portion of fertile stem $\times 16$ (New Galloway, McAndrew). 4, 5. Upper leaves $\times 24$ (ditto). 6, 7. Leaves $\times 24$ (Dartmoor, Holmes). 8. Portion of leaf $\times 290$ (New Galloway, McAndrew). 9, 10. Bracts $\times 16$ (ditto). 11. Perianth $\times 24$ (Dartmoor, Holmes). 12. Cross-section of perianth, upper half $\times 24$ (ditto). 13. Portion of mouth of perianth $\times 31$ (ditto). 14. Ditto $\times 85$ (New Galloway, McAndrew). 15. Pistillidia $\times 85$ (ditto). 16, 17. Perigonial bracts $\times 24$ (Dartmoor, Holmes).

Subtribe VI. EPIGONEANTHÆ.

Genus 22. **LOPHOCOLEA**, *Dum.*

Jungermania, Mich. Nov. pl. gen. p. 8 (1729); L. Sp. pl. ed. 1, 2, p. 1132 (1753).

Jungermania sect. *Lophocolea*, Dum. Syll. p. 59 (1831).

Lophocolea, Dum. Recueil, p. 17 (1835).

Plants large, very rarely small or minute, soft and flaccid, green or whitish-green, when dry usually yellowish, with an unpleasant smell, rarely fragrant, growing more or less in shallow spreading layers. Stems creeping, with long whitish rootlets, equally leaved, vaguely branched, rarely subpinnate, moderately thick, in the more robust species about 7 cells in diameter; cells small, cortical quadrate or oblong, inner linear-prismatic. Branches

prostrate and radiculose or assurgent and sub-erect, all lateral or postico-lateral, eflagelliferous. Leaves moderately large, delicate, in all European species alternate, in several tropical ones opposite, succubous, antical margin much decurrent, postical shortly arcuately inserted, oblique, ovato-oblong or very often sub-triangular, apex broadly truncate, erect, exciso-bidentate or bi-apiculate, rarely perfectly explanate, often convex or decurvulate, rarely recurvo-secund; antical margin somewhat straight, principally recurved at the base, postical rotundate or somewhat straight, margin entire, or in a few species more or less serrulate, ciliate or spinose. Cells rather large or medium size, rarely small, leptodermous, in a few species with the angles thickened. Stipules everywhere present, 2-4 times shorter than the leaves, cuneate or subquadrate, bifid, sometimes unidentate on both sides. Inflorescence dioicous or monoicous (very rarely paroicous). Androecia on the middle or ends of the branches, rarely the whole length; bracts several pairs, small, above recurved, bifid, antical lobule turgid, incurved, unidentate, antheridium solitary, large. Flowers ♀ terminal on the stem or branches (rarely abbreviated); bracts about 3 pairs, but little different from the leaves, slightly larger, more frequently lacinate or spinose; bracteoles a little shorter, apex somewhat conformable to the leaves, very often free, or only at the base connate with one of the bracts. Pistillidia 18-60. Perianth emersed, trigono-prismatic, often oblong 2-4 times longer than broad, rarely shorter and urceolate, angles (antical above the others) in tropical species very often dentato-alate, almost always in European species wingless, in a very few species with a facial crest added; mouth trifid (trilabiate), lips bifid, very often lacinate or ciliate, leptodermous, only towards the base bi- (at the angles tri-)stratose. Calyptra about half the size, obovate, delicate, afterwards lacerated at the apex, surrounded at the base by the sterile pistillidia. Capsule on a long pedicel, oblong-globose, dividing to the base into 4 valves, 5-strata. Elaters elongate, bispiral. Spores minute, smooth.

1. *Lophocolea bidentata* (L.), Dum.

Jungermania major repens foliis bifidis, Mich. Nov. pl. gen. p. 8, t. 5, f. 12 (1729).

Lichenastrum pinnulis acutioribus, concavis, bifidis, majus, Dill. Hist. Musc. p. 487, t. 70, f. 11 (1711).

Jungermania bidentata, Linn. Sp. pl. p. 1598 (1753); Hook. Brit. Jung. t. 30 (1816).

Lophocolea bidentata, Dum. Recueil, p. 17 (1835).

Lophocolea Hookeriana, Nees Nat. Eur. Leb. 11, p. 336 (1836).

Dioicous, loosely and broadly cæspitose, medium size, pale green, sometimes almost white in colour. Stems procumbent, flexuose, firm, ramose, branches ascending; radiculose, rootlets small, whitish. Leaves sub-imbricate, approximate or distant, broadly ovate, antical margin decurrent, plane or slightly undulate, patent-divergent or horizontal, bifarious, bifid to about $\frac{1}{3}$ – $\frac{1}{4}$, segments lanceolate, subulate, acuminate, unequal, the lower usually smaller than the upper, sinus rounded or acute. Aromatic. Texture thin, epidermis smooth, cells largish, oblong-hexagonal or 4, 5-sided, walls thin—but with the chlorophyl granules adhering to them they often appear thick—trigones minute. Stipules free, large, sometimes reflexed, bifid or quadrifid, usually bifid to below the middle, with a smaller segment on the two outer margins, segments subulate. Bracts erect, larger than the leaves, oval or broadly oval, bifid, trifold or quadrifid to about $\frac{1}{3}$, margin here and there dentate or ciliate, segments and sinus acute. Bracteole oblong-oval, bifid, trifold, or rarely quadrifid to about $\frac{1}{6}$ – $\frac{1}{5}$, segments and sinus acute, margin slightly dentate or ciliate. Perianth terminal, ovate-oblong, obtusely triangular, mouth widish, trilobate, laciniate. Pistillidia numerous (60), often with a purplish tinge. Calyptra thin. Capsule ovate, deep brown. Spores rich fulvous brown, spherical, about twice as broad as the elaters. Elaters bispiral, dark brown. Perigonial bracts 10–12, terminal or at the middle of a branch, closely imbricate, erecto-patent, roundish-ovate, bifid, trifold, or rarely quadrifid to about $\frac{1}{6}$ – $\frac{1}{5}$, segments acute, sinus rounded; antheridia 1 or 2, oval; perigonial bracteole quadrifid.

Fruits March, April.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inch long, .4 mm. diameter (young stems .25 mm.), with leaves 3. mm. wide; leaves 2.5 mm. \times 1.5 mm., segments .45 mm., 2.25 mm. \times 1.5 mm., seg. .3 mm., 3. mm. \times 1.75 mm., seg. .5 mm.; cells .08 mm. \times .04 mm., .05 mm. \times .035 mm., .06 mm. \times .04 mm.; stipules 1. mm. \times .6 mm., seg. .6 mm.; sub-bracteoles 1.6 mm. \times .75 mm., seg. .75 mm.; bract 3. mm. \times 1.6 mm., seg. .3 mm., .4 mm., .5 mm.; bracteole 2.5 mm. \times .25 mm., seg. .3 mm.; perianth 2.75 mm. \times 1.25 mm.; pistillidia .15 mm. \times .06 mm.; perigonial bract 1.25 mm. \times 1. mm., seg. .2 mm., .3 mm.; perigonial bracteole .9 mm. \times .6 mm., seg. .6 mm.; antheridia .15 mm. \times .125 mm.

HAB.—Grows in large spreading patches on walls, stones, earth and rotting wood, in the plains and subalpine localities, usually in shady situations. Common.

1 to 18. I.

Common on the Continent and in North America. Recorded from the West Indies.

OBS.—Distinguished from *Lophocolea cuspidata*, Limpr. and *Loph. heterophylla* (Schrad.) by its dioicous inflorescence. *Lophocolea latifolia*, Nees (*L. Hookeriana*, Nees) is a variety with darker green leaves of a firmer texture, usually growing in damper situations, but I cannot fix upon any character to separate it from the type.

DESCRIPTION OF PLATE CI.—Fig. 1. Plants natural size. 2. Portion of young stem \times 16 (Ashley, W. H. P.). 3–5. Leaves \times 16 (ditto). 6. Portion of leaf \times 290 (ditto). 7. Stipules \times 24 (ditto). 8. Sub-bracteole \times 16 (ditto). 9. Bract \times 16 (ditto). 10. Bracteole \times 16 (ditto). 11. Perianth \times 16 (ditto). 12. Portion of the mouth of perianth \times 16 (ditto). 13. Pistillidium \times 85 (ditto). 14. Perigonial bract \times 16 (G. & R. Hep. Eur. n. 630). 15. Perigonial bracteole \times 16 (ditto). 16. Antheridium \times 85 (ditto).

2. *Lophocolea cuspidata*, *Limpr.*

Lophocolea bidentata, var. *cuspidata*, Nees Nat. Eur. Leb. 11, p. 327 (1836).

Lophocolea cuspidata, Limpricht in Cohn Krypt. Fl. Schles. p. 303 (1876).

Monoicous, loosely cæspitose, of medium size, pale yellowish-green in colour. Stems branched, branches spreading, lateral subpostical; radiculose, rootlets few. Leaves imbricate, spreading, horizontal or patent-divergent, antical margin decurrent, ovate, bifid to about $\frac{1}{4}$, segments cuspidate, divergent or connivent, sinus lunate; texture thin, cells medium size, 5- and 6- sided, walls thin, trigones minute. Stipules oblong, bifid to below the middle, with a shorter tooth on one or both of the outer margins, segments subulate. Bracts oblong-subquadrate or semi-oval, bifid or trifid from $\frac{1}{5}$ to the middle, margin plane. Perianth projecting about half beyond the bracts, cylindrical, acutely trigonous, third angle antical, third face postical, mouth dentate. Pistillidia long. Capsule oval, dark brown. Spores reddish-brown, about as broad again as the dark brown elaters.

Andrœcia on long or short branches on the ♀ plant; perigonal bracts 5-8 pairs, smaller than the stem leaves, erecto-patent, closely imbricate, ventricose at the base, trifid, the third antical segment smaller incurved, enclosing 1 or 2, rarely 3, almost spherical antheridia.

Fruits March, April.

DIMENSIONS.—Stems 1 to 2 inches long, diameter .3 mm., with leaves 3 mm. wide; leaves 1.6 mm. × 1.1 mm., segments .4 mm.; cells .04 mm. × .05 mm., .035 mm. × .04 mm., .03 mm. × .03 mm., .04 mm. × .03 mm.; stipules 1.25 mm. × .75 mm., seg. .5 mm., .6 mm. × .4 mm., seg. .3 mm.; bracts 2 mm. × .9 mm., seg. 1 mm. and .7 mm., 1.7 mm. × .9 mm., seg. .65 mm. and .5 mm., 3 mm. × 1.4 mm., seg. .6 mm. and .3 mm.; sub-bracteole 2 mm. × .9 mm., seg. .8 mm. and .7 mm.; bracteole 3 mm. × 1.25 mm., seg. .8 mm. and .7 mm.; perianth 5 mm. × 1.25 mm.; pistillidia .2 mm. × .075 mm., .225 mm. × .06 mm.; perigonal bracts 1.2 mm. × .6 mm., seg. .6 mm.; antheridia .11 mm. × .1 mm.

HAB.—Growing in spreading patches at the base of trees, on walls or stones in exposed or shady places, perhaps commoner than is thought by being confounded with *Loph. bidentata* (L.).

5. Hart Hill, Hoare Park, Warwickshire, *J. E. Bagnall*.
7. Bettws-y-Coed, Carnarvonshire, *W. H. P.* 8. Stirrup Wood, Marple, Derbyshire, *C. J. Wild*. 10. Coneysthorpe Bank Wood, Yorks, *M. B. Slater*. Ash Hag Gill, Hackness, Yorks, *M. B. Slater*. 12. Injebrick, Isle of Man, *G. A. Holt*.

Found on the Continent.

Obs.—Distinguished from *Lophocolea bidentata* (L.) by its monoicous inflorescence, narrower leaves, which are more cuspidate; from *Lophocolea heterophylla* (Schrad.), which is also monoicous, by its more spreading habit, its deeply bifid, cuspidate leaves, which are never entire.

DESCRIPTION OF PLATE CII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 16$ (Hackness, M. B. Slater). 3. Portion of leaf $\times 290$ (ditto). 4, 5. Stipules magnified (Isle of Man, G. A. Holt). 6, 7. Bracts $\times 24$ (ditto). 8. Bract $\times 16$ (Hackness, M. B. Slater). 9. Sub-bracteole $\times 16$ (ditto). 10. Bracteole $\times 16$ (ditto). 11. Perianth $\times 11$ (ditto). 12. Cross-section of perianth $\times 11$ (ditto). 13. Portion of the mouth of perianth $\times 16$ (ditto). 14. Perigonial bract $\times 24$ (Isle of Man, G. A. Holt). 15. Antheridium $\times 64$ (ditto).

3. *Lophocolea heterophylla* (Schrad.), Dum.

Lichenastrum pinnulis obtusioribus bifidis minus, Dill. Hist. Musc. p. 488, t. 70, f. 12 (1741).

Jungermania heterophylla, Schrad. Diar. Bot. p. 66 (1801); Hook. Brit. Jung. t. 31 (1816).

Lophocolea heterophylla, Dum. Recueil, p. 17 (1835).

Paroicous, cæspitose, small, pale green in colour. Stems pro-cumbent, ramose, branches postical, erect; radiculose, rootlets short, white, few, fasciculate, produced from the base of the stipules. Leaves imbricate, horizontal, slightly decurrent antic-ally, plane or slightly concave, bifarious, spreading or secund,

ovate, quadrate, entire or obtusely emarginate, rarely acutely bifid; texture somewhat firm, cells medium size, 4-, 5- and 6-sided, walls thin, no trigones. Stipules oblong, bifid to below the middle, segments subulate, outer margin unidentate, on young branches bifid only or minutely unidentate on one side. Subbracts (perigonial) oblong roundish quadrate, emarginate or entire, lobulate or deeply unidentate at the base, one or two roundish antheridia enclosed in the lobule. Sub-bracteole oblong, bifid or trifid, segments subulate, acuminate. Bracts closely imbricate, oblong quadrate, roundish, or oblong-quadrate, entire or obtusely emarginate, margin entire or furnished with one or two teeth, lobulate or elobulate. Bracteoles oblong bifid to about the middle segments subulate, margin sparsely laciniate-dentate. Perianth terminal on main stem or branches, projecting about half beyond the bracts, ovate, obtusely triangular, mouth wide, trilobate dentate. Calyptra ovate, thin, delicate. Capsule ovate, dark brown. Spores and elaters brown.

Fruits March, April, May.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .25 mm. diam., with leaves 2 mm. wide; leaves 1 mm. \times .6 mm., 1.2 mm. \times 1 mm., 1.25 mm. \times .8 mm.; cells .03 mm. \times .05 mm., .03 mm. \times .035 mm., .04 mm. \times .035 mm.; stipule .9 mm. \times .3 mm., segments .55 mm.; sub-bract 1.4 mm. \times .9 mm.; sub-bracteole 1.1 mm. \times .6 mm., segments .6 mm.; bracts 1.4 mm. \times 1 mm., 1.4 mm. \times .8 mm.; bracteole 1.2 mm. \times .7 mm., segments .5 mm.; perianth 2 mm. \times 1 mm.; antheridia .15 mm. \times .14 mm.

HAB.—Growing usually at the base of trees or on rotting wood.

Common. 1-5, 7-14, 16. I.

Found on the Continent and in North America.

OBS.—Differs from *Lophocolea bidentata* (L.) by its being paroicous; from *L. cuspidata*, Limpricht. by its usually smaller size, its variously shaped leaves, entire, emarginate and bifid—hence its name.

Growing with it are often very small young stems with leaves deeply bifid, stipules bipartite with a small tooth on one side,

resembling small forms of *Geocalyx graveolens*, but if their origin, or connection with mature plants be traced, the difficulty is solved.

This and the previous species have the strong unpleasant smell, more evident when drying, of *L. bidentata*.

DESCRIPTION OF PLATE CIII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 16$ (Dove Dale, W. H. P.). 3. Portion of young branch $\times 64$ (Abergele, W. H. P.). 4. Leaf $\times 24$ (Castle Mill, Cheshire, G. A. Holt). 5. Ditto $\times 24$ (Bowdon, W. Stanley). 6. Ditto $\times 24$ (Dove Dale, W. H. P.). 7. Portion of leaf $\times 290$ (ditto). 8. Stipule $\times 24$ (Bowdon, W. Stanley). 9. Ditto from young branch $\times 85$ (Castle Mill, G. A. Holt). 10. Sub-bract $\times 24$ (Dove Dale, W. H. P.). 11. Sub-bracteole $\times 24$ (ditto). 12, 13. Bracts $\times 24$ (ditto). 14. Bracteole $\times 24$ (ditto). 15. Perianth $\times 16$ (ditto). 16. Ditto, explanate to show mouth $\times 16$ (ditto). 17. Antheridium $\times 64$ (Bowdon, W. Stanley).

4. *Lophocolea spicata*, *Tayl.*

Lophocolea spicata, Taylor in G.L.N. Syn. Hep. 167 (1844).

Monoicous, closely appressed to rocks, in entangled masses, small, pale green in colour. Stems creeping, irregularly branched, outer layer of cells large, hyaline; radiculose, rootlets few, small, whitish. Leaves gradually increasing and decreasing in size, horizontal (90°) to patent-divergent (70°), slightly imbricating, antical margin decurrent, ovate, diversiform, bi-, tri or rarely multi-dentate, segments acute, connivent or divergent; texture delicate; cells small, subquadrate or oblong-quadrate, 4-, 5- or 6-sided; walls moderately thick, no trigones. Stipules free, bipartite, segments acuminate, unidentate near the base of the exterior margins.

Involucres on short branches; bracts oblong, upper portion irregularly dentate; bracteole bipartite, segments acutate, irregularly dentate. Perianth projecting beyond the bracts, triquetrous, angles not winged, mouth wide, laciniate-dentate; pistillidia

about 10. Calyptra after rupture irregularly lobed. Capsule oval; spores light brown; elaters bispiral, hardly as broad as the spores. Male amentula on short branches above or below the ♀, 2–5 pairs of perigonial bracts which are closely imbricate, ovate, complicate, swollen at the base; antheridia single, oval, shortly stipitate. Mixed with the plants are many minute leafy branches.

Fruits April, May.

DIMENSIONS.—Stem $\frac{1}{4}$ to $\frac{1}{2}$ inch long, 1 mm. diam., with leaves 1·5 mm. wide; leaves ·75 mm. × ·5 mm., segments ·1 mm., ·15 mm., ·6 mm. × ·4 mm., seg. ·1 mm.; cells ·02 mm.; stipules ·2 mm. × ·075 mm., seg. ·15 mm., ·2 mm. × ·1 mm., seg. ·15 mm.; bracts ·8 mm. × ·4 mm., seg. ·2 mm.; bracteole ·4 mm. × ·2 mm., seg. ·25 mm.; perianth ·9 mm. × ·5 mm.; pistillidia ·125 mm. × ·04 mm.; calyptra ·5 mm. × ·5 mm.; capsule ·7 mm. × ·45 mm.; pedicel ·175 mm. diam.; spores ·015 mm.; elaters ·15 mm. × ·01 mm.; perigonial bract (not explanate) ·45 mm. × ·2 mm., seg. ·125 mm.; antheridia ·1 mm. × ·075 mm.

HAB.—On shaded wet rocks; very rare.

1. St. Just, Cornwall, *W. Curnow*, 1884. 7. Near Conway, Carnarvonshire, *W. Wilson*, 1844. Trefriw, Carnarvonshire, *W. H. Pearson*, 1887. 16. Moidart, West Inverness, *S. M. Macvicar*.

I. Cromaglow; Dunkerron, *Dr. Taylor*. Bantry, *Miss Hutchins*. Killarney, *Dr. Carrington*, &c. Altadore Glen, Wicklow, *D. McArdle*.

C. Guernsey, *E. D. Marquand*.

OBS.—Distinguished from the other monoicous species, *L. cuspidata* and *L. heterophylla* by its habitat, small size and spicate amentula, in addition to other characters.

DESCRIPTION OF PLATE CIV.—Fig. 1. Plants natural size. 2. Plant × 24. Portion of leaf × 290. 4, 5. Stipules × 85. 6. Bract × 64. 7. Bracteole × 85. 8. Sub-bracteole × 85. 9. Upper portion of perianth, explanate × 64. 10. Perigonial bract × 85. (Near Conway, W. Wilson.)

Genus 23. **CLASMATOCOLEA**, *Spruce*.

Clasmatocolea, Spruce Hep. Am. et And. p. 440 (1885).

Plants small, fragile. Primary stem short, sub-erect, densely leaved; radiculose at the base—sometimes under the terminal flower also; producing slender, arcuate branches having small and distant leaves, and often rooting at the decurved apex. Leaves alternate, subsecund, ascending, plane or concave, obovate, rotundate, subtruncate or retuse; branch leaves very often obcordato-cuneate. Stipules half the size, heteromorphous, most of them ovato-lanceolate and entire, but others (chiefly the upper ones) bifid. Inflorescence dioicous; ♀ bracts larger than the leaves, somewhat similar. Perianths large for the size of the plant, very fragile, obovate or sub-conical, in the upper part obscurely or very slightly trigonous, having a wide 2-4-lobed mouth. Capsule oblongo-globose, in other respects like that of *Lophocolea*.

Clasmatocolea cuneifolia (*Hook.*), *Spruce*.

Jungermania cuneifolia, Hook. Brit. Jung. t. 64 (1816).

Mylia cuneifolia, Gr. & B. Nat. Arr. Brit. Pl. p. 694 (1821).

Leptoscyphus cuneifolia, Mitten in Hook. Journ. Bot. iii. p. 358 (1851).

Coleochila cuneifolia, Dum. Hep. Eur. p. 106 (1874).

Clasmatocolea cuneifolia, Spruce Hep. Am. et And. p. 440 (1885).

Loosely cæspitose or creeping, minute, pale olive green to reddish-brown in colour. Stems simple or with one or two very minute shoots, extremely slender, filiform, flexuose, olive-brown, very fragile; radiculose, rootlets growing in short tufts, white. Leaves approximate or distant, assurgent or erecto-patent, appressed to stem or spreading, slightly decurrent antically, alternate, caducous, plane, cuneate with a narrow insertion, entire, truncate or slightly retuse, texture thick, guttulate; cells minute to small, roundish, lumen clear, containing only few chlorophyl granules, walls thick, reddish-brown or olive colour, angles thickened, no trigones. Stipules distinct, closely appressed to the

stem, near or connate to the adjacent leaf, broadly subulate, entire or bifid to about $\frac{1}{3}$, segments and sinus acute.

♀ and ♂ not seen.

DIMENSIONS.—Stems $\frac{1}{4}$ in. long, with leaves $\cdot 15$ mm. to $\cdot 2$ mm. wide, diam. $\cdot 05$ mm. to $\cdot 075$ mm.; leaves $\cdot 2$ mm. long \times $\cdot 2$ mm. wide at widest part, $\cdot 175$ mm. \times $\cdot 175$ mm., $\cdot 175$ mm. \times $\cdot 125$ mm., $\cdot 125$ mm. \times $\cdot 1$ mm., $\cdot 1$ mm. \times $\cdot 1$ mm.; cells $\cdot 015$ mm. to $\cdot 02$ mm.; stipules $\cdot 075$ mm. long \times $\cdot 05$ mm. broad, $\cdot 06$ mm. \times $\cdot 03$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm.

HAB.—16. “On birch trees growing on the bark and on *Frullania*; on a rock in a ravine creeping among *Radula aquilegia* with *Lejunea orata*, *L. microscopica*, *Plagiochila punctata*, and *P. tridenticulata*. On the trees it grows in reddish-brown patches of a few inches, or creeping over the *Frullania*.” Moidart, West Inverness, *S. M. Macvicar*.

I. Growing parasitically on *Frullania Tamarisci* near Bantry, *Miss Hutchins*. Cromaglow, *Dr. Taylor*, *Dr. Carrington*, *Dr. Moore*. Killarney, *Dr. Carrington*. Connor Hill, Kerry, *D. McArdle*.

Stavenger, Norway, *Dr. B. Kaalaas*.

Extremely rare; the above are the only known stations.

Obs.—Although no ♂ or ♀ have been observed on this species, *Dr. Spruce* (*Hep. Amaz. et And.* p. 440) has no hesitation in referring it to the genus *Clasmatocolea* founded by him on a species he collected on the Andes. He writes: “These curious little plants come very near *Lophocolea*, but are well distinguished by the peculiar habit; the assurgent leaves, with a plane antical margin—not convexo-deflexed, with the antical margin decurrent and recurved at the base (as in *Lophocolea*); the biform stipules mostly entire, but some bifid. The perianth, turgid and indistinctly carinate, is so fragile that the slightest touch breaks off the short unequal lobes at the wide mouth. I cannot doubt that the Irish *Jung. cuneifolia*, Hook. Brit. Jung. t. 64, hitherto known only from sterile specimens, is a true *Clasmatocolea*. Specimens gathered a few years ago by *McArdle* are so like the arcuate barren shoots of *Cl. fragillima* that, until I compared them closely, I thought them

the same species. The Irish plant (like the Andine) has both entire and bifid stipules, and was correctly so described by Nees from original specimens of Miss Hutchins, although Hooker's figure (l.c.) and the Eng. Bot. figure (t. 2700) show only bifid stipules."

Mr. Macvicar, in his "Hepaticæ of Moidart" (Journ. of Bot. Aug. 1899), says: "Although a small plant, it is not difficult to recognise when growing in patches, there being nothing with its appearance in this district except a small lichen which grows in similar places, and has much the same colour. Single stems creeping among *Frullania* can hardly be seen with the naked eye."

From flagelliferous shoots of *Plagiochila spinulosa*, Dicks. and *Plagiochila punctata*, Tayl. it may be distinguished by its assurgent leaves, which are of a different texture, and the presence of stipules along the whole length of the stem.

DESCRIPTION OF PLATE CV.—Fig. 1. Plants natural size. 2. Portion of stem $\times 85$. 3. Ditto, postical view $\times 85$. 4–18. Leaves $\times 85$. 19. Portion of leaf $\times 290$. 20–22. Stipules $\times 85$ (Conner Hill, Kerry, D. McArdle).

Genus 24. **CHILOSCYPHUS**, *Dum.*

Jungermania, Mich. Nov. pl. gen. p. 8 (1729); L. Sp. pl. ed. 1, 2, p. 1131 (1753).

Cheilocyphos, Corda in Opiz Nat. p. 631 (1829).

Chiloscyphus, Dum. Syll. Jung. p. 67 (1831).

Plants more or less flaccid, pale or dark green. Stems prostrate, somewhat thick, simple or slightly branched; radiculose, rootlets proceeding from the base of the stipules. Leaves sub-decurrent, flattened, entire, rotundate, truncate 2 or 3 dentate, rarely bifid. Stipules bifid, lacinate, in some species orbiculate or reniform, margin dentate. Leafy branches postico-lateral, female branches all postical, proceeding from the axils of the stipules, very short. Bracts ♀ 1–2 pairs, exterior minute, innermost always smaller than the leaves, variously divided. Pistillidia 5–30. Perianth small, obconical or campanulate, only above trigonous,

never winged, mouth trilobate, lobes often spinose, postical sometimes bifid. Calyptra carnosae, below 4-8-stratose, either subglobose and included in the perianth or clavate and emersed. Capsule on a long pedicel, oblong-globose, about 4-stratose, 4-valved, dividing down to the base. Elaters bispiral, deciduous. Androecia at the middle or apices of postical branches, in the opposite leaved species always on minute-leaved postical amentula, but in the alternate leaved species at the middle or apices of the stems or branches; perigonal bracts smaller than the leaves; antheridia large, situated at the base of the antical lobe.

Chiloscyphus polyanthos (L.), Dum.

Jungermania major, foliis brevioribus et obtusioribus non dentatis, Mich. Nov. pl. gen. p. 8, t. 5, f. 3 (1729).

Lichenastrum Trichomanis fucie polyanthemum breve et repens, Dill. Hist. musc. p. 486, t. 70, f. 9 (1741).

Jungermania polyanthos, Linn. Sp. pl. n. 1597 (1753); Hook. Brit. Jung. t. 62 (1816).

Chiloscyphus polyanthos, Dum. Syll. Jung. Eur., p. 67, t. 1, f. 9 (1831).

Chiloscyphus polyanthos, Corda in Sturm. Deutschl. Fl., 19, p. 35, t. 9 (1835).

Monoicous, laxly caespitose, patches thin, spreading, medium to large in size, green or yellowish-green in colour. Stems creeping, lax, flexuose, simple or furcately branched, minute branchlets often produced from the axil of the leaf, antically; radiculose, rootlets fasciculate, proceeding from the base of the stipules. Leaves alternate, approximate, almost horizontally inserted, antical base decurrent, plane, rotund-quadrate to oblong-quadrate, entire, rotundate or retuse; texture thin, cells medium size, clear, 5-6-sided, often elongate, walls somewhat thick, no trigones. Stipules small but evident, oblong, bipartite often almost to the base, segments subulate, rarely unidentate on both outer margins.

Inflorescence cladocarpous, ♀ postical on very short branches. Sub-bracts 3, very small, broadly subulate. Bract large, trifid, irregularly dentate. Calyptra exerted, carnosae, 4 cells thick near the base, oblong-obovate, mouth irregular, subentire, after protrusion of capsule, which is dark brown, oval, composed of

5 layers of cells. Spores pale yellowish-brown, large, almost twice the breadth of the elaters, which are darker brown, long, with about 24 spiral turns.

Andrœcia on short catkins, immediately below the perianth or on main stem; perigonal bracts but little different from the leaves, except that a small lobe is produced at the antical base, enclosing 1-3 spherical, shortly stipitate antheridia.

Fruits April, May, June.

Var. *pallescens* (*Jungermania pallescens*, Schrad. Syst. Samml. Krypt. Gew. 2, p. 7 (1797); *Chiloscyphus pallescens*, Dum. Syll. Jung. p. 67 (1831)) is the small, pale green, neat form, usually fertile, but I can detect no character sufficiently reliable to separate it from the type.

On shady rocks. 7. Falls near Barmouth Junction, Merionethshire, growing with *Jubula Hutchinsiae*.

Var. *rivularis*, Nees. A large coarse form, of a somewhat thick, greasy texture. 8, 10, 12, 16.

DIMENSIONS.—Stems from an inch to several inches long, .2 mm. to .4 mm. in diameter, with leaves 3 mm. to 5 mm. wide; leaves 1.75 mm. × 1.5 mm., 2.5 mm. × 2 mm., cells .025 mm. × .04 mm., .025 mm. × .035 mm., .03 mm. × .03 mm.; stipules .4 mm. × .175 mm. wide at the base, segments .2 mm., .3 mm., .275 mm. × .125 mm. at the base, segments .225 mm.; bract, explanate 1.5 mm. × 1.75 mm.; calyptra 3 mm. × 1.5 mm. near apex; pistillidia .16 mm. × .06 mm.; capsule 1.4 mm. × 1.1 mm.; pedicel .5 mm. diam.; spores .02 mm. diam.; elaters .175 mm. × .015 mm.

HAB.—Growing in loose or straggling patches in moist and very wet places, on rocks, stones or earth, rarely on rotting wood, often floating in water, where it attains unusual length, stems sometimes 6 to 7 inches long being met with.

Common. 1, 3, 5, 7-16, 18c. I.

Found generally on the Continent and North America.

Obs.—Distinguished from any of the entire leaved *Jungermania* by its postical, cladocarpous inflorescence, its large, fleshy, exerted calyptra, the perianth being reduced to a trifid bract; when

sterile by its horizontally inserted, plane leaves and oblong, deeply bipartite stipules.

DESCRIPTION OF PLATE CVI.—Fig. 1. Plants natural size (Eng. Bot.). 2. Fertile plant magnified (ditto). 3. Portion of stem, antical view $\times 11$ (Bamford, G. A. Holt). 4. Ditto $\times 11$ (Charlesworth, J. Whitehead). 5. Portion of leaf $\times 290$ (ditto). 6. Stipule $\times 85$ (ditto). 7. Ditto $\times 85$ (Bamford, G. A. Holt). 8, 9. Sub-bracts magnified (ditto). 10. Bracts $\times 24$ (ditto). 11. Calyptra $\times 11$ (ditto). 12. Pistillidium $\times 85$ (ditto). 13. Spore $\times 290$ (Charlesworth, J. Whitehead). 14. Perigonial bract magnified (after Hooker).

Genus 25. **HARPANTHUS**, Nees.

Jungermania, Web & Mohr. Bot. Taschenb. p. 408 (1807).

Harpanthus, Nees, Nat. Eur. Leb. 2, p. 351 (1836).

Pleuranthe, Tayl. in Hook. Lond. Journ. Bot. 5, p. 282 (1846).

Dioicous, plants small, caespitose; stems decumbent, radiculose, stipulate. Leaves succubous, ovate, emarginate or bilobed, semi-vertically imbricated, sub-decurrent, flattened, secund. Stipules numerous, lanceolate, connate with the adjoining leaves, free margin reflexed, unidentate at the base. Fertile shoots very short, postical (issuing from the axils of the stipules), at length sublateral. Bracts small, 1 or 2 pairs with interposed bracteoles. Perianth exerted, fusiform, terete, lower half thickened, mouth contracted, 3-4-fid, segments unequal, entire. Calyptra fleshy, adherent for $\frac{2}{3}$ its length with the perianth, free only near to the apex. Capsule 4-valved, coriaceous. Elaters bispiral. Male plant more slender; perigonial bracts terminal, more concave, enclosing 1-2 oval antheridia.

1. **Harpanthus scutatus** (*W. et M.*), Spruce.

Jungermania scutatus, Web. et Mohr. Bot. Taschenb. p. 408 (1807).

Jungermania stipulacea, Hook. Brit. Jung. t. 41 (1816); Sm. Eng. Bot. t. 2538.

Lophozia scutata, Dum. Recueil, p. 17 (1835).

Harpanthus scutatus, Spruce, Trans. Bot. Soc. Edin. 111, p. 269 (1849).

Dioicous, loosely caespitose, of a pale green colour. Stems

ascending, simple or slightly branched; radiculose, rootlets plentiful, close, white. Leaves imbricate or approximate, patent-divergent, roundish-ovate or ovate, emarginate to about $\frac{1}{4}$, sinus wide, obtuse, rarely acute, segments acuminate, often somewhat connivent; cells roundish-quadrate, from smallish to medium size, walls somewhat thick but delicate, trigones distinct. Stipules almost as long as the leaves, somewhat patulous, with an arcuate incurved apex, broadly lanceolate or lanceolate. Female inflorescence on short postical branches; third sub-bracts small, bifid or trifold, irregular in shape, oval, subquadrate or subcuneate; second series of sub-bracts larger, oval; bracts large, ovate or subquadrate, irregular bifid or trifold to about $\frac{1}{3}$, sinus acute or obtusate, segments acute. Bracteole pyriform. Perianth projecting a little beyond the bracts, oblong-oval, acute, obtusely trigonous, composed of a single layer of cells, about 60 near the middle, near the base composed of two layers, mouth constricted, 6-dentate, teeth small. Calyptra mitriform, rostellate, thickened near the base. Pistillidia few, 4, 5, small. Capsule oval, reddish-brown. Spores brown, as broad as the reddish-brown elaters. Andrœcia on the middle or apex of the main stem or branches, perigonal bracts 3–8 pairs, imbricate, complicate-concave, ventricose, enclosing 1, 2, small, oval antheridia.

Fruits April, May.

DIMENSIONS.—Stems from $\frac{1}{2}$ to 1 inch long, diameter $\cdot 1$ mm., with leaves 1 mm. wide; leaves $\cdot 45$ mm. \times $\cdot 4$ mm., segments $\cdot 1$ mm., $\cdot 5$ mm. \times $\cdot 4$ mm., seg. $\cdot 1$ mm.; cells $\cdot 03$ mm. \times $\cdot 025$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 03$ mm. \times $\cdot 03$ mm., $\cdot 04$ mm. \times $\cdot 025$ mm.; stipules $\cdot 3$ mm. \times $\cdot 1$ mm., $\cdot 35$ mm. \times $\cdot 125$ mm.; sub-bracts $\cdot 3$ mm. \times $\cdot 25$ mm., segments $\cdot 1$ mm., $\cdot 375$ mm. \times $\cdot 225$ mm., seg. $\cdot 1$ mm.; bracts $\cdot 6$ mm. \times $\cdot 35$ mm., segments $\cdot 25$ mm., $\cdot 45$ mm. \times $\cdot 325$ mm., seg. $\cdot 175$ mm.; perianth 1 mm. \times $\cdot 4$ mm.; pistillidia $\cdot 15$ mm. \times $\cdot 04$ mm.; perigonal bracts $\cdot 35$ mm. \times $\cdot 375$ mm.; antheridia $\cdot 1$ mm. \times $\cdot 075$ mm.

HAB.—Growing on shady banks, rocks and stones, or on rotting wood. Rare.

3. Balcombe, Tunbridge Wells, Surrey, *George E. Davies*;

on rocks in Hungershall Wood, Kent, *Jenner*. 7. Near Ilanberis, Carnarvonshire, *W. Wilson*; Tyn-y-Groes, Merionethshire, *C. J. Wild*. 10. Arneliffe Wood, Eskdale, Yorks., *Dr. Spruce*, *M. B. Slater*, *W. H. P.*; Bolton Woods, Yorks., *Dr. Carrington*. 15. *George Don*. 16. Moidart, West Inverness, *S. M. Macvicar*. I. Bantry, *Miss Hutchins*; Loch Bray, *Dr. Taylor*; Killarney, *Dr. Carrington*; O'Sullivan's Cascade, *Prof. Lindberg*; Cromaglow, *Stewart & Holl*.

Found on the Continent and in North America.

Obs.—When fertile this is at once distinguished from others by its postical inflorescence, with the exception of *Harpanthus Flotowii*, which is a larger plant, with more orbiculate leaves, smaller sinus, and cells of a different shape.

It differs from any of the forms of *Jung. bantriensis*, for which it might be mistaken when barren, in its paler green colour and larger arcuate stipules.

DESCRIPTION OF PLATE CVII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 31$ (Killarney, *Dr. Carrington*). 3–5. Leaves $\times 31$ (ditto). 6. Leaf $\times 64$ (ditto). 7. Portion of leaf $\times 290$. 8, 9. Stipules $\times 64$ (ditto). 10. Stipule $\times 85$ (ditto). 11, 12. Sub-braets $\times 64$ (Canada, *Macoun*). 13, 14. Braets $\times 64$ (ditto). 15. Braeteole $\times 64$ (ditto). 16. Perianth $\times 31$ (ditto). 17. Portion of the mouth of perianth $\times 31$ (ditto). 18. Pistillidia $\times 85$ (ditto). 19, 20. Perigonal bracts $\times 64$ (ditto). 21. Antheridium $\times 85$ (ditto).

2. *Harpanthus Flotowii*, *Nees*.

Jungermania Flotowiana, *Nees* in *Diar. Bot. Ratisb.* 11, n. 26, p. 408 (1833).

Jungermania convoluta, *Hübner*. *Hep. Germ.* p. 60, n. 7 (1834).

Jungermania Hartmanni, *Theden*. *Muse. Succ. Exsicc.* v. 1, d. 138, a *ferrugineus*.

Harpanthus Flotowianus, *Nees*, *Nat. Eur. Leb.* 11, p. 353 (1836).

Pleuranthe olivacea, *Tayl.* in *Lond. Journ. Bot.* v., p. 282 (1846).

Dioicous, laxly cæspitose, from small to largish in size, pale or dark green to olive-brown in colour. Stems procumbent, flexuose, simple or slightly branched; radiculose, rootlets white, short.

Leaves horizontal or patent-divergent, spreading or complanate, the insertion of the upper part of leaf is in a line with the side of the stem, whilst the base is decurrent, and brought forward by a gradual symmetrical curve, ovate orbiculate, emarginate to about $\frac{1}{8}$ — $\frac{1}{7}$, sinus small and shallow, lunate, segments acute or obtusate, upper segment sometimes larger and overhanging the other like a claw; texture lax, cells medium size, 4-, 5- and 6-sided, mostly hexagonal, often longer than broad, in the upper portion of leaf subquadrate, basal cells oblong, walls thin, trigones small, sometimes indistinct. Stipules large, prominent, ovate-lanceolate or lanceolate-acute, varying much in shape, inserted obliquely so as to turn from the leaf opposite to which they arise, entire or unidentate, rarely dentate on both sides. Cladocarpous, perianth proceeding from the postical side of stem, from axil of stipule, on a very short branch which bears only a few small bracts and bracteoles; cylindrical, slightly sickle-shaped, smooth, composed of several layers of cells at the base, near the mouth of a single layer, triplicate, mouth contracted, finely crenulate. Bracts small, oval or subquadrate, bifid or trifid. Bracteole oval or ovate-lanceolate, entire or bifid. Calyptra oval, composed of several layers near the base. Pistillidia few, cylindrical. Capsule oval, brown. Spores smooth, brown, small. Elaters bispiral. Andrœcia on small catkin-like branches proceeding from the postical side of distinct stems, from the axil of stipule; perigonial bracts 4 pairs, small, complicate, ventricose, enclosing 1-3 oval, stipitate antheridia; perigonial bracteoles bifid.

Fruits May, June.

DIMENSIONS.—Stems $\frac{1}{2}$ to 2 inches long, diam. .25 mm. to .3 mm., with leaves 1.75 mm. to 2.5 mm. wide; leaves 2 mm. \times 1.4 mm., 2 mm. \times 1 mm., 1.5 mm. \times 1.5 mm., 1.5 mm. \times 1.3 mm., 1.5 mm. \times 1 mm., 1.2 mm. \times 1.2 mm., 1 mm. \times 1 mm., 1 mm. \times .8 mm., .9 mm. \times .6 mm., 1.3 mm. \times 1.2 mm., cells .0775 mm. \times .025 mm., .075 mm. \times .025 mm., .06 mm. \times .03 mm., .05 mm. \times .027 mm., .05 mm. \times .03 mm., .04 mm. \times .03 mm., .03 mm. \times .03 mm.; stipules .65 mm. \times .225 mm., .65 mm. \times .2 mm., .6 mm. \times .2 mm., .55 mm. \times .225 mm., .5 mm. \times .2 mm., .475

mm. \times .15 mm., .75 mm. \times .3 mm.; perianth 3 mm. \times 1 mm., 2.4 mm. \times .7 mm.

HAB.—Growing in alpine regions on wet rocks or in swampy places amongst mosses.

15. Loch-na-Gar, Aberdeen, *George Stabler*, 1884; Ben Lawers, *Rev. H. G. Jameson*, Sept. 1893. 18c. Burra Firth, Uist, Shetland, *John Sim*, 1878.

Found on the Continent and in North America.

OBS.—This very rare British species, which is only found in alpine regions, cannot be mistaken for any other if seen with its laterally inserted perianth; when barren it is easily distinguished from any of the forms of *Jung. bantriensis*, Hook., by its claw-like segments of the leaf and the large obliquely projecting stipules.

Harpanthus scutatus (W. & M.), found on lower elevations, is a smaller plant of different colour, shape and texture of leaves, which see.

DESCRIPTION OF PLATE CVIII.—Fig. 1. Plants natural size. 2. Portion of stem, antical view \times 16 (G. & R. 379). 3. Stem, postical view \times 16 (Uist, Sim). 4. Leaf \times 16 (ditto). 5. Portion of leaf \times 290 (G. & R. 379). 6, 7. Stipules \times 46 (Uist, Sim). 8, 9, 10. Bracts \times 17 (Dr. Gottsche, G. & R. 379). 11. Perianth with portion of stem \times 17 (ditto). 12. Longitudinal section of perianth \times 17 (ditto).

Genus 26. MYLLIA, Gr. & B.

Jungermania, Hook. Brit. Jung. p. 15, t. 34, 57 (1816).

Myllia, Gr. & B. Nat. Arr. Brit. Pl. p. 693 (1821).

Leptoscyphus, Mitten, Hook. Lond. Journ. of Bot. 111, p. 358 (1851).

Coleochila, Dum. Hep. Eur. p. 105 (1874).

Dioicous. Stems simple or innovant below the apex, erect or creeping, tomentose beneath. Leaves succubous, bifariously imbricated, alternate, semi-vertical, either circular or ovate, and acute. Stipules subulate obscured by the rootlets except at the apex of the shoots. Perianth terminal (or from the growth of innovations axillary) ovato-oblong, laterally compressed from a

sub-terete base, apex contracted, truncate, at length bilabiate, denticulate. Bracts 2, patent, from a clasping base; bracteole lanceolate, unidentate, free. Capsule ovate, coriaceous, 4-valved. Elaters bispiral. Perigonial bracts usually narrower, ventricose, clustered near the apex of distinct shoots. Antheridia 2, roundish.

1. *Mylia Taylori* (Hook.), Gr. & B.

Jungermania Taylori, Hook. Brit. Jung. t. 57 (1816).

Mylia Taylori, Gr. & B. Nat. Arrang. Brit. Pl. 1, p. 695 (1821).

Leptoscyphus Taylori, Mitt. in Hook. Journ. of Bot. 111, p. 358 (1851).

Coleochila Taylori, Dum. Hep. Eur. p. 106 (1874).

Dioicous, growing in dense, extensive patches, size medium to large, of a yellowish or reddish-brown to a purple colour. Stems simple or with one or two innovant branches arising from axil of bracts, lateral, or slightly sub-postical, erect or suberect, firm, flexuose, brownish; cells of stem uniform, pale brown colour throughout; very densely radiculose on the underside, rootlets dull white, long, covering almost the whole of the underside of the stem. Leaves bifarious, alternate, horizontal at an angle of 80° to 90°, obliquely semiamplexicaul, antical base slightly decurrent, contiguous or imbricate, secund, suborbicular, broadly ovate or broadly oval, plane or slightly concave, margin entire, sometimes slightly undulate, sometimes retuse; texture thick, sub-carnose, epidermis with each cell convex and minutely verruculose, cells largish, roundish, dull colour with the numerous chlorophyl granules, walls hyaline, trigones distinct, roundish or angular. Stipules small, subulate or lanceolate. Bracts no larger than the leaves, somewhat similar in shape, entire, slightly spreading or appressed. Bracteole free, broadly subulate. Perianth projecting about half beyond the bracts, terminal, laterally subcompressed, oblong-ovate, composed of one layer of cells, mouth contracted, truncate, small, complanate, bilabiate, with about 15 club-shaped irregular cilia, texture similar to the leaves, except near to the mouth, where it is smooth and the cells more delicate, distinctly verruculose in the middle and lower portion. Calyptra obovate,

4 cells thick at the base, at apex one, cells elongate, walls thin, no trigones or angles thickened. Pedicel about $\frac{1}{2}$ inch long. Capsule oval, dark reddish-brown. Spores pale brown. Elaters bispiral, about 15 turns, dark reddish-brown.

Male stems distinct, usually smaller, perigonal bracts about middle of stem, or terminal, suberect, semiamplexicaul, ventricose almost lobulate, enclosing 1 or 2 spherical antheridia, with long bearers.

Fruits May, June.

DIMENSIONS.—Stems from 1 to 3 inches long, .4 mm. diam., with leaves 3.5 mm. wide; leaves 2.25 mm. \times 1.75 mm., 2. mm. \times 1.75 mm., 2.25 mm. \times 2. mm.; cells of leaves .06 mm.; walls of cells .01 mm.; trigones .02 mm.; stipules .3 mm. long \times .075 mm. wide at base; bracts 2. mm. long \times 1.75 mm. wide, 2.25 mm. \times 1.75 mm.; perianth 4.5 mm. long \times 2. mm. wide at the middle, 1.75 mm. wide at the mouth, .75 mm. wide at the base; cilia at mouth of perianth .125 mm. long, from .02 to .03 mm. wide at the base; pedicel .3 mm. diam.; capsule 1.25 mm. \times .75 mm.; spores .02 mm.; elaters .115 long \times .0125 wide.

HAB.—Growing in extensive patches on open heaths or boggy places on moorlands, or on moist rocks in open or shady situations, chiefly subalpine or alpine. Moderately common in the North, very rare in fruit.

1 ? 5. Chartley Moss, Staffordshire, *J. E. Bagnall*. 7. Snowdon, Carnarvonshire, *Dr. Carrington*; Cader Idris, The Arenigs, Merionethshire, *W. H. P.* 8. Charlesworth Coombs; Kinder Scout, Derbyshire, *G. A. Holt*. 9. Botton Head Fell, West Lanc., *A. Wilson*; Clougha, West Lanc., *J. A. Wheldon*. 10. Summit of Ingleboro; Whernside, *Dr. Carrington*; Penyghent, *W. West*; Ayton Moor, *W. Mudd*; Greenfield, *W. Wilson, G. A. Holt*; Todmorden, *John Nowell, A. Stansfield*; Upper Wharfe Valley (c. fr.), *G. A. Holt*. 11. 12. Ambleside and Patterdale, Westmorland, *C. Lyell*; Black Crag and Nan Bield, Mardale (δ and fr.); Kentmere; Foulshaw; Barbon Fell; Red Screes; Wild Boar Fell; Long Sleddale, Westmorland, *G. Stabler*; Borrowdale, *J. R. Byrom* & *W. H. P.* 13. North of Black Craig, New Galloway; Barend

Moss, Castle Douglas, *J. McAndrew*; Moors at Loch Skene, *W. Nichol*. 15. Cairn Gorm, *Sir W. J. Hooker*; Ben-na-Board and Glen Dole, Forfar, *A. Croall*. 16. Moidart, West Inverness, common, *S. M. Macvicar*. 17A. Sutherland Mountains, *Dr. Greville*.

I. Wicklow Mountains, *Dr. Taylor*; near Bantry, *Miss Hutchins*; Killarney, *Dr. Carrington*, *Prof. Lindberg*, and others.

Found on the Continent and in North America.

Obs.—Distinguished from all other round-leaved species with stipules, by the presence of the very copious rootlets, the thick leaves, entire bracts and laterally compressed perianth; from *Mylia anomala* (Hook.) by the never acuminate leaves, presence of minute warts on the epidermis of the leaves and perianth, and the mouth of the perianth being ciliate.

The easiest way to examine the epidermis is to detach a leaf from the plant, bend it on the object-glass, place on it carefully the cover-glass and examine in water with a $\frac{1}{4}$ inch, when the minute warts can be seen, about 7 or 8 on each cell. The copious, dense rootlets cause the stems to be separated with difficulty.

I once found a perigonial bract quite bifid, also an imperfect perianth from which a perfect capsule projected, which, when flattened out like a bract, was subquadrate, emarginate, with the whole of the margin ciliate-dentate.

DESCRIPTION OF PLATE CIX.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 11$ (Ireland, Lindberg). 3–5. Leaves $\times 11$ (ditto). 6. Cross-section of leaf, showing epidermis with the minute warts, free (ditto). 7. Portion of leaf $\times 290$ (Linton, Yorks., Holt). 8, 9. Stipules $\times 85$ (Cwm Bychan, North Wales, Holmes). 10, 11. Bracts $\times 16$ (Linton, Holt). 12. Bracteole $\times 24$ (ditto). 13. Perianth $\times 11$ (ditto). 14. Cross-section of upper portion of perianth $\times 11$ (ditto). 15. Cross-section of middle portion of perianth $\times 11$ (ditto). 16. Cross-section of lower portion of perianth $\times 11$ (ditto). 17. Portion of the mouth of perianth $\times 85$ (ditto). 18, 19.

Perigonial bracts $\times 16$ (Cwm Bychau, W. H. P.). 20. Antheridium $\times 85$ (ditto).

2. *Mylia anomala* (Hook.), Gr. & B.

Jungermania anomala, Hook. Brit. Jung. t. 34 (1816).

Mylia anomala, Gr. & B. Nat. Arr. Brit. Pl. 1, p. 693 (1821).

Jungermania Taylori, var. *anomala*, Nees, Nat. Eur. Leb. 11, p. 455 (1836).

Coleochila anomala, Dum. Hep. Eur. p. 106 (1874).

Dioicous, loosely caespitose or creeping amongst mosses, largish to very large, of a yellowish-green to dark brown colour. Stems (a cross-section shows about 30 cortical cells which are a little larger and darker than the inner, 12×15 in diam.), procumbent, simple or producing one or two short lateral innovant branches, flexuose; radiculose, rootlets numerous, whitish, clothing the whole of the underside of the stem. Leaves obliquely inserted, horizontal to patent-divergent, bifarious, alternate, distant or contiguous, ovate-acuminate, ovate or more rarely orbicular, margin entire, or erose by gemmæ; texture rather firm, but more delicate than in *Mylia Taylori*, epidermis smooth, cells large, oblong-quadrate, cell-walls somewhat thin, showing two bands, trigones distinct, darker coloured than the lumen of the cells. Stipules small, often hidden by the rootlets, subulate, bifid to about the $\frac{1}{5}$, sinus very narrow, segments acuminate. Bracts oblong-oval, apices often erose. Bracteole free from bracts, subulate, about 15 cells broad at the base, bifid to about the $\frac{1}{5}$, sinus very narrow, segments acuminate. Perianth oblong-oval, narrower at the mouth and base than the middle, laterally compressed, mouth truncate, entire. Capsule roundish-oval; spores light-brown; elaters bispiral, about 12 turns of the spiral, reddish-brown. Male stems more slender, ♂ terminal or at the middle of the stem, perigonial bracts smaller, more erect, semiamplexicaul, sublobulate, ventricose, antheridia small, spherical.

Fruits June, July.

DIMENSIONS.—Stems from 2 to 4 inches long, .5 mm. diam., with leaves 3.5 mm. wide; leaves 3 mm. \times 1.75 mm., 2.75 mm. \times 1.5 mm., 2.5 mm. \times 1.5 mm.; cells .1 mm. long \times .05 mm. broad, .1 mm. \times .04 mm., .08 mm. \times .035 mm.; walls .0075 mm.;

trigones .02 mm.; stipules 1.1 mm. × .3 mm. base, segments .2 mm., 1. mm. × .2 mm. base, seg. .2 mm.; bracts 3. mm. × 1.5 mm.; bracteole 1.75 mm. × .5 mm.; seg. .3 mm.; perianth 4.5 mm. long × 1.75 mm. broad at the middle, .75 mm. at the apex, and .75 mm. at the base; diam. of perigonial stem .2 mm.; perigonial bracts .75 mm. × .5 mm.

HAB.—Growing in loose patches, or creeping amongst mosses, especially *Sphagna*, in boggy situations. Moderately rare, extremely so in fruit.

2. New Forest, Hampshire, *C. Lyell*. 4. Holt Lows; Edgefield Hill; Holt Wood, Norfolk, *Rev. R. B. Francis*; Westleton Bogs, near Halesworth, Suffolk, *Dr. Hooker*. 5. Sherbrook Valley; Brindley Valley; Chartley Moss, Staffordshire, *J. E. Bagnall*. 8. Kinder Scout, Derbyshire, *Holt & Whitehead*. 9. Wybunbury Bog, Cheshire (cum. fr.), *W. Wilson*; Cockerham Moss, West Lanc., *A. Wilson*. 10. Harlow Heath, Yorks., *Dr. F. A. Lees*; Ilkley Moor, Yorks., *Dr. Carrington*; Askham Bog, Yorks., *Dr. F. A. Lees*; Thornton Moor, Yorks., *W. West*; Stansfield Moor, Yorks., *John Nowell*. 12. Ambleside, Westmorland, *C. Lyell*; Foulshaw Moss; Witherslack Moss (c. per); Barbon Fell; Sandford Bog, near Warcop, Westmorland, *G. Stabler*. 13. North of Black Craig, New Galloway, *J. McAndrew*; Lochar Moss, Dumfries, *J. Cruickshank*. 15. Kinnordy, *C. Lyell*. 16. Moidart, West Inverness, on wet moors, common, *S. M. Macvicar*.

I. Devis Mountain, Co. Antrim, *Mr. Templeton*; Annahilt Bog, Co. Down, *Mr. Templeton*; near Bantry, *Miss Hutchins*. On wet banks in subalpine parts of the country, *Dr. D. Moore*.

Found on the Continent and in North America.

Obs.—Distinguished from *Mylia Taylori* by the shape and texture of leaves, the smooth epidermis, elongate cells, bifid stipules and bracteole, narrower perianth with entire mouth.

The leaves vary in shape, some being quite orbicular, but the most common are as figured.

DESCRIPTION OF PLATE CX.—Fig. 1. Plants natural size. 2. Portion of stem × 11 (Barton Moss, W. H. P.). 3–5. Leaves × 11 (Fennix, Lindberg). 6. Leaf and stipule × 11 (ditto).

7. Portion of leaf \times 290 (ditto). 8. Stipule \times 24 (ditto).
 9. Stipule \times 11 (ditto). 10, 11. Bracts \times 11 (ditto).
 12. Bracteole \times 11 (ditto). 13. Bracteole \times 24 (ditto).
 14. Perianth \times 11 (ditto). 15. Cross-section of perianth near
 apex \times 11 (ditto). 16. Cross-section of perianth at the middle
 (ditto). 17. Cross-section of perianth at the base \times 11 (ditto).
 18. Portion of the mouth of perianth \times 85 (ditto). 19. Portion
 of male stem \times 24 (ditto). 23. Perigonial bract \times 24 (ditto).

Genus 27. **PEDINOPHYLLUM**, *Lindb.*

Jungermania, Nees, Nat. Eur. Leb. 1, p. 165 (1833).

Plagiochila, Dum. Recueil, p. 15 (1835).

Leptoscyphus, Mitt. in Hook. Journ. of Bot. 111 (1851).

Pedinophyllum, Lindb. Bot. not. p. 156 (1874); Hep. in Hibern. p. 504 (1874).

Monoicous; habit of *Chiloscyphus*; depresso-cæspitose, no
 rhizomatous caudex; stem creeping, radiculose. Leaves very
 slightly decurrent, subplane or plane, rotund-rectangular. Sti-
 pules constantly present, very small and inconspicuous. Perianth
 never on chief stem but terminal on branches, compressed as in
Plagiochila.

Pedinophyllum interruptum (*Nees*), *Lindb.*

Jungermania interrupta, Nees, Nat. Eur. Leb. 1, p. 165 (1833).

Jungermania Dumortieri, Lib. Pl. crypt. Ard. iv. n. 311 (1837).

Plagiochila interrupta, Dum. Recueil, p. 15 (1835).

Leptoscyphus interruptus, Mitt. in Hook. Journ. Bot. 111 (1851).

Plagiochila (*Pedinophyllum*) *pyrenaica*, var. *interrupta* (*Nees*); Lindb. Man.
 Musc. Sec. p. 367 (1874).

Pedinophyllum pyrenaicum, Lindb. in Hep. in Hib. p. 505 (1875).

Monoicous, densely cæspitose, tufts depressed, small, light
 yellowish-green to olive-brown in colour. Stems intricately
 entangled, prostrate, then slightly assurgent, irregularly ramose;
 radiculose, on the prostrate stems rootlets plentiful, whitish, on
 the upper branches rare. Leaves imbricate or approximate,
 alternate, horizontal, antical margin slightly decurrent, spreading
 or complanate, plane or subplane, rotund-rectangular, oval to

oblong-subquadrate, entire or retuse, lower leaves minute, then often acutely bifid; texture firm, cells smallish, roundish-quadrate, lumen full of chlorophyl granules, walls moderately thick, trigones large, distinct. Stipules minute, rudimentary, subulate or broadly subulate, at the base $\frac{1}{3}$ as wide as the stem. Bracts similar to the upper leaves only larger. Perianth terminal on the branches, projecting about $\frac{1}{3}$ beyond the bracts, compressed, obovate, mouth wide, bilabiate, irregularly dentate, teeth few. Pistillidia large, about 15. Calyptra globose, of a delicate texture. Capsule small, oval, dark brown. Spores small, pale brown. Elaters rather darker brown than the spores, bispiral, about 10 turns of the spiral. Andrœcia on proper branches on the same plant as the fertile or proceeding from the fertile branch, terminal or situated at the middle; perigonal bracts 5, 6 pairs, closely imbricate, smaller and more erect than the stem leaves, ventricose, lobate, lobe oval, lobule half the size and oval, antheridia single, large, almost spherical.

Fruits April, May.

DIMENSIONS.—Stems about $\frac{1}{2}$ inch long, diam. .2 mm., with leaves 2.0 mm. to 2.5 mm. wide; leaves 1.0 mm. \times .8 mm.; cells .025 mm. \times .035 mm., .025 mm. \times .03 mm., .025 mm. \times .025 mm., .03 mm. \times .03 mm.; sub-bracts 2.0 mm. \times 1.6 mm., 2. mm. \times 1.4 mm., 2. mm. \times 1.75 mm.; bracts 2.5 mm. \times 2. mm.; perianth 3. mm. \times 1.75 mm.; pistillidia .225 mm. \times .06 mm.; spores .01 mm. diam.; elaters .1 mm. \times .01 mm.; perigonal bracts .75 mm. \times .45 mm.; lobule .5 mm. \times .3 mm.; antheridia .225 mm. \times .2 mm., .3 mm. \times .25 mm.

HAB.—Grows on damp rocks, usually calcareous. Rare.

2. Ardingley Rocks, Sussex, *W. Mitten*. 5, 8. Cheedale, Derbyshire, *G. A. Holt*. 10. On rocks by the Strid, Bolton Woods, *Dr. Carrington, John Nowell*; Malham, *Dr. Carrington*; Ingleton, *W. H. P.* 12. Windermere, Westmorland, *Dr. Carrington*.

I. Benbulbin Range, Co. Sligo; Gleniff, Co. Sligo, *Dr. D. Moore*.

Found on the Continent.

Greenland, *Vahl*.

Obs.—This rare species is not likely to be confused with any other, especially if found fertile.

Chiloscyphus polyanthos (L.) is a larger plant, with quite different cell structure, and furnished with distinct bipartite stipules.

I have examined a large series of specimens from different localities, and am of the opinion that the var. *pyrenaica* is only sportive, as stems which might be described as it are found also on the normal form. Dr. Carrington arrived at this conclusion years ago, and Dr. Spruce, who first noticed it, in later years had no great confidence in its specific or varietal value.

DESCRIPTION OF PLATE CXI.—Fig. 1. Plants natural size. 2. Portion of stem $\times 16$ (near Bolton Abbey, John Nowell). 3. Portion of male stem $\times 16$ (Baden, Jack). 4, 5. Leaves $\times 24$ (ditto). 6. Portion of leaf $\times 290$ (ditto). 7, 8. Stipules $\times ?$ (ditto). 9–12. Sub-bracts $\times 11$ (ditto). 13. Bracts $\times 11$ (ditto). 14. Perianth $\times 11$ (ditto). 15. Cross-section of perianth $\times 11$ (ditto). 16. Portion of the mouth of the perianth $\times 16$ (ditto). 17. Spores $\times 290$ (ditto). 18, 19. Perigonial bracts $\times 24$ (ditto). 20. Antheridium $\times 24$ (ditto).

Genus 28. **PLAGIOCHILA**, *Dum.*

Jungermania, Mich. Nov. pl. gen. p. 7 (1729); L. Sp. pl. ed. i. 2, p. 1131 (1753)

Candollea, Raddi in Act. soc. Modena, 18, p. 22 (1818).

Martinellia, sect. *b.* Gr. & B. Nat. Arr. Brit. Pl. 1, p. 692 (1821).

Radula, Dum. Comm. Bot. p. 112, pp. 1822.

Radula, sect. *Plagiochila*, Dum. Syll. p. 42 (1831).

Plagiochila, Dum. Recueil, 1, p. 14 (1835).

Plants often very large and conspicuous, rarely small, cæspitose or creeping among mosses. Caudex stout, creeping, densely radiculose on the underside, leafless or furnished with few small ones. Stems firm, reddish, or almost black, rarely pale, 3–5 exterior layers of cells coloured, inner pale. Branches ascending or procumbent, dichotomously branched or dendroid, uniformly lateral, springing from the leaf axils. Leaves almost always

large, succubous, opposite or alternate, distichous, patulous or devexo-secund, oblique, rarely acute, usually rotundate or truncate, dentate or spinose, rarely entire; marginal teeth or cilia acute, ending in a single, sharp-pointed, conical cell; antical margin decurrent, recurved or revolute; postical margin arcuate, rotundate, sometimes semicircular, plane, towards the base reflexed, margin dentato-spinose or ciliate, very rarely entire. Cells medium size or rather large, rarely small, subquadrate-hexagonal, only at the base oblong, very rarely all elongate; trigones almost always large and conspicuous; cuticule smooth. Stipules normally wanting, in some species mere scales, in others everywhere present, small, entire or unequally plurifid, segments often flexuose. Inflorescence dioicous. Andrœcia spicate, linear or fusiform, terminal or at the middle; perigonial bracts smaller than the leaves, ventricose, closely imbricated, in two rows. Antheridia oval, 1 to 10, usually 2 or 3. Female flowers terminal on the chief stem or branches, or axillary from the growth of innovations. Bracts ♀ alternate, imbricate, transverse, erect, ventricose-saccate, 1-4 pairs, free, larger and broader than the leaves. Pistillidia numerous (25-70). Perianth more or less projecting, a little longer than the bracts, free, laterally compressed at right angles to the plane of the stem, campanulate or longer, and obconico-cylindrical or clavate, erect or decurved at the apex, leptodermous, mouth wide, obliquely truncate, rotundate or bilabiate, entire, dentate, or ciliate. Calyptra free, included, about half the size of the perianth, globose or oval-globose, leptodermous, slightly carnos near the base, where it is surrounded by the sterile pistillidia. Pedicel firm, about 10 cells in diameter, usually short, in a few species elongate. Capsule large, globose or oval-globose, coriaceous, dividing down to the base into 4 valves, valves sometimes bilobed, 3-8 layers thick. Elaters bispiral, long, deciduous, attached to the centre of the valves.

1. *Plagiochila Stableri*, Pearson.

Plagiochila Stableri, Pears. in Jour. of Bot. June (1890).

Dioicous, loosely caespitose, small, pale to brownish-green in colour. Stems creeping, simple or irregularly branched; branches ascending; radiculose, rootlets few, single, white. Leaves imbricate or distant, bifarious, alternate, horizontal or patent-divergent, largest near the middle of the stem, very slightly or not at all decurrent antically, plane or slightly concave, oblong-quadrate, oval or subcuneate, bidentate to about one-fourth, retuse or entire, margin quite entire; texture somewhat thick; cells from moderate to largish in size, roundish-quadrate; walls thick, angles thickened. Stipules evident, simple or bifid, segments subulate.

DIMENSIONS.—Stems $\frac{1}{2}$ inch long, with leaves 1.25 mm. wide; diameter of stem 0.15 mm.; leaves 0.7 mm. \times 0.5 mm., 0.5 mm. \times 0.5 mm., 0.7 mm. \times 0.45 mm.; segments 0.2 mm., 0.6 mm. \times 0.5 mm., 0.7 mm. \times 0.55 mm.; segments 0.1 mm.; cells 0.04 mm. \times 0.045 mm., 0.04 mm. \times 0.04 mm., 0.035 mm. \times 0.04 mm., 0.035 mm. \times 0.035 mm.; stipules 0.225 mm. \times 0.05 mm., 0.2 mm. \times 0.08 mm., 0.2 mm. \times 0.04 mm.

HAB.—On rocks near Fall, Rydal Park, Rydal, Westmorland, *Mr. George Stabler*, Sept. 1877.

OBS.—Although the small flagelliferous varieties of *P. spinulosa* (Dicks.) and *P. punctata*, Tayl. are numerous, *P. Stableri* cannot be confounded with any of them, the almost horizontal insertion of the bidentate, retuse, or entire leaves, which are nearly plane, and their much larger cells at once distinguish the species.

P. tridenticulata, Tayl., which has usually bidentate leaves, oblong-oval in shape, with a very narrow base and small cells, is very distinct.

P. exigua, Tayl. has very decurrent leaves of a different shape, with an extremely narrow base; cells much smaller.

Pedinophyllum interruptum (Nees), with which it agrees somewhat in the insertion of its leaves, is a much more robust plant, with usually entire leaves and less evident stipules.

DESCRIPTION OF PLATE CXII.—Fig. 1. Plants natural size. 2. Plant, antical view $\times 24$. 3–8. Leaves $\times 31$. 9. Portion of leaf $\times 290$. 10–12. Stipules $\times 85$.

2. *Plagiochila asplenioides* (L.), Dum.

Lichenastrum asplenii facie, pinnis laxioribus (et confertioribus), Dill. Hist. musc. p. 482, t. 69, f. 5 et 6 (1741).

Jungermania asplenioides, L. Sp. pl. p. 1595 (1753).

Radula (Plagiochila) asplenioides, Dum. Syll. Jung. Eur. p. 42, n. 28 (1831).

Plagiochila asplenioides, Dum. Recueil. p. 14 (1835).

Dioicous, cæspitose or creeping amongst mosses, from medium to very large in size, of a pale green to greenish-brown colour. Creeping stem or caudex firm, blackish; radiculose on the underside, leafless or with few small leaves, ascending stems pale brown, rootless, or rootlets very few, but long, apex often recurved, ramose, branches lateral, subpostical, arising from the axil of the leaves. Lower leaves small and distant, others large, contiguous or subimbricate, succubous, obliquely inserted, patent, alternate, decurved, slightly concave, postical margin recurved, postically decurrent, much decurrent antically, ovate, obovate or suborbicular, apex rotundate, ciliate-dentate, dentate, subdentate or entire, teeth acute; texture thin to moderately firm, epidermis smooth, cells medium size to rather large, hexagonal, vacuous or with the chlorophyl granules lining the margin, walls thin, trigones wanting or very minute. Stipules absent or rudimentary only. Bracts similar to upper leaves only larger, erect. Bracteole wanting. Perianth projecting about half beyond the bracts, tubular at the base, laterally compressed, long, oblong obovate, mouth truncate, wide, ciliate-dentate, cilia 3–4 cells long at the most, usually only 2, apical ones acute, pistillidia 12–25. Pedicel long. Capsule oval, spores smooth or finely punctate, yellowish-brown, elaters reddish-brown.

Male stems distinct, ♂ terminal, perigonial bracts about 5 pairs closely imbricating, semi-amplexicaul, small, obovate, saccate at the base, basal margin a little incurved, slightly lobulate, antheridia oval to roundish, 2 in each bract.

Fruits April, May.

DIMENSIONS.—Stems from 1 to 6 inches long, diam. $\cdot 75$ mm., with leaves 8 mm. broad; leaves 4 mm. \times 3 mm., $\cdot 35$ mm. \times $\cdot 275$ mm.; teeth of leaves $\cdot 5$ mm.; cells $\cdot 04$ mm.; bracts 4.5 mm. \times 3 mm.; perianth 7 mm. long \times 3.75 mm. wide at the mouth; teeth at mouth of perianth $\cdot 1$ mm.; elaters $\cdot 15$ mm. long \times $\cdot 01$ mm. wide; spores $\cdot 0175$ mm.; perigonial bracts 1.5 mm. \times 1 mm.; antheridia $\cdot 3$ mm. \times $\cdot 225$ mm.

HAB.—Growing in dense patches on rocks or creeping aerially amongst the larger mosses in shady places.

Common. 1–18. I.

Found on the Continent and in North America.

OBS.—The large aerial form, almost tropical in some of its forms, and which rarely fruits, is remarkably different in habit from the smaller and fertile form, which grows usually in dense patches on damp rocks, but a close microscopic examination reveals no permanent character which can be relied upon; the leaves differ in shape, the margin of both forms vary, from being entire to ciliate-dentate.

According to original specimens, *Plagiochila Dillenii*, Tayl. is the small form.

DESCRIPTION OF PLATE CXIII.—Fig. 1. Plant natural size. 2. Portion of stem $\times 11$, antical view (Carr. & Pears. 87). 3. Perianth and bract $\times 11$ (Baden, Jack). 4. Portion of mouth of perianth $\times 85$ (ditto).

DESCRIPTION OF PLATE CXIV.—Fig. 1. Plants natural size (var. *Dillenii*, Tayl.). 2. Portion of stem of type $\times 11$, postical view (Carr. & Pears. 87). 3. Portion of margin of leaf $\times 85$ (ditto). 4. Portion of leaf $\times 290$ (ditto). 5. Perigonial bract $\times 16$ (G. & R. 620). 6. Antheridium $\times 24$ (ditto).

3. *Plagiochila ambagiosa*, Mitten.

Plagiochila ambagiosa, Mitten, Trans. Linn. Soc. vol. iii. p. 193 (1891); Steph. Bull. de l. Herb. Boissier, vol. v. p. 83 (1897).

Dioicous, caespitose, medium size, of a yellowish-brown colour. Stems arising from a creeping or procumbent rhizome

with a few stoloniferous divaricate shoots; leaves larger towards the apex, patulous or divergent, oval or ovato-oval, apex rounded or truncate, usually trispinose, antical margin shortly decurrent, entire, postical margin dentate, teeth short and broad; cells smallish to medium size, punctate, round or roundish-oblong, walls thick. Bracts similar to the leaves only larger and more dentate. Perianth obovate, bent over on the postical side, without wing, mouth rounded, shortly dentate.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inch long, $\cdot 5$ mm. \times $\cdot 75$ mm. diam., with leaves $5\cdot$ mm. to $6\cdot$ mm. wide; leaves $3\cdot 5$ mm. \times $2\cdot 25$ mm., $3\cdot 25$ mm. \times $2\cdot$ mm., $3\cdot$ mm. \times $1\cdot 5$ mm.; teeth $\cdot 2$ mm.; cells $\cdot 03$ mm.

HAB.—Bantry, South of Ireland, *Miss Hutchins* (Herb. Mitten).

The only known station.

OBS.—Mr. Mitten detected this fine species in a collection made many years ago by the late Miss Hutchins in the South of Ireland. It is abundantly distinct from either *P. punctata*, Tayl. or *P. spinulosa* (Dicks.), with which it is nearest allied.

I am indebted to Mr. Mitten's description for most of my notes of the species.

DESCRIPTION OF PLATE CXV.—Fig. 1. Plant natural size. 2. Portion of stem, antical view $\times 11$. 3–8. Leaves $\times 11$. 9. Teeth of leaf $\times 64$. 10. Portion of leaf $\times 290$.

4. *Plagiochila spinulosa* (Dicks.), Dum.

Lichenastrum ramosus foliis trifidus et L. pinnulis alternis quasi spinosis, Dill.

Hist. musc. p. 489, t. 60, f. 15, 16 (1741).

Jungermania spinulosa, Dicks. Pl. Crypt. Brit. fasc. 2nd, p. 14 (1790); Hook.

Brit. Jung. p. 9, t. 14 (1816).

Plagiochila spinulosa, Dum. Recueil, p. 15 (1835).

Dioicous, cæspitose or creeping amongst mosses, medium to largish size, of a pale yellow, yellowish-green, or olive-brown colour. Stems erect or creeping, simple or dichotomously branched; radiculose almost up to apex of stem, rootlets whitish,

branches lateral, subpostical, arising from axil of leaves or bracts. Leaves patent at an angle of 40° to 60° , alternate, distant or contiguous, much decurrent antically, oblong-oval, obovate or semi-ovate, with few large teeth or spines on the upper margin, lower margin entire, reflexed; texture somewhat firm, cells smallish, roundish; walls rather thick, angles thickened, trigones wanting. Stipules rudimentary, minute, bifid or trifid, or wanting. Bracts larger than the leaves, with numerous teeth on the upper margin, broadly ovate. Bracteole wanting. Perianth broadly obovate, compressed, mouth wide, ciliate-dentate; pistillidia numerous. Male stems distinct, more slender and graceful, perigonal bracts at the middle or end of the stem, catkin-like, small, closely imbricate, about 5 pairs, broadly oval, lobulate, lobule 2-3 dentate; antheridia roundish-oval.

HAB.—On rocks or at the base of trees, in woods and shady or exposed places, chiefly subalpine. Somewhat common.

1. Penzance; Redruth, Cornwall, *W. Curnow*; Devon, *C. Lyell*.
 2. Rufus-stone, New Forest, Hants, *C. Lyell*. 7. Merionethshire; Carnarvonshire, common, *W. H. P.* 9. Easgill, near Leek, West Lanc., *A. Wilson*; Greycarth Fell, West Lanc., *J. A. Wheldon*.
 10. Bolton Woods, *J. Nowell*; Ingleboro', *J. Nowell*, *J. G. Baker*; Dent, *G. Stabler*; Todmorden, *A. Stansfield*; Teesdale, *Dr. Spruce*.
 11, 12. Westmorland, *G. Stabler*; Cumberland, frequent, *W. H. P.*
 13. New Galloway, frequent, *J. McAndrew*. 15, 16. Moidart, West Inverness, very common and variable, ascending to 1700 ft. at least, *S. M. Maccicar*.

I. Common.

C. Jersey, *Mrs. McKenzie*; St. Ouen, *Aug. Martin*.

Found on the Continent.

DIMENSIONS.—Stems 1 to 2 inches long, diam. $\cdot 25$ mm. with leaves $2\cdot 5$ mm. wide; leaves $1\cdot 3$ mm. \times $\cdot 7$ mm., $1\cdot 8$ mm. \times $\cdot 7$ mm., $1\cdot 9$ mm. \times $\cdot 8$ mm.; cells $\cdot 0175$ mm. \times $\cdot 02$ mm., $\cdot 025$ mm. \times $\cdot 02$ mm., $\cdot 025$ mm. \times $\cdot 02$ mm., $\cdot 03$ mm. \times $\cdot 02$ mm.; bracts $1\cdot 9$ mm. \times $1\cdot 9$ mm.; perianth $2\cdot 5$ mm. \times $2\cdot$ mm.; perigonal bracts $1\cdot$ mm. \times $\cdot 75$ mm.; lobule $\cdot 5$ mm. \times $\cdot 3$ mm.; antheridium $\cdot 3$ mm. \times $\cdot 275$ mm.

Obs.—This species in its normal state is only to be confused with *Plagiochila punctata*, Tayl., which see.

The small flagelliferous forms, of which there many, are apt to be mistaken for *Plagiochila tridenticulata*, Tayl., but this species is at once separated from any of them by its erect habit, darker coloured leaves, which also differ in shape and cell structure.

The American *P. spinulosa* of Sullivant and others has justly been removed to another species, *P. Sullivantii*, Gottsche MS., see Evans' admirable monograph, "North American Species of Plagiochila," Bot. Gaz., April 1890.

DESCRIPTION OF PLATE CXVI.—Fig. 1. Plant natural size. 2. Portion of stem $\times 24$, antical view (Cader Idris, J. Ralfs). 3, 4. Leaves $\times 24$ (Cromaglow, Lindberg). 5. Portion of leaf $\times 290$ (ditto). 6. Bract $\times 24$ (Cader Idris, J. Ralfs). 7. Perianth $\times 24$ (ditto). 8, 9. Perigonial bracts $\times 24$ (Cromaglow, Lindberg). 10. Antheridium $\times 24$ (ditto).

5. *Plagiochila punctata*, Tayl.

Plagiochila punctata, Tayl. Hep. Antaret. in Lond. Journ. of Bot. p. 371 (1844); G.L.N. Syn. Hep. Suppl. p. 626 (1847).

Plagiochila spinulosa, var. *punctata*, Carr. Irish Crypt. p. 19, t. 2, f. 3 (1863).

Dioicous, densely cæspitose, flagelliferous, medium size, yellow or olive-brown, young plants pale green in colour. Stems erect, dark brown; radiculose, rootlets whitish, branched, branches arising from the axil of the upper leaves or bracts, lateral, but slightly subpostical. Leaves patent to patent-divergent at an angle of 55° (from 50° to 70°), alternate, obliquely inserted, lower leaf smaller, more distant, others subapproximate, only slightly decurrent antically, roundish-ovate or roundish-oval, upper margin recurvate, spinose-ciliate, lower margin entire or almost so; texture firm, cells small, roundish, lumen clear, walls thick, angles thickened, trigones wanting, punctate. Stipules wanting, or rudimentary. Bracts larger than the leaves. Perianth from a narrow base broadly obovate, compressed at the mouth, bilabiate, truncate, mouth wide, spinose-ciliate.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, diam. .2 mm., with leaves 1.75 mm. wide; leaves, upper 1.4 mm. \times .9 mm., 1.25 mm. \times .9 mm., middle 1.2 mm. \times .6 mm., 1.1 mm. \times .5 mm., lower .9 mm. \times .75 mm., .8 mm. \times .6 mm.; cells .02 mm. (.02 mm. \times .0175 mm., .0175 mm. \times .0175 mm., .015 mm. \times .015 mm., .02 mm. \times .02 mm., .025 mm. \times .02 mm., .03 mm. \times .015 mm.); bracts 1.2 mm. high \times 1.6 mm. broad; perianth 1.2 mm. high \times 1.5 mm. broad; cilia at the mouth from .3 mm. to .6 mm. long; pistillidia .22 mm. long \times .05 mm. broad.

HAB.—Growing in woods and shady places, chiefly subalpine, on rocks in dense compact tufts, or creeping amongst mosses, when it is remarkably flagelliferous. Moderately rare.

1. Carn Galva; Carn Brea, Redruth, *W. Currow* (as *P. tridenticulata* in Report and Trans. Penzance N. H. & A. Soc. 1881-2). 7. Barmouth; Dolgelly; Tyn-y-Groes, Merionethshire, *Dr. Carrington, G. A. Holt, W. H. P.* Snowdon District, Carnarvonshire, *G. E. Davies, E. M. Holmes.* 10. Wensleydale, *Dr. F. A. Lees.* 12. Borrowdale, *Dr. Carrington & W. H. P.* 13. Glenlaggan Hill, Parton; Burnfoot Hill, New Galloway, *J. McAndrew.* 15. Bowling, *A. McKinlay.* 16. Moidart, West Inverness, common and very variable, on tree stems and rocky banks, ascending to 2500 ft., *S. M. Macvicar.*

I. Abundant in Co. Kerry, especially in the Killarney Woods, but not common in the northern or eastern counties; Altdore Glen, and at Seven Churches, Wicklow; Glenad, Co. Leitrim, *Dr. D. Moore*; Killarney and the South-west, most abundant, *Dr. Carrington.*

Found on the Continent.

Obs.—Distinguished from *Plagiochila spinulosa* (Dicks.) by its smaller size, more compact habit, darker colour, rounder leaves, which are more transversely inserted, not decurrent, cells slightly smaller, bracts broader proportionately, perianth shorter with longer cilia; it is also more flagelliferous. I do not rely much upon the punctate character of the leaves, for there is little difference to be observed in the cell structure of *P. spinulosa* and *P. punctata.*

The lumen of the cells being clear and the thick walls and angles of a brown colour, the leaves appear to be punctate, bringing into prominence the feature which gives the name to this plant.

It is more variable in size than *P. spinulosa*, often growing in small dense pulvinate tufts, very closely entangled, about $\frac{1}{2}$ inch high.

DESCRIPTION OF PLATE CXVII.—Fig. 1. Plants natural size. 2. Portion of stem $\times 24$ (Killarney, Dr. Carrington). 3, 4. Upper leaves $\times 24$ (original, Herb. Taylor). 5, 6. Lower leaves $\times 24$ (ditto). 7. Portion of leaf $\times 290$ (ditto). 8, 9. Bracts $\times 24$ (Killarney, Dr. Carrington). 10. Perianth $\times 24$ (ditto). 11. Pistillidium $\times 85$ (ditto).

6. *Plagiochila tridenticulata*, *Tayl.*

Jungermania spinulosa, var. *tridenticulata*, Hook. Brit. Jung. p. 9, t. xiv. ff. 9, 10 (1816)?.

Radula corniculata, Dum. Syll. Jung. p. 13 (1831)?.

Plagiochila corniculata, Dum. Recueil, p. 15 (1835)?.

Plagiochila tridenticulata, Dum. Recueil, p. 15 (1835)?.

Plagiochila tridenticulata, Taylor in G.L.N. Syn. Hep. p. 26 (1844).

Dioicous, densely cæspitose or rarely creeping, small, of a dark indigo-green colour, when dry almost black. Stems filiform, flexuose, dark brown, erect, ramose, branches lateral; radiculose, rootlets dull white, ascending almost to apex of the stem. Leaves obliquely inserted, patent to divergent-patent, 60° (from 50° to 70°), distant or approximate, alternate, oblong-ovate or cuneate-ovate, from a narrow base, caducous, 2-3-lobulate, bifid or less often trifid to about $\frac{1}{4}$ or $\frac{1}{3}$, sinus rounded or acute, segments acute or apiculate, margin entire; texture somewhat firm, cells small, roundish, lumen clear, walls thick, angles thickened and pale brown, no trigones. Stipules wanting or rudimentary. Perigonial bracts middle or end of the stem, 3-5 pairs, closely imbricated, more erect, semi-amplexicaul, ventricose at the base, ovate, trifid; antheridia spherical.

Female plants not seen.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, diam. .1 mm., with leaves 1 mm. wide; leaves .8 mm. \times .4 mm., segments .3 mm., .7 mm. \times .3 mm., seg. .2 mm., .65 mm. \times .4 mm., seg. .3 mm.; cells .03 mm., .02 mm., .0175 mm., .015 mm.; cell-walls .01 mm.; perigonal bracts .7 mm. \times .55 mm., seg. .2 mm.; antheridia .1 mm.

HAB.—Growing on rocks or trees in shady places. Rare. 7. Tyn-y-Groes, Merionethshire, *C. J. Wild, G. A. Holt, Dr. Carrington, W. H. P.*; Dolgelly, Merionethshire, *W. Wilson, E. George*; Aber, Carnarvonshire, *W. Wilson*; Llanberis, Carnarvonshire, *W. H. P.*; 12. Keswick, *C. Lyell*, 1812; *Dr. Carrington & W. H. P.*, 1884. 13. New Galloway, *J. McAndrew*. 16. Moidart, West Inverness, *S. M. Macvicar & W. H. P.*; Scotland, *W. Wilson*. South of Ireland, *Dr. Taylor*, and others. Bantry, Glengariff, Killarney, &c.

The *Plag. tridenticulata*, Tayl., reported as collected in Cornwall by the late Wm. Curnow, belongs to another species.

Obs.—Distinguished from *Plagiochila punctata*, Tayl., by its smaller size, compact habit, darker colour, oblong-ovate, cuneate leaves, which are only bifid or trifid, and which when dry easily fall off, leaving only the naked stem.

When dry it turns almost black, and is then at once distinguished from any of the other *Plagiochilæ*.

It is very doubtful whether Hooker's *Jung. spinulosa*, var. *tridenticulata*, is this species; the figures given in his "Brit. Jung." certainly do not represent it.

Plagiochila tridenticulata, Dum. Recueil 1835, and *Plagiochila corniculata*, Dum. Recueil 1835, are both founded on Hooker's *Jung. spinulosa*, var. *tridenticulata*, which probably is not the same as Taylor's species. Dr. Spruce remarked in a letter, "the specific name is not a very happy one, for 'denticulata' means only rudimentarily toothed, whereas the leaves of this plant are decidedly 2-3-lobulate."

DESCRIPTION OF PLATE CXVIII. Fig. 1. Plants natural size. 2. Plant \times 24 (Tyn-y-Groes, North Wales, W. H. P.). 3. Portion of stem \times 24 (ditto). 4. Leaf \times 85 (ditto). 5. Portion of

leaf \times 290 (ditto). 6, 7. Perigonial bracts \times 24 (ditto).
8. Antheridium \times 85 (ditto).

7. *Plagiochila exigua*, *Tayl.*

Jungermania exigua, *Tayl.* in *Trans. Bot. Soc.* Ed. 1, p. 179 (1843).

Plagiochila exigua, *Tayl.* in *Lond. Journ. Bot.* v. p. 264, n. 14 (1846).

Cæspitose or creeping upon other larger species, very small, of a light green to olive-brown colour. Stems ascending or procumbent, slightly radiculose up to the apex, rootlets dull white, proceeding from the postical side of the stem below the stipules, in small fascicules; filiform, cortical cells oblong-quadrate, about 10. Leaves obliquely inserted, slightly decurrent antically, patent to patent-divergent, 55° , alternate, remote, but forming small capitula at the apex of the stem, caducous, roundish obovate, obovate, or cuneate, from a narrow base, margin quite entire, bifid from about $\frac{1}{4}$ to $\frac{1}{3}$, sinus rounded, segments acute or obtusate; texture delicate, cells very small to small, subquadrate, lumen clear, walls thick, angles thickened, no trigones. Stipules evident, persistent, subulate, entire, 5-7 single cells long. Neither male nor female yet seen.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diam. .1 mm., with leaves .75 mm. wide; leaves .5 mm. \times .3 mm., segments .175 mm., .4 mm. \times .3 mm., seg. .15 mm., .35 mm. \times .25 mm., seg. .1 mm., .275 mm. \times .175 mm., seg. .1 mm., .5 mm. \times .45 mm., seg. .175 mm., .4 mm. \times .3 mm., seg. .15 mm., .35 mm. \times .25 mm., seg. .1 mm.; cells .025 mm. \times .0175 mm., .02 mm. \times .0175 mm., .0175 mm. \times .015 mm.; stipules .175 mm. \times .03 mm. wide at the base.

HAB.—Epiphytic on tufts of *Frullania*, *Radula*, &c.; about the bases of moss-covered trees at Cromaglow and Killarney, *Dr. Taylor*. On wet rocks, Knockavoila and Dunkerron, *Dr. Taylor*. Tore Mountain, on *Frullania Tamarisci*, *Dr. Taylor*. Killarney, *Dr. Carrington*. Glengariffe, *Dr. Carrington*. O'Sullivan's Cascade and Glena, *Dr. Moore*. Adrigole, near Glengariffe, *Rev. C. H. Binstead*.

Extremely rare, no other stations known.

Obs.—This very rare and minute species, about which many botanists have had their doubts, has generally been referred to the genus *Plagiochila*; the constant presence of stipules along the length of the whole stem, which remain, whilst the leaves fall off, and its peculiar habit, lead me to conjecture that it may belong to some other genus, but until more perfect plants are found I place it with the *Plagiochila*.

Shortly before the lamented death of Dr. Spruce, I had some correspondence with him about this plant. He had specimens of what I considered small flagelliferous forms of *Plagiochila punctata* under this name, and his opinion was, that my plant (which is an original specimen from Taylor) and the one collected by Dr. Carrington was a new species. As the specimen I have fairly agrees with Taylor's description, I have no desire to further complicate this subject, and I name it *P. exigua*, Tayl., and refer other small forms which do not agree with Taylor's specimen to either *P. punctata* or *P. spinulosa*. Amongst these are to be placed specimens published in C. & P. Hep. Brit. Ex. n. 15, which were doubtfully referred to *P. exigua*.

Dr. Carrington described and figured *P. exigua* with stipules sometimes acutely bidentate; in the fine specimens from Dr. Taylor I have only been able to observe long, entire subulate ones. Small, flagelliferous forms of *Plag. punctata* or *Plag. spinulosa* are likely to be mistaken for it, but they are at once distinguished by the absence of the long, subulate stipules. The leaves having a very narrow base become easily detached from the stem. A similar feature also has *Plag. tridenticulata*, Tayl., which is a more robust species, of a darker colour, with longer, sometimes trifid leaves, cells larger, and in this also the numerous long stipules are absent.

DESCRIPTION OF PLATE CXIX.—Fig. 1. Plants natural size. 2. Stem, antical view $\times 24$. 3–9. Leaves $\times 85$. 10. Portion of leaf $\times 290$. 11–13. Stipules $\times 85$. (Original specimens from Dr. Taylor, Cromaglow, Ireland.)

Genus 29. **LIOCHLÆNA**, *Nees*.

Jungermania, L. Sp. pl. 1 ed., 2, p. 1597 (1753); Hook. Brit. Jung. t. 28 (1816).

Liochlæna, Nees in G.L.N. Syn. Hep. p. 150 (1844).

Aplozia, Dum. Hep. Eur. p. 58 (1874).

Stems prostrate, with rootlets very long, pale or reddish, slightly (laterally) branched, rarely flagelliferous. Leaves ovate-oblong, sublingulate, apex rotundate or retuse, very rarely sub-emarginate, slightly decurved, antical base shortly decurrent, very slightly recurved; reticulation somewhat lax, subopaque. Stipules absent. Inflorescence dioicous or paroicous. Female flowers terminal. Bracts ♀ 1-2 pairs, similar to the leaves only broader. Pistillidia 5-12. Perianth at first pyriform, afterwards cylindrical, incurved, eplicate, apex abruptly rotundato-constricted, mouth minutely ciliolate. Capsule highly exerted, dividing down to the base into 4 valves, composed of two layers, inner layer with semi-annular fibres. Elaters attached to the middle of the valves, bispiral. Spores globose, minute, as broad as the elaters. Perigonial bracts similar to the leaves, antical base turgid. Antheridia 2-4.

Liochlæna lanceolata (*L.*), *Nees*.

Jungermania pulustris minima repens foliis subrotundis densissimis latè cirentibus, Mich. Nov. pl. gen., p. 8, tab. 5, fig. 6 (1729).

Jungermania lanceolata, Linn. Sp. pl. 1 ed., 1597 (1753); Hook. Brit. Jung. t. 28 (1816).

Liochlæna lanceolata, Nees in G.L.N. Syn. Hep. p. 150 (1844).

Paroicous or monoicous, ♂ flowers usually immediately below the ♀ bracts, sometimes on proper branches which proceed from below the perianth, densely cæspitose, small, pale or dark green to a greenish-brown in colour. Stems dark brown, 30 cortical cells, slightly darker than the inner ones, of equal size, about 12 in diameter, inner very clear, vacuous, walls thin but firm, dark; procumbent or suberect, simple or slightly ramose, branches lateral, produced at right angles or ascending; radiculose, rootlets

brownish-white, strong, long, ascending to apex of the stem. Leaves close, horizontal or patent-divergent, obliquely inserted, often projecting antically from the stem, slightly decurrent at the antical and postical base, oblong-oval or oblong-obovate, entire; texture somewhat thin, epidermis smooth, cells roundish, near the base elongate, lumen pellucid, with few chlorophyllose granules, walls somewhat thin, two bands, trigones distinct. No stipules. Bracts similar to leaves only a little larger and a trifle broader. Bracteole absent. Perianth terminal, erect, somewhat curved, composed of one layer of cells, similar to leaf-cells, but more elongate, clavate-cylindrical, smooth, apex depressed, plane, mouth very small, contracted, conical, cells delicate, hyaline, with thin walls, elongate-quadrangle, about 20 rows, margin crenulate. Pistillidia few, about 7, surrounding base of immature capsule. Calyptra delicate, composed of one layer of cells. Capsule oval, spores yellowish-brown. Perigonial bracts slightly lobulate, saccate; antheridia 2-3, spherical, bearers short, composed of 4 rows of cells.

Fruits spring.

DIMENSIONS.—Stems from $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .4 mm. diam.; leaves 2 mm. long \times 1.2 mm. broad, 1.5 mm. \times 1 mm., 1.4 mm. \times .8 mm.; cells .05 mm. \times .03 mm., .04 mm. \times .03 mm., .03 mm. \times .03 mm., .02 mm. \times .02 mm.; trigones .01 mm.; bracts 2 mm. \times 1.25 mm., 1.75 mm. \times 1.25 mm.; perianth 3.2 mm. long \times 1.5 mm. broad, 2.5 mm. \times 1.25 mm.; pistillidia 1.6 mm. long \times .04 mm. broad; antheridia .2 mm. diam.

HAB.—Grows in small dense patches in woods or moist shady places, or on banks of streams on clayey or gravelly soil, on stones and rocks or at the base of trees. Very rare.

2. Tunbridge Wells, Sussex, *W. Borrer*, *E. M. Holmes*. 10. Cronkley Gill, Eskdale, Yorks, *Dr. Spruce*; Arncliffe Wood, Eskdale, Yorks, *M. B. Slater*. 12. Mill Beck Stock, Rayrigg Wood, Windermere, Westmorland, *G. Stabler*.

Found on the Continent and in North America.

Obs.—Hooker figured and described this species from Continental specimens; it was first described from British specimens

in "Eng. Bot. Suppl." tab. 2947 (Oct. 1, 1848) by Dr. Spruce, who discovered it in Eskdale, December 1842.

Distinguished from *Jung. pumila*, With. and *Jung. sphaerocarpa*, Hook., which are both parocious, by the insertion and shape of leaves and clavate perianth; some forms of *Jung. riparia*, Tayl. might be taken for *lanceolata*, but *riparia* is always dioicous.

DESCRIPTION OF PLATE CXX.—Fig. 1. Plants natural size. 2. Portion of fertile stem $\times 11$ (C. & P. n. 170). 3, 4. Leaves $\times 16$ (ditto). 5–7. Leaves $\times 24$ (Canada, Macoun). 8. Portion of leaf $\times 290$ (C. & P. n. 170). 9, 10. Bracts $\times 24$ (Canada, Macoun). 11. Cross-section of perianth near the middle $\times 24$ (ditto). 12. Apex of perianth $\times 16$ (ditto). 13. Portion of the mouth of the perianth $\times 85$ (ditto). 14. Pistillidium $\times 85$ (ditto). 15, 16. Perigonial bracts $\times 16$ (ditto). 17. Antheridium $\times 85$ (ditto).

Genus 30. **JAMESONIELLA**, *Spruce*.

Jamesoniella, Spruce, Journ. of Bot. (1876).

Large, showy, cæspitose, rosy or pale. Stems often suberect, sparingly and fastigiately branched, flagelliferous, circinnate; branches postico-lateral. Leaves large, alternate, succubous, laterally appressed, decumbent, remarkably decurrent at the base, insertion oblique, very concave, quite entire or very distantly ciliate or denticulate; cells small or minute, semipellucid, beautifully thickened at the angles. Stipules none or very rare and minute, except near the involucre. Inflorescence dioicous; ♀ flowers terminal, with innovations below; bracts and interposed bracteole much laciniated. Perianth more or less projecting beyond the bracts, towards the apex 6–10-plicate, mouth scarcely denticulate. Capsule, &c., not seen. ♂ cauline, very often terminal, perigonial bracts equalling the leaves, 2–3 androus.

Jamesoniella Carringtoni (*Balf.*), *Spruce*.

Adelanthus Carringtoni, Balf. MSS. Carr. in Trans. Bot. Soc. Edin. p. 378 (1870).

Nardia Carringtoni, Carr. Brit. Hep. p. 27 (1874-6).

Nardia compressa, var. *Carringtoni*, Lindb. in Hep. Hibern. in Act. Soc. Sc. Fenn. (1875).

Jamesoniella Carringtoni (Balf.), Spruce, Journ. of Bot. (1876).

Dioicous, cæspitose, flagelliferous, largish to very large, pale or olive green in colour. Stems procumbent or suberect, simple or innovantly branched, branches postical-lateral, rootlets slender, few, whitish, fasciculate; firm, flexuose, brownish colour, apex more or less circinnate. Leaves alternate, succubous, laterally appressed, obliquely inserted, secund, very concave, imbricate, regular, lower ones minute, distant, subrotund or cuneate; obliquely orbicular or reniform, antical base very decurrent, postical semicordate, ampliate, abruptly and very narrowly decurrent, margin entire or furnished with few large teeth, 1-6; epidermis polished, texture firm, subpellucid, little altered when dry, cells from very small to medium size, roundish, walls thick, trigones distinct, angles thickened. Stipules absent or rudimentary, towards apex of stem or branches, very minute, sublinear, much narrower than the stem, appressed; to about the middle or base unequally or equally divided, segments subulate. Andrœcia at apex of stem or branch or on lateral branches, spicate, perigonal bracts 6-10 pairs, a little smaller, turgid, antical lobule narrow; antheridia at base solitary (2-3, Dr. C.), spherical, mixed with paraphyses.

DIMENSIONS.—Stems 2 to 4 inches long, diam. .2 mm., with leaves 1.5 mm. to 1.75 mm. wide; leaves 1.5 mm. high from the decurrent base \times 1.4 mm. broad, 1.3 mm. \times 1.3 mm., 1.2 mm. \times 1.4 mm.; teeth .125 mm. long; cells .035 mm., .03 mm., .0225 mm., .02 mm.; cell-walls .0075 mm.; trigones .01 mm.; stipule .2 mm. long \times .05 mm. broad at base; antheridia .14 mm. \times .12 mm.

HAB.—Growing on wet rocks and damp rocky ledges in alpine districts in Scotland. Very rare.

15. On rocks above Loch Avon, *Dr. Greville*, 1830; *A. Croall* 1850; *G. Stabler*. Ben Lawers, *Dr. Stirton*, 1866. Ben Voilich, *Dr. Stirton*, 1869. Ben Laoigh, *C. J. Wild & G. A. Holt*, 1880.
 16. Loch Maree, *C. Howie*, 1867. Glen Finnan, *Dr. Carrington*. Moidart, West Inverness, *S. M. Macvicar*, 1898; *S. M. Macvicar & W. H. P.*, 1899. Faroe Isles.

Obs.—This very fine, rare, and beautiful species was first recognised as distinct by *Dr. Stirton*, who named it in his MSS. *Alicularia viridis*.

Prof. Balfour published it as *Adelanthus Carringtoni* in the *Trans. Bot. Soc. Edin.* 1870, and I am glad that the memory of my dear friend should be associated with such an unique British species.

From *Nardia compressa* (Hook.), to which it has even been relegated, as a variety, by *Prof. Lindberg*, it is at once and readily distinguished by its beautiful cell structure. In *N. compressa* the cells are more quadrate, with thin walls and small trigones; the leaves also are nearly plane, appressed to each other, texture more delicate, epidermis not polished, and it has a terminal immersed perianth.

DESCRIPTION OF PLATE CXXI.—Fig. 1. Plants natural size
 2. Portion of stem $\times 16$ (*C. & P.* n. 233, and following figures).
 3, 4. Leaves $\times 24$. 5. Leaf with teeth $\times 24$. 6. Leaf $\times 16$.
 7. Portion of leaf margin $\times 85$. 8. Portion of leaf $\times 290$.
 9. Stipule $\times 85$. 10. Antheridium.

Genus 31. JUNGERMANIA, L.

Jungermania, L. Sp. pl. 1131 (1753); Dum. Recueil, p. 16 (1835).

Plants medium size, rarely very large. Stems simple or furcate, in a few species repeatedly dichotomous, in several vaguely ramose, branches (few) lateral, proceeding from the postical angle of the leaves, true postical branches none or very rare, but rooting flagella present in some species. Rootlets usually pale, in the prostrate species plentiful, in the cæspitoso-

erect species few or almost wanting. Leaves succubous, rarely subtransverse, patent, assurgent or laterally accumbent, moderately broad, in several species entire, in others bilobed, in a few 3-5 lobate or dentate; margin plane or incurved, never recurved, almost always quite entire, rarely denticulate; cells medium size, rarely small. Stipules usually absent, where present more or less small, entire or bifid, rarely subquadrid. Inflorescence dioicous or paroicous; female flowers terminal, fertile rarely innovant, sterile frequently present on subfloral innovations. Bracts ♀, rarely more than 2-pairs, somewhat similar to the leaves or more incised, free from the perianth, sometimes connate with themselves. Pistillidia numerous (8-70). Perianth usually emersed, slightly compressed laterally, rarely all ecarinate, almost always (at least above) 3-10-carinate, smooth, rarely rough, never winged; mouth usually small, quite entire or denticulate, rarely ciliate, sometimes tubular, sometimes at first closed, afterwards rupturing into lobes, very rarely bursting on one side. Calyptra pyriform or oval, delicate, or only towards the base slightly carnose, where are the free sterile pistillidia. Capsule highly (rarely shortly) exserted, globose or oblong, rarely cylindrical, 2-5 layers of cells, 4-valved, valves rarely bifid. Elaters bispiral. Spores minute, smooth or scaberulous.

Subgenus I. *APLOZIA*, Dum.

Jungermania, sect. *Aplozia*, Dum. Syll. Jung. Eur. p. 47 (1831).

Aplozia, Dum. Hep. Eur. p. 55 (1874); Schiffner, Engl. and Prantl. Pfl. Fam. p. 82 (1893).

Dioicous, paroicous or monoicous, caespitose, small to medium in size, green, brown or reddish-brown in colour. Stems creeping or erect, determinate, simple or slightly branched, often with one or two innovations proceeding from below the perianth; usually radiculose. Leaves succubous, orbicular or ovate, entire or rarely retuse. Stipules absent (except in *J. autumnalis*). Bracts similar to leaves (except in *J. autumnalis*). Perianth terminal, 3-5, very rarely 6 and 7 keeled.

1. *Jungermania cordifolia*, *Hooker*.

Jungermania cordifolia, Hook. Brit. Jung. t. 32 (1816).

Jungermania tersa, Nees Nat. Eur. Leb. 1, p. 329 (1833), fide letter from Dr. Gottsche to Dr. Spruce.

Aplozia cordifolia, Dum. Hep. Eur. p. 59 (1874).

Dioicous, laxly cæspitose, flagella absent, large, dark olive-green in colour, when young pale reddish-brown. Stems simple or dichotomously branched, branches lateral-subpostical arising from the postical aspect of the leaf axil, often several (3-6) arising from the base of old bracts, suberect or floating, lax, oval on cross-section, 12 cells \times 20, cortical cells 40, similar to the inner, hyaline, walls thin, firm, dark-brown; rootlets absent. Leaves transversely inserted, succubous, decurrent antically, slightly so postically, suberect, subimbricate or approximate, accrescent, subopposite near apex, close, lower smaller, alternate, distant, cordate or ovate-oblong, sheathing, amplexicaul; texture flaccid; cells smallish to medium in size, 4-, 5- and 6-sided, lumen with numerous chlorophyl granules, walls firm, thick, reddish-brown, no trigones or thickened angles. No stipules. Bracts similar to the upper leaves, sub-vertical, ventricose-concave. No bracteole. Perianth almost hidden by the bracts, projecting only about $\frac{1}{4}$, fusiform, acute, very slightly plicate near the apex, near the base composed of 3 layers of cells, lower half of 2, upper half of 1 only, interior layer of cells convex; mouth contracted, very small, laciniate, laciniae entire. Perigonial bracts swollen near the base; antheridia two in each bract, oval.

DIMENSIONS.—Stems from 1 to 4 inches long, .3 mm. to .4 mm. diam.; leaves 2.25 mm. long \times 2.25 mm. broad, 2 mm. \times 1.75 mm., 1.75 mm. \times 1.3 mm., 1.6 mm. \times 1.3 mm., 1.5 mm. \times 1.25 mm.; cells .035 mm. \times .025 mm., .025 mm., .02 mm.; perianth 4.5 mm. long \times 1.25 mm. broad; young perianth 2.25 mm. \times .75 mm.

HAB.—Growing in large patches on rocks and earth by the side of mountain rills, often submerged in the water. Somewhat rare.

7. Cwm Idwal, Carnarvonshire, *W. H. P.* 9. Longridge Fell, *J. A. Wheldon*; Udale, *Wheldon & A. Wilson*; Easegill Kirk, West Lanc., *A. Wilson*. 10. Howgill Fells, *Dr. F. A. Lees*. Whiteside, *Dr. F. A. Lees*. Ingleboro, *John Nowell*. Ingleton, *Dr. Carrington*. Clapham, *W. West*. Penyghent, *W. West*. Middlesmore, *W. West*. Teesdale, *Dr. Spruce*. 12. Plentiful in small streamlets among the mountains in Westmorland, Nan Bield, Mardale; Hill Bell; Merke Side; Middleton Fell; Barbon Fell; Long Sleddale, Westmorland, *G. Stabler*. 13. Dalveen Scott, Criffel, *Cruickshank*. Blackhope Glen, *Nichol*. 15. Ben Lawers, *G. A. Holt*. Forfar, *C. Lyell*. Mael Tarmachan, *C. J. Willd.*

I. Rather rare in Ireland. Mangerton, in the stream from the Punch Bowl, *Dr. Taylor*. Coomashana Lake, *Dr. Carrington*. Brandon, *Dr. D. Moore*. Maghanabo Glen, Co. Kerry, *D. McArdle*. Cushinden, Co. Antrim, *Dr. D. Moore*.

Found on the Continent and in North America.

Obs.—This is very distinct, and cannot well be confused with any of the allied species; small forms of it have been mistaken for *Jung. riparia*, Tayl. (and *Jung. tersa*, Nees, which is a mixture of both), but it is distinguished by the absence of rootlets and flagella, the more distinctly cordate-shaped leaves, the transverse insertion of them, and the almost hidden fusiform perianth.

When fresh it smells strongly like *Daucus Caróta*.

DESCRIPTION OF PLATE CXXII.—Figs. 1 and 2. Plants natural size. 3. Fertile stem $\times 16$ (C. & P. 27). 4–7. Leaves $\times 16$ (ditto). 8. Leaf $\times 11$ (Penyghent, West.). 9. Portion of leaf $\times 290$ (C. & P. 27). 10. Perianth $\times 11$ (Penyghent, West.). 11. Cross-section of perianth from near the middle $\times 11$ (ditto).

2. *Jungermania pumila*, *Withering*.

Jungermania pumila, Wither. Brit. Fl. p. 866 (1776); Hook. Brit. Jung. t. 17 (1816).

Aplozia pumila, Dum. Hep. Eur. p. 59 (1874).

Paroicous, cæspitose, small, olive-green colour. Stem simple or branched, creeping or suberect, no flagella; radiculose, rootlets thick, frequent; branches lateral-subpostical, arising from the postical side of the leaf-axil, or proceeding from the base of perianth. Leaves succubous, upper imbricate, sheathing complicate, concave, erecto-patent or patent, lower alternate, spreading, approximate, obliquely inserted, horizontal or patent-divergent, ovate, oval or oblong-oval; texture delicate, epidermis smooth; cells 4-, 5- and 6-sided, quadrate or elongate, walls delicate, composed of two bands, no trigones or thickened angles. No stipules. Bracts similar to the upper leaves, only larger and swollen at the base, where the antheridia are. No bracteole. Perianth projecting about $\frac{2}{3}$ beyond the bracts, composed of a single layer of cells, about 120 round the middle, fusiform, acute, mouth very small with few delicate teeth or subentire, upper portion anticlinally obtusely 2-plicate with a narrow fold between the folds. Calyptra extremely delicate. Capsule oval, dark brown, spores pale golden-brown, elaters the same, bispiral, 12 turns of the spiral. Perigonal bracts immediately below the perianth, 2 or 3 pairs; antheridia oval, 1 or 2 at the swollen base.

Fruits May, June.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diam. .1 mm. to 15 mm.; leaves 1 mm. long \times .75 mm. broad, .9 mm. \times .7 mm., .9 mm. \times .6 mm., .8 mm. \times .55 mm.; cells .05 mm. \times .02 mm., .04 mm. \times .025 mm., .035 mm. \times .03 mm., .03 mm. \times .03 mm., .03 mm. \times .02 mm.; bracts 1.5 mm. long \times 1 mm. broad, 1.5 mm. \times .8 mm., 1.25 mm. \times .75 mm.; perianth 2.25 mm. long \times .6 mm. broad, 1.75 mm. \times .65 mm.; pedicel .1 mm. thick; capsule .75 mm. \times .5 mm.; valves .75 mm. \times .25 mm.; spores .025 mm.

HAB.—Growing on wet rocks and earth by streams. Somewhat rare.

1. Helston, *Rev. C. A. Johns*. Riverside, Truro, *W. Curnow*.
 3. Hungershall Rocks, Kent, *Jenner*. 6, 7. Tyn-y-Groes, *Dr. Carrington & W. H. P.* Barmouth, Merionethshire, *W. H. P.* Pass of Llanberis, Carnarvonshire, *J. Cash & W. H. P.* Cwm Idwal, Carnarvonshire, *Griffiths*. 10. Howgill, *W. West*. Dent, *G. Stabler*. Clapham, *Dr. Carrington*. Bolton Woods, *Dr. Carrington & W. H. P.* Todmorden, *A. Stansfield*. Studley, *Dr. Hooker*. 12. On damp rocks by River Kent, Kentmere; Black Crag; by River Lune, Sedbergh; Groom Ghyll; Barbon Fell, Westmorland, *G. Stabler*. 13. Glenlee Glen, &c., New Galloway, *J. McAndrew*. Moffat, Dumfries, *Nichol*. Dalscairth, Dumfries, *Cruikshank*. 15. Killin, Perthshire, *G. A. Holt*. 16. Very common on rocks by the side of streams; frequent on wet banks, Moidart, West Inverness, *S. M. Macvicar*.

I. On rocks at the side of streams and rivers, not rare, *Dr. Taylor*. Glen near the Hunting Tower, Cromaglow, *Dr. Carrington*. Connor Hill, Brandon, Co. Kerry, *Dr. D. Moore*. Loeh Bray, Co. Wicklow, *Dr. D. Moore*. Glenad, Co. Leitrim, *Dr. D. Moore*. Ballyhaise Wood, Co. Cavan, *D. McArdle*.

Found on the Continent and in North America.

OBS.—Distinguished from small forms of *Jungermania riparia*, Tayl., with which it is most commonly mistaken, by its paroiceous inflorescence, absence of flagella, and its narrower perianth.

DESCRIPTION OF PLATE CXXIII.—Fig. 1. Plants natural size. 2. Fertile stem $\times 24$. 3. Portion of stem $\times 24$. 4–6. Leaves $\times 24$. 7. Portion of leaf $\times 290$. 8. Braet $\times 24$. Perianth with bracts and upper leaves $\times 24$ (Tyn-y-Groes, North Wales, *Dr. Carrington & W. H. P.*).

3. *Jungermania riparia*, Taylor.

Jungermania riparia, Tayl. Ann. and Mag. Nat. Hist. August (1843). Spruce in Phyt. March (1843).

Jungermania tristis, Nees Nat. Eur. Leb. 11, p. 461 (1836).

Jungermania pumila, var. *notha*. G. et R. n. 396.

Aplozia tristis, Dum. Hep. Eur. p. 63 (1874).

Aplozia riparia, Dum. Hep. Eur. p. 65 (1874).

Dioicous, caespitose, flagelliferous, small, pale to dark olive-green colour. Stems creeping or suberect, simple or branched, flagella frequent, postical, branches lateral-subpostical, arising from the postical side of the leaf axil, or frequently from base of perianth; radiculose, rootlets ascending to apex of stem, whitish, somewhat thick. Leaves imbricate or approximate, alternate, obliquely inserted, horizontal, spreading, broadly ovate, oval, oblong-ovate or orbicular; where the branches arise the leaves are sometimes (but very rarely) small, and acutely bifid, on sterile stems decreasing in size towards the base and apex; texture somewhat delicate, cells smallish to medium size, 4-, 5- and 6-sided, quadrate or elongate, walls firm, no trigones or thickened angles. Stipules absent. Bracts similar to leaves, usually broadly ovate, spreading. No bracteole. Perianth projecting about $\frac{2}{3}$ beyond the bracts, fusiform or oblong-ovate, below smooth, slightly frontally compressed, with a somewhat deep, antical furrow, bordered by two distinct folds, near apex with from 5 to 8 folds, mouth contracted, laciniate. Perigonial stems small, perigonial bracts at the middle or terminal, erect, imbricate, complicate, ventricose, smaller but proportionately broader than the stem leaves; antheridia oval, single.

DIMENSIONS.—Stems from $\frac{1}{4}$ to 1 inch long, .1 mm., .15 mm., .2 mm. diam.; leaves 1.3 mm. long \times 1.2 mm. broad, 1.2 mm. \times 1.1 mm., 1.1 mm. \times .7 mm., .9 mm. \times .7 mm., .8 mm. \times .7 mm.; cells .04 mm. \times .025 mm., .04 mm. \times .02 mm., .03 mm. \times .025 mm., .025 mm. \times .02 mm.; bracts 1.5 mm. \times 1.25 mm., 1.4 mm. \times 1.5 mm.; perianth 2.4 mm. long \times .75 mm. broad, .2 mm. \times .75 mm., 1.75 mm. \times .75 mm.; perigonial bract .8 mm. long

× .7 mm. broad, .8 mm. × .6 mm.; antheridia .125 mm. × .1 mm.

HAB.—Growing in depressed tufts on wet or damp rocks by the side of streams and in shady places. Somewhat rare, more frequent in limestone districts.

1. Near St. Ives, West Cornwall, *Mitten & Curnow*. 5. Boulder near Seekley Wood; Stream near Flash; Dove Dale, Staffordshire, *J. E. Bagnall*. 7. Glyder Vawr, Carnarvonshire, *W. H. P.* Tyn-y-Groes, Merionethshire, *Dr. Carrington & W. H. P.* 8. Miller's Dale, Derbyshire, *G. A. Holt*. 9. Bamford Wood, Lanc., *G. A. Holt*. Marple, Cheshire, *G. A. Holt*. 10. Wharfedale, *Dr. Spruce*. *Dr. Carrington*. Horton, *J. Whitehead*. Saltersgate Beck, *M. B. Slater*. Ingleboro', *W. West*. Dent, *Dr. Carrington*. Clapdale, *Dr. Carrington*. Ingleton, *W. West, W. H. P.* Gordale, *Dr. Carrington*. Baildon, *W. West*. Sheddon Clough, *J. Nowell*. 12. Leven's Park; on wet limestone rocks, Brightseer, Kentmere Plantation. Whitbarrow, Westmorland, *G. Stabler*. Helvellyn, *Rev. C. H. Binstead*. Patterdale, Westmorland, *Dr. Carrington & W. H. P.* Borrowdale, Cumberland, *Dr. Carrington & W. H. P.* 13. The Glen; Holme Glen, Kirkeudbright, *J. McAndrew*. 15, 16. Common among wet rocks and sides of streams, ascends to 1700 ft., Moidart, West Inverness, *S. M. Maccicar*.

I. Kerry, *Dr. Taylor*. Tore Cascade, Killarney, *Dr. Carrington*. Brandon, Co. Kerry, *Dr. D. Moore*. Enniscona, Co. Cork, *I. Carroll*. Loch Bray and near Woodenbridge, Co. Wicklow, *Dr. D. Moore*. Benbulbin, Co. Sligo, *Dr. D. Moore*. Rathlin Island, *S. A. Stewart*.

Found on the Continent and in North America.

OBS.—This is a species which assumes many forms, varying extremely in size and in shape of leaves, the perianth varying also according to its being more or less imperfect. Some of the acute Continental botanists have attempted to separate and describe some of the forms, but, from the study of an extensive collection, I have come to the conclusion that all the differences of size and shape depend upon locality only. It is often confused with *Jungermania pumila*, from which it is distinguished by being dioicous

and the perianth proportionally wider; from small forms of *Jungermania cordifolia*—see notes under the latter species.

DESCRIPTION OF PLATE CXXIV.—Fig. 1. Plants natural size. 2. Stem × 24 (Miller's Dale, W. H. P.). 3. Leaves × 24 (276, G. & R.). 4. Leaf (ditto). 5, 6. Leaves × 24 (Miller's Dale, G. A. Holt). 7. Portion of leaf × 290 (Miller's Dale, W. H. P.). 8. Bract × 24 (276, G. & R.). 9. Perianth × 24 (Miller's Dale, W. H. P.). 10. Perigonial stem × 24 (ditto). 11. Perigonial bract × 24 (Wharfedale, Herb. Slater). 12. Ditto (Canada, Macoun). 13. Antheridia × 85 (ditto).

4. *Jungermania sphærocarpa*, Hooker.

Jungermania sphærocarpa, Hook. Brit. Jung. t. 74 (1816).

Jungermania Goulardii, Husn. Hep. Gall. n. 68 et Hepaticol. Gall. p. 29 (1881).

Aplazia sphærocarpa, Dum. Hep. Eur. p. 61 (1874).

Monoicous, rarely paroicous, cæspitose, pale to yellowish-green to brown in colour. Stems somewhat fleshy, simple or innovantly branched, innovations arising from base of perianth, erect or ascending; radiculose, rootlets ascending to apex of stem, long, whitish. Leaves succubous, regular, alternate, approximate, obliquely inserted, slightly decurrent, embracing the stem, secund or spreading, subhorizontal, orbicular or roundish, somewhat slightly retuse, concave, plane or slightly undulate, lower leaves distant and smaller; texture somewhat fleshy, epidermis smooth; cells medium size, 5-, 6-sided, walls moderately thin, firm, trigones distinct, marginal cells quadrate, distinct. Stipules none. Bracts similar to the leaves. Bracteole none. Perianth often projecting far beyond the bracts, usually $\frac{2}{3}$, obovate or obovate-oblong, sometimes with a long neck, composed of one layer of cells in the upper portion, in the lower 2 cells thick, 4-angled, sometimes with 5 or 6 angles. Pistillidia 7–10. Capsule spherical, sometimes slightly hypophysate. Spores brown. Elaters bispiral. Perigonial bracts terminal on the innovant branches, 3 to 4 pairs, small, oval; antheridia oval, with long bearers, 1 or 2 at the base of each bract.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .2 mm. to .3 mm. diam.; leaves 1.4 mm. long \times 1.35 mm. broad; cells .04 mm., .025 mm. \times .03 mm., .05 mm. \times .025 mm., .02 mm. \times .03 mm.; bracts 1.1 mm. \times .9 mm., .9 mm. \times .9 mm.; perianth 2.5 mm. long \times 1.5 mm. broad, 2.1 mm. \times 1.25 mm., 2.1 mm. \times 1.1 mm., 1.75 mm. \times 1.1 mm.; pistillidia .15 mm. long \times .05 mm. broad; capsule .75 mm. \times .65 mm.; spores .02 mm. diam.; perigonal bract .8 mm. long \times .7 mm. broad; antheridia .15 mm. \times .125 mm.

HAB.—Growing on sandy or clayey damp banks or boggy places. Generally distributed.

1, 2. Cadnum Bog, New Forest, Hants, *C. Lyell*. 3. North Frith Wood, Kent, *Howse*. Joyden's Wood, near Bexley, Kent, *E. M. Holmes*. 5. Seckley Wood; Arley Wood; Sherbrook Valley, Staffordshire, *J. E. Bagnall*. 7. Near Harlech, Merionethshire, *Dr. Carrington & W. H. P.* 9. Early Bank Wood, Staleybridge, Cheshire, *G. A. Holt*. Near Kemple End, *J. A. Wheldon*, Hindburn, *A. Wilson*. Easegill, West Lanc., *J. A. Wheldon*. 10. Penyghent, *W. West*. Spofforth, *Dr. F. A. Lees*. Bingley, *W. West*. Hareley Wood, Todmorden, *John Nowell*, *G. A. Holt*. 12, 13. New Galloway, *J. McAndrew*.

I. On stones by the side of rivulets. Nr. Dublin, *Dr. Taylor-Kelly's Glen*, Dublin, *Dr. D. Moore*. Lough Bray, Co. Wicklow, *Dr. D. Moore*. Tore Waterfall, Killarney, *Dr. Carrington*. Glenad, Co. Leitrim, *Dr. D. Moore*. Hill of Howth, *D. McArdle*.

Found on the Continent and in North America.

Obs.—Distinguished from all the other British round-leaved *Jungermannia* by the characters given, from *Nardia scalaris* (Schrad.) and *Nardia compressa* (Hook.) by the absence of stipules and bracteole, from *Nardia hyalina* (Lyell) and *Nardia obovata* (Nees) by its free bracts and white rootlets, from *Jungermannia cordifolia* Hook., *Jung. riparia* Tayl., *Jung. pumila* With. by its inflorescence and shape of leaves and perianth, from *Jungermannia crenulata*, var. *gracillima* (Sm.) by its larger size, shape of perianth, &c. See further notes under var. *lurida* (Dum.).

DESCRIPTION OF PLATE CXXV.—Fig. 1. Plants natural size.

2. Fertile stem \times 16 (Scotland, Original, Hooker). 3. Ditto (Sweden, Lindberg). 4. Ditto (Yorkshire, Mudd). 5. Leaf \times 16 (Sweden, Lindberg). 6. Portion of leaf \times 16 (Todmorden, Nowell). 7, 8. Bracts \times 24 (Todmorden, Dr. Carrington). 9. Perianth \times 16 (Slogdale, Mudd). 10. Cross-section of perianth \times 16 (ditto). 11. Ditto (Baysdale, Mudd). 12. Perigonal bract \times 24 (495, G. & R.) 13. Antheridium \times 85 (ditto). 14. *Jungermania Goulardii*, Husn. \times 16 (68, Husn. Hep. Gall.).

5. *Jungermania sphærocarpa*, Hook., var. *lurida* (Dum.).

Jungermania lurida, Dum. Syll. Jung. p. 50 (1831).

Jungermania nana, Nees Nat. Eur. Leb. 1, p. 317 (1833).

Aplozia lurida, Dum. Hep. Eur. p. 60 (1874).

OBS.—Dr. Spruce writes: “*Jungermania sphærocarpa*, Hook. is a species I have gathered abundantly both in England and the Pyrenees, but I have not had occasion to re-examine it for many years. Now, I have gone over all my *sphærocarpa* and *lurida*, and utterly fail to find any specific distinction between them. The former is larger and often lax-leaved; the latter smaller and with more crowded, more transverse, and proportionately wider leaves; but there is no essential difference.

“The *Jungermania Goulardii*, Husn. (of which you will have specimens in his Exsiccata) had been previously gathered by myself in exactly the same place—the ascent to the Gorge of Esquierry in the Pyrenees. It is exactly what we Britons should call *Jungermania sphærocarpa*, with rather broader leaves than ordinary.

“Let us come to the conclusion of the matter, which is, I presume, that *J. lurida*, or *nana*, should stand as *J. sphærocarpa*, var. *lurida*. Other synonyms will doubtless be found in plenty by those who hunt for them.”

From the examination of numerous specimens from all quarters obtainable, I quite agree with the conclusion arrived at by Dr. Spruce, that no satisfactory characters can be relied upon to separate *J. lurida*, Dum. (*Jung. nana*, Nees) from *J. sphærocarpa*.

What slight differences do exist are owing to either drier localities or higher altitudes. Typical *J. lurida* has been named *J. sphaerocarpa* by Hooker himself (Scotia, Herb. Hooker).

Jungermania sphaerocarpa, var. *lurida*, (Dum.), is usually smaller, with less erect, fleshy stems; leaves usually darker in colour, pale brown to reddish-brown, more compressed, crowded, upper ones along with the bracts broader, lower ones on the contrary oval or slightly obovate; cell structure identical.

Jungermania Goulardii, Husn. (68 Husn. Hep. Gall. Exsicc.), is a smaller form, inflorescence like type monoicous, spores same size.

Fruits April, May, June.

DIMENSIONS.—Stems $\frac{1}{2}$ to $\frac{3}{4}$ inch long, .2 mm. to .25 mm. diam.; leaves 1.1 mm. long \times .9 mm. broad, 1. mm. \times .7 mm., .9 mm. \times .7 mm.; branch leaves .6 mm. \times .5 mm.; cells .04 mm. \times .03 mm., .03 mm. \times .025 mm., .03 mm.; bracts 1.6 mm. long \times 1.6 mm. broad, 1.2 mm. \times 1.6 mm.; perianth 2.25 mm. long \times 1. mm. broad; valves of capsule 1.1 mm. long \times .45 mm. broad; spores .02 mm. diam.; elaters .16 mm. long \times .01 mm. broad.

HAB.—On wet rocks or in damp places, usually subalpine or alpine. Rare.

7. Pass of Llanberis, *W. Wilson*, 1830. Snowdon, *W. H. P.* Glyder Vawr, Carnarvonshire, *W. H. P.* Tyn-y-Groes, Merionethshire, *C. J. Wild.* 8. Marple, *G. A. Holt.* Woodhead, *J. Whitehead* & *W. H. P.* Mellor, *G. A. Holt.* Kinder Scout, Derbyshire, *J. Whitehead.* 11. Cleveland, *W. Mudd.* 15. Mael Tarmachan, Perthshire, *C. J. Wild.*

I. Glengariff, Co. Cork, *Miss Hatchins.* Kelly's Glen, Co. Dublin; near Seven Churches, Co. Wicklow, *Dr. D. Moore.*

Found on the Continent.

DESCRIPTION OF PLATE CXXVI.—Fig. 1. Stems natural size. 2. Fertile stem \times 16 (Glyder Vawr, *W. H. P.*). 3. Ditto, with imperfect perianth \times 16 (Mael Tarmachan, *C. J. Wild.*). 4. Ditto (*Jung. nana*, *N.*, original, ex herb. Flowtow, *Nees.*) 5-8. Leaves \times 24 (Mael Tarmachan, *Wild.*) 9. Branch-leaf \times 24

(Glyder Vawr, W. H. P.). 10. Portion of leaf \times 290 (Pyrenees, Dr. Spruce). 11, 12. Bracts \times 16 (Glyder Vawr, W. H. P.). 13. Perianth \times 24 (Verona, Massalongo). 14. Antheridium \times 85 (Glyder Vawr, W. H. P.).

6. *Jungermania crenulata*, *Smith.*

Jungermania crenulata, Sm. Eng. Bot. t. 1463 (1805); Hook. Brit. Jung. t. 37 (1816).

Aplozia crenulata, Dum. Hep. Eur. p. 57 (1874).

Dioicous, loosely caespitose, flagelliferous, small, of a pale green, rosy or reddish colour. Stems reddish-brown, procumbent, cortical cells larger than the inner, whitish, 20 round, inner same colour, 7×8 in diam.; simple or innovantly branched, innovations lateral, arising from axil of leaf, numerous, with small distant leaves; radiculose, rootlets dull white, plentiful, ascending to apex of stems. Leaves on the upper portion of stem larger and more crowded, imbricate, obliquely inserted, patent, secund or spreading, lower leaves smaller and more distant; broadly ovate to subrotund; texture somewhat thin, epidermis smooth, cells from smallish to small, roundish-quadrate, 4-, 5- and 6-angled, near the base elongate ($\cdot 0237$ mm.), walls thick, trigones very small or wanting, marginal cells largish ($\cdot 053$ mm.), oblong-quadrate, which give the plant a very distinct appearance, margin quite plane, not crenulate; these large marginal cells are usually wanting in the small leaves of the innovations. Stipules absent. Bracts similar to the leaves, only larger, appressed, sometimes produced from the lower part of the perianth, but very rarely. Bracteole wanting or sometimes rudimentary, then lingulate. Perianth terminal, projecting about $\frac{1}{2}$ beyond the bracts, composed of a single layer of cells, 130 round, larger at the angles, obovate, slightly compressed, plicate, 4-angled, angles smooth or irregular, obtuse or acute; mouth contracted, submucronate, fringed with hyaline, elongate cells, margin crenulate. Calyptra thin, delicate. Pedicel long, pellucid, white, cross-section shows 17 cells round, 6×6 in diam. Capsule small, oval, dark reddish-

brown, spores pale reddish-brown, elaters reddish-brown. Male stems smaller, slender, with several pairs of perigonial bracts, small, closely imbricate, semi-amplexicaul, ventricose at base, margin inflexed; antheridia 1 or 2, oval, pale green, bearers short.

Fruits Winter and Spring.

DIMENSIONS.—Stems $\frac{1}{2}$ to $\frac{3}{4}$ inch long., diam. .2 mm.; leaves .7 mm. long \times .8 mm. broad, .75 mm. \times .75 mm., .6 mm. \times .6 mm.; cells .0275 mm., .0225 mm., .02 mm., .03 mm. \times .0175 mm.; marginal cells .06 mm. \times .03 mm., .055 mm. \times .03 mm., .04 mm. \times .05 mm.; bracts 1.35 mm. long \times 1.1 mm. broad, 1.1 mm. \times 1.1 mm.; perianth 1.6 mm. long \times 1 mm. broad, 1.5 mm. \times .85 mm.; spores .015 mm. diam.; elaters .1 mm. long \times .01 mm. broad; perigonial bract .5 mm. \times .5 mm.; antheridia .125 mm. \times .11 mm.

HAB.—Grows in swampy places on moors and in bogs, or in very damp situations by roadsides, &c. Generally distributed.

1. Cornwall, common, *W. Curnow*. 2. Bogs at Amberley, Sussex, *W. Borrer*. New Forest, Hants, *C. Lyell*. 3. Epping Forest, Essex, *E. Forster*. 4. Holt Heath, Norfolk, *Rev. R. B. Francis*. Hungershall Rocks, &c., Kent, *E. M. Holmes*. 5. Cannoek Chase; Winkshill, near Froghall; Canwell, Staffordshire, *J. E. Bagnall*. 7. Roadside, Barmouth, Merionethshire, *W. H. P.* 8, 9. Longridge Fell, *J. A. Wheldon*. Udale, West Lanc., *Wheldon & A. Wilson*. 10. Ingleton; Clapham, *W. West*. Yeadon Moor, *Dr. Carrington*. Todmorden, *John Nowell*. Rose Wood, Sheffield, *A. Carr*. 11, 13. Roadsides, New Galloway, *J. McAndrew*. Glen Mills and Goldielea, Dumfries, *Cruickshank*. Grey Mare's Tail, Dumfries, *Nichol*. 15. Kinnordy, Forfar, *C. Lyell*. 16. Local; on loamy footpaths, Moidart, West Inverness, *S. M. Macvicar*.

I. Not unfrequent, Kelly's Glen, Dublin; side of river, Seven Churches, Co. Wicklow, *Dr. D. Moore*. Connemara, *Dr. D. Moore*. Ross Bay, *Dr. Carrington*. Hill of Howth, *D. McArdle*. Slieve Glah, Co. Cavan, *D. McArdle*.

C. Pointe Corbière, *Aug. Martin*.

Found on the Continent and in North America.

Obs.—Recognised at once, by the remarkably large marginal cells, from any of the other round-leaved *Jungermania*.

The perianths are generally 4-angled, sometimes more; Dr. Spruce met with a form in the Pyrenees with 8, some with 7, 6, and 5, but he could find no difference whatever from the ordinary *J. crenulata*, and remarks: "So that an occasional duplication of one or more of the perianth-angles would seem a common occurrence in this section."

DESCRIPTION OF PLATE CXXVII.—Fig. 1. Plants natural size. 2. Fertile stem \times 24. 3–6. Leaves \times 24. 7. Portion of leaf near margin \times 85. 8. Ditto \times 290. 9, 10. Bracts \times 24. 11. Perianth \times 24. 12. Cross-section of perianth, upper half \times 24. 13. Portion of mouth of perianth \times 85. (All Walton Swamp, Cheshire, Holt & Pearson.) 14. Perigonial bract \times 24 (Baden, Jack). 15. Antheridium \times 85 (ditto).

7. *Jungermania crenulata*, Hook., var. *gracillima*. (Sm.).

Jungermania crenulata, var. Hook. Brit. Jung. t. 37 (1816).

Jungermania gracillima, Smith, Eng. Bot. n. 2238 (1805).

Jungermania Gentiana, Hueben. Hep. Germ. p. 107 (1834).

Aplozia gracillima, Dum. Hep. Eur. p. 57 (1874).

Aplozia cristulata, Dum. Hep. Eur. p. 57 (1874).

Dioicous, caespitose, tufts shallow, innovations plentiful, marginal cells similar to the others, on stronger stems the tendency to become larger is observable, bracts similar to the upper leaves, perianth mucronate, margin of mouth slightly crenulate, angles of perianth cristulate, calyptra delicate, claret coloured.

Fruits April, May.

HAB.—Growing in thin patches on shady sandy or gravelly banks. Generally distributed.

1, 2, 4, 5. Seckley Wood; Arley Wood; Dimmings Dale, near Dane Bridge, Staffordshire, *J. E. Bagnall*. 7. Torrent Walk, Dolgelly, Merionethshire, *W. H. P.* 9. Alderley Edge, Cheshire, *C. J. Wild*. 10. Castle Howard, *M. B. Slater*; Teesdale, *Dr.*

Carrington. 12. Plentiful in the Lake District; Grayrigg Forest; in a quarry near Staveley; Witherslack; Whitbarrow; Barbon Fell; Long Sleddale, Westmorland, *G. Stabler*. 13. Common on damp ground, New Galloway, *J. McAndrew*. 15, 16. Frequent on loam and shale banks, Moidart, West Inverness, *S. M. Macriear*.

I. Westaston, Co. Wicklow, *Dr. D. Moore*; Killakeen; Slieve Glah; on the shores of Lough Cultra, Co. Cavan, *D. McArdele*; Hill of Howth, *D. McArdele*.

Found on the Continent and in North America.

OBS.—This form is so nearly related to the type that I regard it simply as a variety.

DESCRIPTION OF PLATE CXXVIII.—Fig. 1. Plants natural size. 2. Fertile stem $\times 31$ (Alderley Edge, Cheshire, C. J. Wild). 3. Stem $\times 31$ (*Jung. Genthiana*, Hüb. & Genth. Hep. Germ. 65. Original). 4–7. Leaves $\times 24$ (n. 248, C. & P.). 8–10. Ditto (Alderley Edge, Wild). 11. Portion of leaf $\times 290$ (n. 248, C. & P.). 12, 13. Bracts $\times 24$ (ditto). 14. Portion of mouth of perianth $\times 290$ (ditto).

8. *Jungermania autumnalis*, *De C.*

Jungermania autumnalis, De Candolle Fl. Franc., 5, p. 202, sp. 1154b (1815); Moug. et Nest. Exsicc. n. 528. Lindb. Musc. Scand. p. 6 (1879).

Jungermania subapicalis, Nees, Nat. Eur. Leb. 1, p. 310, n. 33 (1833); G. et R. n. 230 (as *Jung. Schraderi*, Mart.); G. et R. n. 231 (as *Jung. Schraderi*, Mart.); G. et R. n. 592 (as *Jung. Schraderi*, Mart.); Husn. Hep. Gall. Exsicc. n. 67 (as *Jung. Schraderi*, Mart.); Aust. Hep. Amer. Exsicc. n. 27 (as *Jung. Schraderi*, Mart.); Underw. Hep. Amer. n. 18 (as *Jung. Schraderi*, Mart.).

Jungermania Schraderi, Ekart Syn. Jung. Germ. p. 39, t. xl, f. 97, and of most authors (not Martius).

Dioicous, caespitose, small, of a yellowish- or reddish-brown colour. Stems procumbent or suberect, simple or slightly branched, branches subpostical; 40 to 50 cells in circumference, cortical cells slightly darker with the walls rather firmer, inner 12 to 15 cells in diam., whitish; radiculose, rootlets distant, short,

dull white. Leaves obliquely inserted, horizontal or slightly ascending, alternate, approximate, plane or slightly concave, broadly ovate, entire or retuse, upper ones subquadrate with rounded angles, sometimes with a small antical tooth; cells of medium size, roundish, walls thick, of a pale brown colour, trigones distinct, lumen clear or with few chlorophyllose granules, epidermis smoothish. Stipules subulate. Bracts a little larger than the leaves, broadly ovate to subquadrate, retuse or entire with one or several long segments near to the base on one or both sides. Bracteole free or connate with bract on one side, oblong-quadrate or irregular in shape, lacinate or dentate. Perianth projecting $\frac{2}{3}$ beyond the bracts, cylindrical or clavate, upper portion plicate, mouth slightly constricted, ciliate, cilia 5–10 cells long, 1 or 2 wide at base. Pistillidia about 30. Capsule oval, reddish-brown. Spores pale to reddish-brown. Elaters dark red, about 20 turns of the spiral. Male stems with 4–6 pairs of perigonal bracts, terminal or situated at the middle of the stem, close, ventricose, with a small incurved segment at the antical base protecting the single, large, shortly stiped, oval antheridium.

Fruits April, May.

DIMENSIONS.—Stems about $\frac{1}{2}$ inch long, diam. .15 mm.; leaves 1.25 mm. \times .9 mm., 1.1 mm. \times .8 mm., 1. mm. \times .7 mm., .9 mm. \times .6 mm., .8 mm. \times .7 mm., .75 mm. \times .6 mm.; cells .04 mm. \times .03 mm., .03 mm., .03 mm. \times .02 mm.; stipules .75 mm. long \times .2 mm. broad at the base; bracts 1.4 mm. \times .9 mm., 1.2 mm. \times .9 mm., 1. mm. \times .75 mm., 1.1 mm. \times .7 mm.; bracteole 1. mm. \times .6 mm.; perianth 2. mm. \times .9 mm., 1.5 mm. \times .7 mm.; cilia of perianth .125 mm., .225 mm.; pistillidia .2 mm. \times .05 mm.; capsule .25 mm. \times .2 mm.; spores .0175 mm. diam.; elaters .15 mm. long \times .0125 mm. broad; perigonal bract .8 mm. \times .8 mm. explanate; antheridia .3 mm. \times .2 mm.

HAB.—Grows in large patches or tufts in somewhat dry situations, on heathy banks or rotting wood in shady places. Rare.

7. Tyn-y-Groes, Merionethshire, *Dr. Carrington & W. H. P.*,

April 1879, *G. A. Holt*, May 1885. 12. On a bank by River Lune, near Ingmire Hall, Westmorland, *G. Stabler*; Borrowdale, Cumberland, *Dr. Carrington & W. H. P.* 13. Troquhain Wood, Balmaclellan; Blackbank dyke, Glenlee, New Galloway, *J. McAndrew*.

Found on the Continent and in North America.

Obs.—I have taken as type of *Jung. autumnalis*, De C., n. 528 Moug. et Nest. Stirpes Crypt. Vog-Rhen. Exsic., which agrees entirely with the description of *Jung. subapicalis*, Nees, in habitat, habit, more elliptic leaves and narrower perianth with ciliated mouth.

Jung. Schraderi, Mart., I consider merely a variety of the same, distinguished by its more marshy habitat, laxer habit, broader leaves and perianth, which, so far as I have been able to observe, has no long cilia at its mouth.

This very rare species is at once distinguished from any of the other round-leaved ones with stipules, by the very different bracts and in the type by the ciliated perianth.

DESCRIPTION OF PLATE CXXIX.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 24$ (Canada, Macoun). 4. Ditto $\times 24$ (Tyn-y-Groes, *G. A. Holt*). 4, 5. Leaves $\times 24$ (ditto). 6-8. Ditto (Ingmire, *Stabler*). 9. Portion of leaf $\times 290$ (Tyn-y-Groes, *Holt*). 10, 11. Stipules $\times 24$ (Ingmire, *Stabler*). 12, 13. Bracts $\times 24$ (New Galloway, *McAndrew*). 14. Bracteole $\times 24$ (ditto). 15. Perianth $\times 24$ (ditto). 16. Cilia from mouth of perianth $\times 85$ (Ingmire, *Stabler*). 17. Pistillidium $\times 85$ (ditto). 18. Perigonial bract $\times 24$ (Canada, *Macoun*). 19. Antheridium $\times 85$ (ditto).

9. *Jungermania autumnalis*, De C. var. *Schraderi* (*Mart.*)

Jungermania Schraderi, Mart. Fl. crypt. Erl. p. 180, t. 6, f. 55 (1817).

Jungermania Schraderi, var. *undulifolia*, Nees, Nat. Eur. Leb. 1, p. 306; G. et R. Hep. Eur. n. 338.

Dioicous, loosely caespitose, medium in size, of a pale green to yellowish-brown colour. Stems procumbent; radiculose, rootlets

plentiful, long, whitish, ascending to apex of stem; simple or innovantly branched, branches lateral, sub-postical, proceeding from axil of leaves or from below the perianth. Leaves contiguous, alternate, horizontal or slightly ascending, slightly decurrent anticlinal, secund or spreading, suborbicular, entire or slightly retuse, undulate, lower leaves distant and smaller; texture flaccid, epidermis smooth, cells roundish, medium size, lumen hyaline, with few chlorophyllose granules, walls distinct, angles thickened, trigones small and often indistinct, stipules present near apex of stem, absent below, subulate or suborbicular. Bracts broadly oval or suborbicular, entire or emarginate, undulate, with a small segment on one side near the base; bracteole small, free, suborbicular or obovate. Perianth projecting $\frac{2}{3}$ beyond the bracts, oblong, composed of a single layer of cells, about 200 round the middle, terete at the base, trigonous near the middle and 6-plicate at the upper part, mouth lobate, lobes entire, hyaline, delicate. Calyptra very delicate, cells with thin walls, no trigones. Capsule oval, dark brown. Spores dark reddish-brown; elaters of a lighter colour, bispiral, 20–25 turns of the spiral.

Fruits October.

DIMENSIONS.—Stems about an inch long, diam. .3 mm.; leaves 1.6 mm. × 1.6 mm., 1.7 mm. × 1.4 mm., 1.6 mm. × .15 mm., 1.5 mm. × 1.75 mm., 1.3 mm. × 1.3 mm.; cells .04 mm., .03 mm., .025 mm.; trigones .005 mm.; stipules .4 mm. × .5 mm., .5 mm. × .6 mm.; bracts 1.5 mm. × 1.25 mm., 1.6 mm. × 1.5 mm.; bracteole 1 mm. × .75 mm.; perianth 3 mm. long × 1.1 mm. broad; pistillidia .225 mm. × .06 mm.; spores .02 mm.; elaters .125 mm. × .01 mm.

HAB.—Growing in loose patches, or creeping amongst *Sphagna*. Very rare.

12. Barrowfield, Westmorland, *G. Stabler*, October 1878.

DESCRIPTION OF PLATE CXXX.—Fig. 1. Plants natural size. 2. Portion of fertile stem × 16. 3–7. Leaves × 16. 8. Portion of leaf × 290. 9–11. Stipules × 24. 12, 13. Bracts × 16. 14. Bracteole × 16. 15. Cross-section of perianth, lower half × 24. 16. Ditto. upper half, near the middle × 24. 17. Portion

of mouth of perianth $\times 85$. 18. Pistillidium $\times 85$ (Barrowfield, Westmorland, G. Stabler).

Subgenus 2. *GYMNOCOLEA*, Dum.

Jungermania, sect. *Gymnocolea*, Dum. Syll. Jung. p. 52 (1831).

Gymnocolea, Dum. Recueil, p. 17 (1835).

Plants without stipules. Leaves subdecurent, flattened, bilobed. Bracts small, similar to the leaves. Perianth exserted, erect, naked, terete, contracted at the apex, mouth denticulate. Capsule four-valved, coriaceous. Elaters double, deciduous.

10. *Jungermania inflata*, Hudson.

Jungermania inflata, Huds. Fl. Angl. p. 511 (1798); Hook. Brit. Jung. t. 38 (1816).

Gymnocolea inflata, Dum. Recueil, p. 17 (1835).

Dioicous, densely or loosely caespitose, eflagelliferous, from small to largish in size, green or brownish-green, sometimes black in colour. Stems on a cross-section 8×10 cells in diameter, 20 cortical cells, similar to the inner ones, a few rather larger, lumen clear, walls thin, firm; procumbent, lax, simple or sparingly furcately branched, branches lateral, slightly postical, arising from the mid-axil of a leaf or from its postical angle; radiculose, rootlets frequent or sparse, long or short, delicate, ascending to the apex of the stem. Leaves bifarious, distant or approximate, semi-vertically obliquely inserted, antical margin slightly decurrent, horizontal or slightly ascending, plane or a little concave, oval or roundish-obovate, bifid to about a third, sinus roundish, rarely acute, segments obtuse; texture lax, cells smallish, subquadrate, lumen clear, walls firm, pale olive, no trigones, angles slightly thickened. Stipules wanting, very rarely subfloral, small, subulate. Bracts similar to the leaves, only smaller, bracteole wanting or rarely present, similar to the bracts, but smaller. Perianth terminal on main stem or on long leafy branches, projecting far beyond the bracts, oblong-oval, obovate, pyriform or cylindrical,

narrow at the base, soon falling off, smooth, obscurely 4-, 5-plicate only at the very apex, composed of a single layer of cells, about 100 round at the middle, near the base and up to $\frac{1}{3}$ of its height bistratose, mouth somewhat contracted, dentate, 8 to 16 teeth, 2 or 3 cells wide at the base, incurved. Pistillidia 8-10. Calyptra ovate, reticulate, very delicate. Capsule oval, brown; spores small, fulvous brown; elaters same colour, broad as the spores.

Male stems similar to the others, δ terminal, 3, 4 pairs of bracts, imbricate, ventricose; antheridia large, 1 or 2 at the base of each bract.

Fruits very rarely, May, June.

DIMENSIONS.—Stems $\frac{1}{2}$ to 2 inches long, diam. .15 mm. to .2 mm., with leaves from 1.25 mm. to 2 mm. wide; leaves 1.1 mm. \times .8 mm., segments .25 mm., 1 mm. \times .6 mm., seg. 2 mm., .75 mm. \times .65 mm., seg. .15 mm.; cells .02 mm. \times .035 mm., .02 mm. \times .03 mm., .02 mm., .03 mm., .025 mm.; stipules .2 mm. \times .05 mm. broad at the base; bracts .6 mm. \times .45 mm., seg. .15 mm., .45 mm. \times .4 mm., seg. .1 mm.; perianth 3 mm. \times 1.25 mm., 2.25 mm. \times .9 mm.; teeth at the mouth .125 mm., .05 mm.; spores .015 mm. diam.; elaters .09 mm. \times .015 mm.; perigonial bracts .9 mm. \times .9 mm.; antheridia 2 mm. \times 175 mm.

HAB.—Growing often in very densely matted patches of considerable extent, or floating in water in bogs and marshy places, generally distributed. 1 to 18. I.

Found on the Continent and in North America.

Obs.—A distinct species, and not likely to be confused with any other, except *Cephalozia fluitans* (Nees) Spruce, which may at first sight be mistaken for it, has obtusely-lobed leaves, and is found in similar situations to the lax bog form; “it is distinguished by the stem rooting by numerous stout flagella, branches whether foliiferous or floriferous all postical, the longer, narrower and more laxly-reticulated leaves; the constant presence of stipules; the cladocarpous inflorescence; the tristichous female bracts, toothed at the base, the innermost embracing the perianth; finally the linear-fusiform, trigonous, thin perianth.” R. S.

Cephalozia heterostipa, Carr. & Spruce, which might be confounded with the small alpine form of *Gymnocolea inflata*, has stolons and postical branches, with linear, subulate stipules, bracts 3-, 4-lobed, perianth obscurely trigonous.

DESCRIPTION OF PLATE CXXXI.—Fig. 1. Plants natural size. 2. Fertile stem $\times 16$ (G. & R. 679, Cornwall, W. Curnow). 3-7. Leaves $\times 24$ (Cader Idris, W. H. P.). 8. Portion of leaf $\times 290$ (G. & R. 627). 9. Stipule $\times 85$ (G. & R. 174, Ingleboro, Dr. Carrington). 10, 11. Bracts $\times 24$ (Cader Idris, W. H. P.). 12. Cross-section of perianth $\times 24$ (ditto). 13, 14. Portions of the mouth of perianths $\times 85$ (ditto). 15. Perigonial bract $\times 24$ (G. & R. 174). 16. Antheridium $\times 85$ (Festiniog, W. H. P.).

11. *Jungermania turbinata*, Raddi.

Jungermania turbinata, Raddi in Act. soc. Modena xviii. p. 29, t. 111, f. 2, 3 (1820).

Jungermania acuta, pp., Lindenb. Syn. Hep. p. 88 (1829).

Jungermania affinis, Wils. in Hook. Brit. Fl. 11, p. 128 (1830).

Jungermania coreypracea, Nees, Nat. Eur. Leb. 11, p. 39 (1836).

Jungermania Wilsoniana, Nees, Nat. Eur. Leb. 111, p. 548 (1838).

Jungermania Wallrothiana, Nees, in G. L. N. Syn. Hep. p. 104 (1844).

Jungermania balensis, Gott. in G. et R. Hep. Eur. n. 95.

Jungermania algeriensis, Gott. in G. et R. Hep. Eur. n. 391.

Gymnocolea affinis, Dum. Hep. Eur. p. 65 (1874).

Gymnocolea affinis, var. *Wallrothiana*, Dum. Hep. Eur. p. 66 (1874).

Dioicous, caespitose, small, of a pale green colour. Stems simple or slightly branched, prostrate or suberect; radiculose, rootlets long, plentiful, delicate, whitish. Leaves succubous, alternate, contiguous or distant, obliquely semi-vertically inserted, slightly decurrent antically, concave or plane, spreading or recurved, horizontal or slightly ascending, ovate, orbicular, subrotund or subquadrate, bifid to about $\frac{1}{2}$, sometimes with a small third basal antical tooth, sinus acute or obtuse, segments subequal, acute or obtuse; texture somewhat delicate, cells between medium and rather large (0.4 mm.), 4-, 5- and 6-sided, quadrate or oblong-quadrate, walls somewhat thick, two bands, trigones absent or

very indistinct. No stipules. Bracts larger than the leaves, repand or appressed, subrotund, trifid, the third segment smaller and antical, sinus acute or obtuse, divided to about $\frac{1}{4}$, segments acute. No bracteole. Sub-bracts with a third basal antical tooth. Perianth terminal, projecting about $\frac{1}{2}$ or barely beyond the bracts, composed of a single layer of cells, about 30 round the middle, turbinate or pyriform, terete, smooth or slightly folded near the apex, mouth contracted, small, ciliolate, fringed with 15 to 20 cilia composed of 1 or 2 elongated cells, incurved. Calyptra very delicate. Capsule oval. Spores and elaters deep reddish-brown. Perigonial stems small, bracts small, crowded, imbricate, more erect, ventricose, bifid with a third antical, basal segment, monandrous, antheridia oval.

Fruits April, May.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diam. $\cdot 1$ mm. to $\cdot 15$ mm., with extended leaves 1 mm. to $1\cdot 25$ mm. wide; leaves $\cdot 8$ mm. long \times $\cdot 75$ mm. broad, segments $\cdot 2$ mm., $\cdot 8$ mm. \times $\cdot 6$ mm., seg. $\cdot 2$ mm., $\cdot 7$ mm. \times $\cdot 45$ mm., seg. $\cdot 2$ mm., $\cdot 65$ mm. \times $\cdot 5$ mm., seg. $\cdot 2$ mm., $\cdot 5$ mm. \times $\cdot 4$ mm., seg. $\cdot 2$ mm., $\cdot 45$ mm. \times $\cdot 3$ mm., seg. $\cdot 1$ mm.; cells $\cdot 06$ mm. \times $\cdot 03$ mm., $\cdot 05$ mm. \times $\cdot 035$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 035$ mm. \times $\cdot 03$ mm., walls $\cdot 0075$ mm.; sub-bracts $\cdot 8$ mm. long \times $\cdot 75$ mm. broad, seg. $\cdot 2$ mm., $\cdot 07$ mm. \times $\cdot 06$ mm., seg. $\cdot 2$ mm.; bracts $\cdot 95$ mm. long \times $\cdot 9$ mm. broad, seg. $\cdot 25$ mm.; perianth $1\cdot 75$ mm. long \times $\cdot 5$ mm. broad upper half, 2 mm. long \times $\cdot 6$ mm. broad upper half; pedicel 1 mm. long \times $\cdot 01$ mm. diam.; capsule $\cdot 5$ mm. long \times $\cdot 35$ mm. broad; antheridia $\cdot 13$ mm. long \times $\cdot 1$ mm. broad.

HAB.—Growing on wet or damp shaley banks or rocks, chiefly magnesian limestone or chalk. Somewhat common.

1. Near Hayle Causeway, and near Lelant Ferry, Cornwall, *W. Carnow*.
- 2, 3. Atford, Kent, *E. M. Holmes*.
4. Bedminster, *E. H. Reel*.
5. Banks of drain, one mile from Arley, Staffordshire, *J. E. Baynall*.
7. Bangor, Carnarvonshire, *G. E. Hunt*.
8. Monsal Dale, Ashwood Dale, Derbyshire, *G. A. Holt*.
9. Cetterill Clough, *W. Wilson*; Oversley Fold Wood, Handforth *Capt. P. G. Cudiffe*; Marple, Cheshire, *C. J. Wild*; South-

port, Lanc., *G. E. Hunt*, *Dr. Carrington*. 10. Quarry Moor, Ripon, *Miss M. Morton*. 11, 12. On wet limestone rocks, Levens Park; The Force, Levens; on the banks of River Kent, Nether Levens; Milnthorpe; near Whitbarrow Hall, *G. Stabler*; near Kendal, Westmorland, *Rev. C. H. Binslead*. 13. Orroland, Rerrick, Kirkeudbright, *J. McAndrew*. 14.

I. Woodlands, near Dublin, *W. Wilson*; not unfrequent on the grey limestone in Co. Dublin, where it fruits freely, *Dr. D. Moore*; Finglas Quarry, *D. M. Arille*; on white limestone near Glenarm, Co. Antrim, *Dr. D. Moore*; Killarney on limestone, *Dr. Carrington*; Tore Cascade, Killarney and Carrantual, Kerry, *Dr. D. Moore*.

Found on the Continent and in North America.

OBS.—Under this name I have grouped all the small forms of what were considered *Jungermania acuta*, Lindenb., which are without stipules; the form published in G. & R. n. 643 as *Jung. acuta* is the same as a form named *Jung. turbinata* var. *acutiloba*, Spruce, which connects *Jung. turbinata* with *Jung. bantriensis* var. *Muelleri*. *Jung. turbinata* is a very constant form and may be regarded as the extended type of a group with *Jungermania bantriensis*, Hook., at the other extreme.

It may be distinguished from other dioicous species by the antical segment at the base of the upper leaves and bracts, its delicate cell structure and the turbinate perianth.

DESCRIPTION OF PLATE CXXXII.—Fig. 1. Plants natural size. 2. Portion of stem $\times 31$, antical view (*Jung. Wilsoniana*, Original. Herb. Taylor). 3. Ditto, postical view (Bedminster, E. H. Read). 4, 5. Leaves $\times 31$ (Cotterill Clough, Cheshire, W. Wilson). 6. Portion of leaf $\times 290$ (Hb. Taylor). 7. Bracts $\times 31$ (Bedminster, E. H. Read). 8. Sub-bracts $\times 31$ (ditto). 9. Perianth $\times 31$ (Hb. Taylor). 10. Cross-section of perianth $\times 31$ (ditto). 11, 12. Portions of the mouth of perianth $\times 31$ (ditto). 13. Antheridium $\times 85$ (Monsal, Derbyshire, G. A. Holt).

Subgenus 3. *LOPHOZIA*, Dum.

Jungermania, sect. *Lophozia*, Dum. Syll. Jung. p. 53 (1831); Spruce, Hep. Am. et And. p. 511 (1885).

Lophozia, Dum. Recueil, p. 17 (1835); Schiffner emend Eng. & Prant. 1; Pflanz. 91 und 92 Lief. p. 84 (1893).

Leaves suborbicular or subquadrate, bifid, in a few species 3-5-fid, quite entire or sometimes denticulate. Stipules absent or present, often bipartite. Perianth usually deeply plicate, very rarely cylindrical and smooth.

Section 1. *BIDENTES*, Schiffn.

Stem leaves always bifid; bracts similar or multifid. Stipules absent or present.

12. *Jungermania bantriensis*, Hooker.

Jungermania bantriensis, Hook. Brit. Jung. in note under *J. stipulacea*, n. 41 (1816).

Jungermania bidentata, var. Hook. Brit. Jung. Suppl. t. 111 (1816).

Jungermania hygrophylla, Spruce, Trans. Bot. Soc. Edin. 11 (1846).

Jungermania culearis, Wils. MSS. in Spruce, Hep. Pyren. Trans. Bot. Soc. Edin. 111, p. 20 (1850).

Jungermania subcompressa, Limpr. Jahr. Schl. Ges. p. 7 (1884).

Dioicous, loosely caespitose, medium size, of a pale, dark green or brown colour. Stems creeping or suberect, simple or innovantly branched; on a cross-section cells alike, walls dark, firm; radiculose, rootlets long, few, whitish; firm, flexuose, sometimes flaccid. Leaves succubous, alternate, imbricate, secund or spreading, obliquely semi-vertically inserted, horizontal or suberect, antical margin decurrent, roundish-quadrate, broadly ovate or orbicular, emarginate-bidentate, from about $\frac{1}{10}$ to $\frac{1}{7}$ deep, very shallow, broad, rounded, often folded at the base, segments acute or obtuse; texture somewhat lax; cells medium size, roundish or roundish-hexagonal, lumen pellucid, with few chlorophyl granules, walls somewhat firm, trigones small but distinct. Stipules lanceo-

late-subulate, broadly subulate or ovate-oblong, entire or with a basal tooth on one side. Braets broadly ovate or broadly oval, sinus acute, folded at the base, segments acute. Bracteole absent. Perianth projecting about $\frac{1}{2}$ beyond the braets, obovate or obconical, smooth or slightly folded near the apex, composed of a single layer of cells, about 100 round the middle, near the base 1, 2 or sometimes 3 cells thick, cells quadrate, near the base elongate, with trigones very small but distinct, mouth contracted, laciniate-ciliate, 20 to 25 cilia. Calyptra pale brown, delicate, composed of a single layer of cells above, 2 to 3 near the base.

DIMENSIONS.—Stems 1 to 2 inches long, .2 mm. to .3 mm. diam., with extended leaves 2 mm. to 3 mm. broad; leaves 1.25 mm. long \times 1.6 mm. broad, segments .2 mm., 1.3 mm. \times 1.2 mm., seg. .2 mm., 1.25 mm. \times 1.25 mm., seg. .1 mm.; cells .03 mm., .03 mm. \times .035 mm., .03 mm. \times .025 mm.; stipules .5 mm. long \times .15 mm. broad at the base; braets 2 mm. long \times 1.75 mm. broad, segments .75 and .5 mm. long, 2 mm. \times 1.5 mm., seg. .5 mm.; perianth 2.25 mm. long \times 1.25 mm. broad, 2 mm. \times 1.1 mm.

HAB.—Growing in loose patches, or straggling amongst mosses on damp rocks or banks in woods. Rare.

7. Dolgelly, Merionethshire, *J. Ralfs*; near Dolbadarn Castle, Llanberis, Carnarvonshire, *W. H. P.* 10. Banks of the Tees, *Dr. Spruce*; Teesdale, *John Nowell*; Bolton Woods, *Dr. Carrington*. 11, 12. Westmorland, *P. Drecson*; Garburn, Kentmere Park, *G. Stabler*; Kentmere Waterfall, *G. Stabler*; Long Sleddale, *Rev. C. H. Binslead*; Stock Ghyll, *G. Stabler*; Groove Ghyll, Barbon Fell, *G. Stabler* (These Westmorland stations probably include var. *Muelleri*). 13. Crumroy Park Glen; Ballingear Glen, New Galloway, *J. McAndrew*. 16. On a wet bank, rare, Moidart, West Inverness, *S. M. Macvicar* & *W. H. P.*

I. Near Bantry, *Miss Hutchins*; Glengariff, *Dr. Carrington*; Brandon, Co. Kerry; Benbulbin, Co. Sligo; Gleniff, Co. Leitrim, *Dr. D. Moore*.

Found on the Continent.

Obs.—This I regard as the most perfectly developed type of a

series of forms running through *Jung. Muelleri*, Nees, *Jung. acuta*, Lindenb. to *Jung. turbinata*, Raddi. at the other extreme, which all agree in their dioicous inflorescence, but the variation in size, shape of leaf, stipule and perianth differ to a very great extent; for further notes see under the varieties following.

Distinguished from var. *Muelleri*, Nees, by its larger size, more lax habit, more quadrate leaves, with shallower and broader sinus.

From *Harpanthus Flotowii*, Nees, by its smaller stipules and terminal perianth.

From *Jungermania ventricosa*, Dicks., which is also dioicous, by the presence of stipules and absence of bracteole.

DESCRIPTION OF PLATE CXXXIII.—Fig. 1. Plants natural size. 2, 3. Portions of stem $\times 16$ (Bantry, Miss Hutchins, Original). 4. Ditto $\times 24$ (Saltzburg, Dr. Sauter). 5. Portion of leaf $\times 290$ (Original). 6. Stipule $\times 85$ (ditto). 7. Bract $\times 16$ (Banks of the Tees, Dr. Spruce). 8. Ditto (Gotland, Lindberg). 9. Perianth $\times 24$ (Original). 10. Ditto $\times 16$ (Saltzburg, Dr. Sauter). 11. Portion of the mouth of the perianth $\times 85$ (Gotland, Lindberg).

13. *Jungermania bantriensis*, Hook., var. *Muelleri* (Nees).

Jungermania Muelleri, Nees in Lindenb. Syn. Hep. Eur. p. 39 (1829).

Lophozia Muelleri, Dum. Recueil, p. 17 (1835).

Dioicous, cæspitose, small, pale green to dark greenish-brown in colour. Stems simple or slightly branched, flexuose, creeping or suberect, innovations arising from base of the perianth; radiculose, rootlets plentiful, whitish. Leaves succubous, alternate, subimbricate, contiguous or distant, obliquely semi-vertically inserted, horizontal or slightly ascending, slightly decurrent antically, spreading, plane or concave, orbicular, ovate or subquadrate, emarginate-bidentate, sinus acute or rounded, narrow or broad, segments acute or obtuse, equal or unequal; texture somewhat lax, cells medium size, roundish-quadrate, walls mode-

rately thick, trigones distinct. Stipules small, lanceolate-subulate, acuminate, entire or dentate on one or both sides near the base. Bracts similar to the upper leaves, only larger. Bracteole wanting. Perianth terminal, projecting about $\frac{1}{2}$ beyond the bracts, obovate or subcylindrical, smooth, mouth slightly plicate, contracted, laciniate-ciliate, cilia 2-4-cells long, submucronate. Pistillidia few (5). Perigonial stems smaller, bracts small, imbricate, ventricose, with a third antical segment.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, .1 mm. to .3 mm. diam., with leaves extended 1 mm. to 2 mm. broad; leaves 1 mm. long \times .9 mm. broad, segments .3 mm., .9 mm. \times .85 mm., seg. .2 mm., .8 mm. \times .8 mm., seg. .2 mm., .75 mm. \times .75 mm., seg. .2 mm., .75 mm. \times .65 mm., seg. .2 mm., .5 mm. \times .4 mm., seg. .15 mm., .45 mm. \times .45 mm., seg. .15 mm.; cells .033 (.04 mm. \times .04 mm., .04 mm. \times .03 mm., .03 mm. \times .03 mm., .03 mm. \times .02 mm.); stipules .9 mm. long \times .2 mm. broad at the base, .5 mm. \times .15 mm., .4 mm. \times .125 mm., .25 mm. \times .05 mm., .15 mm. \times .05 mm.; bracts 2 mm. long \times 1.4 mm. broad, segments .5 mm. and .3 mm.; perianth 2.75 mm. long \times 1 mm. broad.

HAB.—Growing in somewhat dense, often small patches on damp rocks by streams or shaded places. Somewhat rare. 8. Ashwood Dale, Buxton, Derbyshire, *G. A. Holt*. 10. Near the Strid, Bolton Woods, Yorks, *Dr. Carrington & W. H. P.*; near Linton, Yorks, *G. A. Holt*, and other stations. 11, 12. Brown Ghyll; Kentmere; and other stations in Westmorland, *G. Stabler*. 15. Near Rumbling Bridge, Dunkeld, Perthshire, *Dr. Carrington*. 16. Moidart, West Inverness, *S. M. Macvicar*.

Found on the Continent.

Obs.—This is a form connecting *Jung. bantriensis*, Hook., with *Jung. turbinata*, Raddi, and has been variously named; an interesting series of varieties is met with in Europe which has been a source of perplexity to many authorities.

I refer to it all the small forms of *Jung. bantriensis*, Hook., which have leaves with more acute segments and sinuses, stipules present and with more cylindrical perianths.

One of the types of Lindenberg's *Jung. acuta* (Sillen. Muse.

Succ. n. 191) is certainly this variety, being a large form with stipules. Dr. Spruce observes that *Jung. bantriensis*, when young, has perianth pyriform or broadly clavate, but var. *Muelleri*, cylindrical.

Jung. bantriensis has often the sinus folded at the base, var. *Muelleri* usually plane, but I find the type and var. with and without this feature. Nees describes *Jung. Muelleri* with bracts dentate: I should think he had some other species under his notice, for I have seen no approach, in any form, to this character.

Forms of *Jung. ventricosa*, Dicks., have been confounded with this variety, but are recognised by the postical side of the stem being coloured violet, the absence of stipules, the presence of bracteole, which is connate, the bracts and the ovate perianth. Distinguished from *Jung. bantriensis*, var. *acuta*, by the presence of stipules, &c.

DESCRIPTION OF PLATE CXXXIV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 16$ (as *Jung. bantriensis*, Salzburg, Sauter, Original, Hb. Flowtow, Nees). 3. Ditto, postical view $\times 24$ (Buxton, Derbyshire, G. A. Holt). 4-6. Leaves $\times 24$ (Salzburg, Sauter). 7. Leaf $\times 31$ (Linton, Yorks., G. A. Holt). 8, 9. Leaves $\times 64$ (Buxton, G. A. Holt). 10. Portion of leaf $\times 290$ (Craven, Yorks., Dr. Carrington). 11, 12. Stipules $\times 85$ (Linton, Holt). 13-15. Ditto $\times 85$. (Buxton, Holt). 16. Stipule $\times 24$ (191 Sillen. Musc. Succ. n. 191, as *Jung. acuta*). 17, 18. Bracts $\times 16$ (ditto). 19. Perianth $\times 16$ (ditto).

14. *Jungermania bantriensis*, Hook., var. *acuta* (Lindenb.)

Jungermania acuta, Lindenb. Syn. Hep. Eur. p. 88 (1829).

Lophozia acuta, Dum. Recueil, p. 17 (1835).

Dioicous, cæspitose, small, pale or dark green to brown in colour. Stems decumbent or suberect, simple or innovantly branched, branches delicate, arising from base of perianth or apex of old stems; radiculose, rootlets white, copious, ascending to apex of stems. Leaves approximate or distant, somewhat secund

or repand, semi-vertically inserted, slightly ascending, antical base a little decurrent, ovate, oval or orbicular, bifid to about $\frac{1}{5}$, sinus narrow, obtuse or acute, segments acute or sometimes obtuse, margin entire; texture lax, cells roundish-quadrate, sometimes elongate, walls thick, trigones distinct. No stipules. Sub-braets similar to leaves, slightly larger. Braets larger, oval, ovate or subrotund, bifid to about $\frac{1}{5}$, sinus obtuse or acute, segments obtuse or acute, margin entire or sometimes with a very slight antical indentation. Perianth projecting about $\frac{2}{3}$ beyond the braets, cylindrical or oblong-obovate, smooth, mouth small, slightly dentate.

Male stems delicate, braets more erect, clasping the stem, oval, complicate, saccate at the base, bifid, with usually an antical segment, antheridia single, oval.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .2 mm. diam., with leaves .75 mm. to 1.25 mm. wide; leaves .3 mm. long \times .275 mm. broad, segments .075 mm., .35 mm. \times .3 mm., seg. .075 mm., .5 mm. \times .45 mm., seg. .1 mm., .55 mm. \times .4 mm., seg. .1 mm., .6 mm. \times .5 mm., seg. .1 mm., .6 mm. \times .6 mm., seg. .1 mm.; cells .03 mm., .04 mm. \times .03 mm., .05 mm. \times .03 mm., .05 mm. \times .035 mm.; trigones .01 mm.; sub-braets .75 mm. \times .65 mm., seg. .15 mm., .75 mm. \times .75 mm., seg. .1 mm.; braets 1.1 mm. \times 1.1 mm., seg. .2 mm., 1.25 mm. \times 1.1 mm., seg. .3 mm.; perianth 2 mm. long \times .75 mm. broad, .15 mm. \times .75 mm.; pistillidia .1 mm. long \times .05 mm. broad; perigonal braet, flattened out .3 mm. \times .3 mm.

HAB.—Growing on damp shady limestone rocks. Rare. 8. Near Buxton, Derbyshire, *J. Whitehead*; Ashwood Dale, near Buxton, *G. A. Holl*. 10. Under a bridge (limestone) at Castle Howard, *Dr. Spruce*. 15. Dunkeld, *Dr. Carriagton*.

Found on the Continent.

OBS.—This form differs from the type by its smaller size, absence of stipules; from var. *Muelleri* by the absence of stipules; from *Jungermania turbinata*, Raddi, by the shape and texture of its leaves, the sub-braets and braets being rarely distinctly antically notched, the perianth not turbinate.

It is another interesting link connecting *Jungermania bantriensis*, Hook., with *Jungermania turbinata*, Raddi.

DESCRIPTION OF PLATE CXXXV.—Fig. 1. Plants natural size. 2. Portion of fertile stem \times 24 (Dunkeld, Dr. Carrington). 3. Portion of stem \times 31 (Castle Howard, Dr. Spruce). 4, 5. Leaves \times 24 (Dunkeld, Dr. Carrington). 6–10. Leaves \times 24 (Castle Howard, Dr. Spruce). 11, 12. Ditto \times 64 (G. & R. n. 643). 13. Portion of leaf \times 290 (Dunkeld, Dr. Carrington). 14, 15. Sub-bracts \times 24 (Castle Howard, Dr. Spruce). 16, 17. Bracts \times 24 (Dunkeld, Dr. Carrington). 18, 19. Ditto \times 24 (Castle Howard, Dr. Spruce). 20. Perianth \times 24 (ditto). 21. Perigonial bract \times 85 (Dunkeld, Dr. Carrington).

15. *Jungermania obtusa*, Lindb.

Jungermania obtusa, Lindberg Musc. Scand. p. 7 (1879); Kaalaas Leverm. Norge, p. 348 (1893).

Dioicous, loosely cæspitose, medium size, pale green to fuscous in colour. Stem simple or bifurcate, thick, succulent, fragile, flexuose, below pale brown, above dark or pale green, on the postical side more or less brownish, prostrate, apex slightly ascending, the whole postical side densely radiculose; rootlets short or long, often in fascicles, near the base purplish-brown, near apex hyaline. Leaves on sterile stems usually decrescent, sometimes of equal size, somewhat remote, upper often closer and contiguous, somewhat concave, obliquely inserted, slightly decurrent anticlinal, rotund to obovato-quadrate, to $\frac{1}{3}$ or a little more bilobed, sinus semi-lunate, broad, gibbous, obtuse, rarely acute and narrow; lobes oval, obtuse or rotundate, sometimes somewhat acute, slightly unequal, postical usually larger; texture tender and soft; cells smallish to medium in size, somewhat dense, quadrate-rotundate, more or less chlorophyllose but often translucent; angles slightly thickened; cuticle verruclose. Stipules usually absent, when present rudimentary, more frequent on the male stems and at the apex and fork of bifurcate stems, minute,

subulate-lanceolate. Bracts similar in size to the leaves, or rather smaller, irregularly 2-4-lobed. Bracteole variable, entire or bifid. Perianth projecting, pale green, cylindrical-obovate, upper $\frac{1}{3}$ pluri-plicate, below smooth, composed of one layer of cells, mouth narrow, hyaline, irregularly ciliolate, with 15-20 cilioles, 1 and 2 cells long. Male plant more slender; andrœcia 3 to 4 pairs at the middle or apex of stem; perigonal bracts much smaller than the leaves, concave, at the base saccate, bilobed; lobes obtuse, connivent, unequal, postical larger; sinus broad, obtuse. Antheridia 1-3 in each bract, oval-globose, yellowish-green, stipitate.

DIMENSIONS.—Stems 1 to 2 inches long, with leaves 2 mm. to 3 mm. wide, .5 mm. thick, leaves 1.5 mm. long \times 1.25 mm. broad, segments .3 mm., cells .03 mm. \times .025 mm., .025 mm., stipules .4 mm. \times .15 mm., perianth 3.5 mm. \times 1.25 mm., perigonal bract 1 mm. \times 1 mm., antheridia .15 mm. \times .125 mm.

HAB.—On rocky ledges, in alpine situations. Ben Gaïre, 1700 ft., Moidart, West Inverness, *Symers M. Maevicar*, July 27, 1898.

The only known British station. Found in Norway, Switzerland and Styria.

Obs.—There is no other alpine hepatic which this species is likely to be mistaken for, the obtuse lobes of the leaves readily distinguishing it.

Drs. Kaalaas and Jorgensen have confirmed the Scotch specimens and have also sent me a series of Norwegian specimens with which our species fully agrees.

The figure given by Dr. Henri Bernet in his "Cat. Hep. Sud-Ouest Suisse" does not well agree with any specimens I have seen. *Jung. obtusa* is one of the numerous discoveries made in Scotland by my friend Mr. Maevicar.

DESCRIPTION OF PLATE CXXXVI.—Fig. 1. Plants natural size. 2. Stem \times 11 (Moidart, Maevicar). 3-5. Leaves \times 16 (ditto). 6. Portion of leaf \times 290 (ditto). 7. Stipule \times 24 (Norway, Bryhn). 8. Perianth \times 16 (ditto). 9. Perigonal bract \times 24 (ditto). 10. Antheridium \times 85 (ditto).

16. *Jungermania socia*, Nees.

Jungermania socia, Nees, Nat. Eur. Leb. 11, p. 72 (1836).

Paroicous, loosely cæspitose, from small to medium size, dark green to pale brown in colour, sometimes with a slight purplish tinge on the upper leaves. Stems simple or innovantly branched, branches slender; prostrate or suberect, flexuose, thick, somewhat tender; radiculose, rootlets long, whitish. Leaves subimbricate or approximate, accrescent, obliquely semi-vertically inserted, horizontal or slightly ascending, decurrent antically, secund or spreading, slightly concave, undulate, orbicular, ovate, broadly ovate, or subquadrate, bifid to about $\frac{1}{4}$ or $\frac{1}{3}$, segments acute or obtuse, sinus acute or rounded, sometimes trifid, the third segment being basal and smaller; texture tender, cells smallish to medium size, 4-, 5-, and 6-sided, quadrate or oblong-quadrate, trigones very small but distinct, walls thin, lumen full of chlorophyl granules which often cling to the walls, giving them a thickened appearance. Stipules generally present on the upper portion of stem, absent below, free or connate with the adjacent sub-bracts, lanceolate, ligulate, subulate, simple or rarely bifid. Sub-bracts (δ) orbicular, subquadrate, bifid-trifid, with one or two marginal small teeth, usually two pairs, containing several antheridia, which are large, roundish-oval with rather long stipes. Bracts broadly ovate, irregularly dentate, bracteole oval or ovate, bidentate, connate or free. Perianth terminal, projecting more than $\frac{1}{2}$ beyond the bracts, cylindrical, subclavate, upper portion slightly folded, mouth with 5 segments, margin slightly and irregularly bluntly dentate, teeth one cell long, when young with a slight purple tinge. Calyptra mitriform, ovate. Pistillidia linear-oblong, about twelve. Spores pale brown golden colour; elaters rather short, thick, dark claret colour, very different in colour from the spores, bispiral, spiral threads thick, closely twisted.

Fruits April, May.

DIMENSIONS.—Stems from $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, with leaves 2· mm. broad, diam. ·4 mm., diam. of young stem ·25 mm.; leaves ·8 mm.

× 1 mm., segments .3 mm., 1.1 mm. × .9 mm., seg. .3 mm., .8 mm. × .9 mm., seg. .3 mm., 1 mm. × .8 mm., seg. .4 mm., .8 mm. × .8 mm., seg. .3 mm., .8 mm. × .7 mm., seg. .3 mm., .7 mm. × .6 mm., seg. .2 mm.; cells .03 mm. × .03 mm., .025 mm. × .04 mm., .025 mm. × .03 mm., .02 mm. × .04 mm., .02 mm. × .02 mm.; stipules .45 mm. × .2 mm., .45 mm. × .15 mm., .225 mm. × .2 mm.; sub-bracts 1.1 mm. × 1.2 mm.; sub-bracteole 9 mm. × .3 mm., .6 mm. × .25 mm.; bract 1 mm. × 1.6 mm.; bracteole .8 mm. × .5 mm.; perianth 2.5 mm. × .7 mm.; pistillidia .25 mm. × .075 mm.; spores .02 mm. diam.; elaters .1 mm. × .01 mm.; antheridia .175 mm. × .175 mm.

HAB.—Growing intermixed with *Campylopus atrocivens* in marshy places on the ascent of Cader Idris, Merionethshire, to the left of the bridle path to Towyn, from Dolgelly, about 1500 ft. *W. H. Pearson*, April 1876.

Extremely rare. Found on the Continent.

Variety. Near Barmouth, Merionethshire. *W. H. Pearson*, June, 1878.

Obs.—Distinguished from *Jungermania capitata*, Hook., by its much larger size, more distant leaves, which are more delicate in texture, and by the presence of stipules on the upper portion of the stem, &c.

I had some hesitation in adding this species to our list of British Hepaticæ, but as I sent good specimens to the late Prof. Lindberg, who replied, “your *Jung. socia*, Nees, is correctly named, no doubt left,” I think it will stand good.

I collected, near Barmouth, another form, where the stipules are found all along the stem.

DESCRIPTION OF PLATE CXXXVII.—Fig. 1. Plants natural size. 2. Portion of young stem × 24 (Helsingfors, Lindberg). 3. Portion of stem × 16 (ditto). 4. Leaves × 24 (ditto). 5. Leaf × 24 (Original, Hb. Nees). 6–11. Leaves × 24 (Cader Idris, W.H.P.). 12. Portion of leaf × 290 (Helsingfors, Lindberg). 13. Sub-bract × 24 (Cader Idris, W.H.P.). 14. Sub-bract with sub-bracteole × 24 (Original, Hb. Nees). 15. Portion of bracts × 24 (ditto). 16. Sub-bracteole × 64 (Cader

- Idris, W.H.P.). 17, 18. Ditto \times 85 (Original, Hb. Nees).
 19. Ditto (Cader Idris, W.H.P.). 20. Bracteole \times 24 (ditto).
 21. Perianth \times 24 (Original, Hb. Nees). 22. Pistillidia \times 85
 (ditto). 23. Spores \times 290 (Helsingfors, Lindberg). 24. Elaters
 \times 290 (Ditto). 25. Antheridia \times 85 (Cader Idris, W.H.P.).
 26. Ditto, rather young (ditto).

17. *Jungermania capitata*, Hook.

Jungermania excisa, Dicks. Pl. crypt. Brit. fasc. 111, p. 11 (1793) ?; Lindb. Musc. Scand. p. 7 (1879).

Jungermania capitata, Hook. Brit. Jung. p. 86 (1816).

Jungermania excisa, var. *crispata*, Hook. Brit. Jung. t. 9 (1816).

Jungermania intermedia, Lindenb. Syn. Hep. Eur. p. 83, p. 93 (1829).

Paroicous, cæspitose, small, pale or dark green in colour. Stems simple or innovantly branched, frontally compressed, 14 cells \times 10, cortical cells darker; prostrate or suberect, somewhat succulent. Leaves above semi-vertically and below sub-horizontally inserted, crowded, imbricate, capitate, crisp and undulate, below smaller and more distant, ovate, orbicular or subquadrate, bifid to about $\frac{1}{3}$, rarely trifid, uppermost leaves and sub-bracts trifid, sometimes quadrifid, segments acute, sinus obtuse, sometimes lunulate; texture tender, cells from moderate to largish in size ($\cdot 038$ mm.), 4-, 5- and 6-sided, somewhat thin walls, trigones very small. No stipules. Bracts broadly ovate or orbicular, quadrifid, segments irregular. Bracteole free or connate with a bract, obovate or oblong-quadrate, obtuse or apiculate, sub-bracts with a large lateral antical segment to enclose the antheridia. Perianth obovate or oblong-obovate or subcylindrical, upper third portion slightly folded, 4 or 5 furrows, mouth contracted, bluntly dentate, teeth one cell long, usually very short, often tinted slightly purple. Pistillidia about 20. Calyptra delicate. Spores brown. Elaters bispiral, brown. Antheridia inserted immediately below the perianth, 1, 2 or rarely 3 at the base of each bract and sub-bract.

This plant is sometimes gemmiparous, gemmæ diamond-

shaped, pyriform or spherical, pale green or sometimes of a purple colour.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, $\cdot 2$ mm. diam., with leaves $1\cdot 5$ mm. broad; leaves $1\cdot 1$ mm. \times $1\cdot 1$ mm., segments $\cdot 4$ mm. long, $1\cdot 1$ mm. \times $1\cdot 1$ mm., seg. $\cdot 4$ mm., $\cdot 8$ mm. \times $\cdot 6$ mm., seg. $\cdot 2$ mm., $\cdot 6$ mm. \times $\cdot 6$ mm., seg. $\cdot 2$ mm.; cells $\cdot 05$ mm. \times $\cdot 04$ mm., $\cdot 05$ mm. \times $\cdot 03$ mm., $\cdot 04$ mm. \times $\cdot 04$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 04$ mm. \times $\cdot 025$ mm.; bracts $1\cdot 2$ mm. \times $1\cdot 5$ mm., segments $\cdot 2$ mm., $\cdot 4$ mm., $\cdot 5$ mm. long, $1\cdot 1$ mm. \times $1\cdot 2$ mm., seg. $\cdot 2$ mm., $\cdot 25$ mm., $\cdot 4$ mm., $1\cdot 1$ mm. \times $1\cdot 2$ mm., seg. $\cdot 2$ mm., $\cdot 3$ mm., $\cdot 5$ mm., $1\cdot 1$ mm. \times $1\cdot 1$ mm., seg. $\cdot 4$ mm., $\cdot 9$ mm. \times $1\cdot 1$ mm., seg. $\cdot 3$ mm., $\cdot 7$ mm. \times $\cdot 7$ mm., seg. $\cdot 2$ mm.; bracteoles $\cdot 8$ mm. \times $\cdot 5$ mm.; sub-bracteole $\cdot 4$ mm. \times $\cdot 4$ mm., perianth $2\cdot 5$ mm. \times $1\cdot 1$ mm., $2\cdot 1$ mm. \times $\cdot 7$ mm.; spores $\cdot 02$ mm. diam.; elaters $\cdot 1$ mm. \times $\cdot 01$ mm.; antheridia $\cdot 14$ mm. \times $\cdot 1$ mm.; stipe $\cdot 06$ mm. long \times $\cdot 01$ mm. thick.

HAB.—Growing in patches on sandy banks or moors. Somewhat rare. 1, 2. Guestling near Hastings, *Rev. E. N. Bloomfield*; Cadnum Bog, New Forest, Hants; Lyndhurst Racecourse, *C. Lyell*. 3. Hungershall Rocks, *Jenner*. 5. Cannock Chase, near Rugeley; Gospel End Common, Staffordshire, *J. E. Baynall*. 7. Llanfaelog, Anglesea, *W. Wilson*. 9. Udale, West Lane., *Wheldon & A. Wilson*. 10. Strensall Moor, *Dr. Spruce*; Castle Howard, *Dr. Spruce*; Grosmont, *M. B. Slater*. 12. Witherslack, Westmorland, *G. Stabler*. 13, 15. Sculty and Gateside, Strachan, Aberdeenshire, *J. Sim*; Kinnordy, *C. Lyell*. 16. Moidart, West Inverness, *S. M. Macvicar*.

I. Near Bantry, *Miss Hutchins*; Galtymore Mountain, Co. Tipperary, *Dr. D. Moore*.

Found on the Continent.

Obs.—This may be the *Jung. excisa* of Dickson (Pl. crypt. Brit. fasc. 3, 1793), as Lindberg asserts, but his description and figures are vague and incorrect, so I prefer to adopt the very characteristic name of Hooker.

Distinguished from *Jung. ventricosa*, Dicks., by its parvicous inflorescence.

From *Jung. socia*, Nees, and *Jung. bicrenata*, Lindenb., both paroicous species, see notes under them.

DESCRIPTION OF PLATE CXXXVIII.—Fig 1. Plants natural size. 2. Fertile stem \times 16 (Castle Howard, Dr. Spruce). 3-5. Leaves \times 24 (Strachan, Sim). 6, 7. Ditto (Kinnordy, C. Lyell). 8. Leaf \times 24 (Llanfaelog, North Wales, Wilson). 9. Portion of leaf \times 290 (Castle Howard, Dr. Spruce). 10. Bract \times 24 (Llanfaelog, Wilson). 11. Ditto (Strachan, Sim). 12. Bract with connate bracteole \times 24 (Grosmont, Slater). 13. Bracteole \times 24 (Castle Howard, Dr. Spruce). 14, 15. Sub-bracts \times 24 (Strachan, Sim). 16. Ditto (Grosmont, Slater). 17. Ditto (Kinnordy, Lyell). 18. Sub-bracteole \times 31 (Castle Howard, Dr. Spruce). 19. Perianth \times 24 (Strachan, Sim). 20. Cross-section of perianth \times 24 (Castle Howard, Dr. Spruce). 21. Antheridium \times 85 (ditto).

18. *Jungermania bicrenata*, *Schmidel*.

Jungermania bicrenata, Schmid. Anal. p. 347, t. 64, f. 1 (1747).

Lophozia bicrenata, Dum. Recueil, p. 17 (1835).

Paroicous, cæspitose, patches thin; small, from yellowish to reddish-brown in colour. Aromatic. Stems simple, rarely innovantly branched, creeping, procumbent, the perianth and upper portion of stem suberect, stem bearing rarely more than 8 pairs of leaves; radiculose, rootlets abundant, whitish, by which the stems are firmly attached to the ground. Leaves semi-vertically inserted, ascending, imbricate, concave, not undulate, accrescent, ovate, orbicular, sometimes subquadrate or obovate, bifid from $\frac{1}{4}$ to $\frac{1}{3}$, segments and sinus acute or obtusiusculus; texture thick, guttulate, cells from smallish to medium in size, roundish or roundish-oblong, walls very thick, no trigones. No stipules. Bracts oblong-quadrate, trifid, quadrifid, segments irregularly dentate, rarely entire, from $\frac{1}{4}$ to $\frac{1}{3}$ long; bracteole subulate, entire or oblong-quadrate and emarginate, connate with one of the bracts, second pair of bracts orbiculate, irregularly dentate, third

pair broadly ovate, less dentate, but with a large tooth or segment near the antical base to enclose the antheridia. Perianth terminal, projecting about $\frac{1}{2}$ beyond the bracts, ovate, oblong-oval, upper half plicate, mouth contracted, hyaline, divided into about 8 segments, which are ciliate, cilia 20 to 24, from 2 to 4 single cells long, incurved. Pistillidia about 12. Calyptra oval, narrow at the base, delicate texture. Capsule brownish-red, almost spherical. Spores brown. Elaters brown, bispiral. Antheridia situated below the perianth, in one or two pairs of sub-bracts below the innermost pair of bracts, roundish-oval, single, bearers long.

Fruits March, April.

DIMENSIONS.—Stems about $\frac{1}{4}$ inch long, rarely $\frac{1}{2}$ inch, diam. .25 mm., upper portion of stem with leaves 1 mm. wide, lower portion .5 mm.; leaves 1 mm. \times .8 mm., sinus .4 mm. deep, .9 mm. \times .8 mm., seg. .3 mm., .9 mm. \times .7 mm., seg. .25 mm., .7 mm. \times .7 mm., seg. .15 mm., .7 mm. \times .6 mm., seg. .2 mm.; cells .04 mm. \times .025 mm., .035 mm. \times .03 mm., .03 mm. \times .025 mm., .03 mm. \times .02 mm.; bracts 1.4 mm. \times 1.2 mm., segments .2 mm., .3 mm. and .4 mm., 1.6 mm. \times .9 mm., seg. .6 mm. and .4 mm.; sub-bracts 1.1 mm. \times 1.1 mm., sinus .35 mm. deep, 1 mm. \times .8 mm., seg. .25 mm., .9 mm. \times .9 mm., seg. .2 mm., perianth 2.75 mm. \times 1.25 mm., 2.5 mm. \times 1.1 mm., 2.3 mm. \times 1.2 mm., 2.2 mm. \times 1 mm., 1.75 mm. \times .9 mm., 1.5 mm. \times .7 mm.; cilia at mouth of perianth .15 mm. long \times .02 broad, at the base .12 mm. \times .02 mm.; pistillidia .15 mm. \times .05 mm.; antheridia .16 mm. \times .13 mm.; stipe .1 mm.; spores .015 mm. diam.; elaters .1 mm. long \times .01 mm. broad.

HAB.—Growing on exposed rocks, in woods and on heaths, on sandy soil, soft sandstone or on mud covered walls. Rare.

2. Ashdown Forest, Sussex, *G. E. Davies*. 5. Sandpit near Aldridge; Brindley Valley, Staffordshire, *J. E. Bagnall*. 7. Portmadoc; Tremadoc, Carnarvonshire, *W. Wilson*. Barmouth, Merionethshire, *J. Whitehead*, *C. J. Willd.* 8. Swithland Wood, *Bloxam*, *F. T. Mott*. Bardon Hill, Leicestershire, *Coleman*. 9. Dale Ford Dingle, *W. Wilson*. Delamere, *W. H. P.* Alderley

Edge, Cheshire, *G. A. Holt*. Whiteley Dean, near Hollingworth Lake, Lanc., *G. A. Holt*. 10. Strensall Common; Grosmont, Yorks., *M. B. Slater*. 13. S. of L. Dungeon, New Galloway, *J. McAndrew*; Lochar Moss, Kirkcudbrightshire, *J. Cruickshank*. 15. Strachan, Aberdeenshire, *J. Sim*. 16. Moidart, West Inverness, on bare peaty banks with *Scapania curta*, *S. M. Macvicar*.

I. Temple Michal, Cork, *Isaac Carroll*; near Letterfrack, and Kylemore, Co. Galway, *Dr. D. Moore*; Ballykill, Hill of Howth, *D. McArdle*.

Found on the Continent and in North America.

OBS.—A very distinct species. From *Jung. capitata* Hook., another paroicous species, it is distinguished by its brown colour, the closely and uniformly imbricated, concave leaves, areolation quite different, guttulate, the lumen small, with remarkably thick walls, bracts and sub-bracts more acutely dentate, perianth ciliate; in addition to these characters, the plant has a strong aromatic smell when fresh, and even when dry, which becomes more noticeable by moistening it.

DESCRIPTION OF PLATE CXXXIX.—Fig. 1. Plants natural size. 2. Fertile stem $\times 24$ (Sussex, G. Davies). 3. Leaf $\times 24$ (Dale Ford, Wilson). 4–7. Leaves $\times 24$ (Sussex, Davies). 8. Leaf $\times 24$ (G. & R. n. 187). 9, 10. Leaves $\times 24$ (Nassau, Huebener). 11. Portion of leaf $\times 290$ (Sussex, G. Davies). 12, 13. Bracts $\times 24$ (ditto). 14. Sub-bract, 2nd sub-bract $\times 24$ (Dale Ford, Wilson). 15. Ditto, 3rd sub-bract (ditto, from smaller plant). 16. Ditto, 3rd sub-bract (Nassau, Huebener). 17. Sub-bract and leaf near sub-bract $\times 24$ (Dale Ford, Wilson). 18. Perianth $\times 24$ (Sussex, G. Davies). 19. Cilia $\times 85$ (ditto). 20. Pistillidia with paraphyses $\times 85$ (Barmouth, J. Whitehead). 21. Antheridium $\times 85$ (ditto). 22. Spores $\times 290$. 23. Elaters $\times 290$.

19. *Jungermania ventricosa*, Dicks.

Jungermania minima repens, foliis bifidis, vagina florum ventricosa, Mich. Nov. pl. gen. p. 9, t. 5, f. 15 (1729).

Lichenstrum quod Jungermania minima repens, foliis bifidis, vagina florum ventricosa, Dill. Hist. Musc. p. 489, t. 70, f. 14 (1741).

Jungermania ventricosa, Dicks. Pl. crypt. Brit. fasc. 11, p. 14 (1790); Hook. Brit. Jung. t. 28 (1816).

Lophozia ventricosa, Dum. Recueil, p. 17 (1835).

Jungermania ventricosa, var *porphyroleuca*, Limpr. in Cohn. Krypto. Fl. Schles. 1, p. 280 (1876).

Jungermania porphyroleuca, Nees, Nat. Eur. Leb. 11, p. 78 (1836).

Dioicous, caespitose or straggling amongst mosses, small to medium in size, of a light or dark green colour, sometimes with a reddish tinge. Stems procumbent or suberect, simple or branched, frontally compressed, innovations arising from below the perianth, single and stout, giving the perianth a laterally inserted appearance, or several and then slender, the postical side of the cortical layer usually of a reddish or violet colour; radiculose, rootlets abundant, of a whitish colour. Leaves semi-vertically inserted, horizontal or patent-divergent, imbricate or approximate, on fertile stems accrescent, on sterile stems often largest about the middle, concave or reflexed, gemmiparous, obovate, ovate, broadly ovate or subquadrate, obtusely and widely but not deeply (about $\frac{1}{4}$) emarginate, rarely and only near the bracts trifid, segments obtuse or acute; texture somewhat succulent, cells from moderate to largish in size, 4-, 5- and 6-sided, roundish-quadrate, lumen usually filled with chlorophyl granules, trigones small but very distinct. No stipules. Bracts broadly ovate, ovate or subquadrate, bifid, trifid or quadrifid; bracteole simple and lingulate or oblong-quadrate and emarginate, connate with the bracts or rarely free. Perianth terminal, projecting about $\frac{1}{2}$ beyond the bracts, ovate-oblong, obovate, ventricose, when young and barren, smooth, upper portion obtusely folded, with about 5 folds, mouth contracted, margin irregular, dentate, teeth minute. Pistillidia large, long. Capsule dark brown,

valves splitting down to the base, viewed through transmitted light of a deep dark red colour. Spores reddish-brown, elaters the same, bi-trispiral.

Perigonial stems usually slenderer, growing in separate tufts or entangled with the fertile; bracts clasping the stem, ventricose, usually terminal, two or three pairs, containing in each bract 2 large, oval antheridia.

Gemmæ on the ends of many of the upper leaves, yellowish-green, three and four angled.

Fruits March, April.

DIMENSIONS.—Stems from $\frac{1}{2}$ to 1 inch long, diam. $\cdot 2$ to $\cdot 3$ mm., with leaves spreading 2 mm. broad; leaves 1.5 mm. long \times 1.4 mm. broad, segments $\cdot 4$ mm., 1.5 mm. \times 1.1 mm., seg. $\cdot 4$ mm., 1.3 mm. \times 1.3 mm., seg. $\cdot 4$ mm., 1.2 mm. \times 1 mm., seg. $\cdot 3$ mm., 1.1 mm. \times $\cdot 9$ mm., seg. $\cdot 25$ mm., 1.1 mm. \times $\cdot 7$ mm., seg. $\cdot 3$ mm.; cells $\cdot 06$ mm. \times $\cdot 03$ mm., $\cdot 05$ mm. \times $\cdot 04$ mm., $\cdot 045$ mm. \times $\cdot 04$ mm., $\cdot 04$ mm. \times $\cdot 03$ mm., $\cdot 035$ mm. \times $\cdot 035$ mm.; trigones $\cdot 0075$ mm.; bracts 2.1 mm. long \times 2 mm. broad, seg. $\cdot 5$ mm., 1.7 mm. \times 1.3 mm., seg. $\cdot 5$ mm., 1.5 mm. \times 1.4 mm., seg. $\cdot 4$ mm., 1.5 mm. \times 1.2 mm., seg. $\cdot 4$ mm., 1.4 mm. \times 1.2 mm., seg. $\cdot 5$ mm.; bracteoles $\cdot 5$ mm. long \times $\cdot 175$ mm. broad, $\cdot 325$ mm. long \times $\cdot 1$ mm.; pistillidia $\cdot 3$ mm. long \times $\cdot 06$ mm. broad, $\cdot 25$ mm. \times $\cdot 05$ mm.; perianth 3 mm. long \times 1.3 mm. broad, 1.8 mm. \times 1 mm., 1.7 mm. \times 1.1 mm., 1.3 mm. \times $\cdot 7$ mm.; spores $\cdot 015$ mm. diam.; elaters $\cdot 17$ mm. long \times $\cdot 015$ mm. broad; perigonial bract $\cdot 9$ mm. long \times $\cdot 6$ mm. broad; antheridia $\cdot 2$ mm. \times $\cdot 175$ mm.; gemmæ $\cdot 02$ mm., $\cdot 015$ mm., $\cdot 0125$ mm.

HAB.—Growing in patches on rocks, clayey or sandy ground or straggling amongst mosses on heaths or in bogs, in the plains or subalpine situations, on rotting wood, when it becomes the *Jungermania porphyroleuca* of authors. Generally distributed.

1. Penzance, Cornwall, *W. Curnow*. 2. Sussex, *G. E. Davies*; Tunbridge Wells, Sussex, *Dr. Spruce*; Hastings, Sussex, *Rev. E. N. Bloomfield*. 3. Southborough, *Fawcett*; Roadside near Seal, Sevenoaks, *Horse*; Ightham, Kent, *E. M. Holmes*. 4. Tuddenham, West Suffolk, *Eagle*. 5. Near Leek, *J. E. Bagnall*; Dimmings

Dale, *J. E. Bagnall*; Trentham, *R. Garner*; Gospel End; Seekley; Tettensor, &c., Staffordshire, *J. E. Bagnall*. 7. Abergynolwyn, *T. Rogers*; Cader Idris, *W. H. P.*; Tyn-y-Groes, *W. H. P.*; Cwm Bychan, Merionethshire, *E. M. Holmes*; Lyn Bodlyn, *E. M. Holmes*; Llanberis, Carnarvonshire, *G. E. Hunt*. 8. Kinder Scout; Charlesworth Coombs, Derbyshire, *G. A. Holt*. 9. Greenfield, *W. West*; Bamford Wood, *G. A. Holt*; Clifton June., Lane., *G. A. Holt*; Above Kemple End, West Lanc., *J. A. Wheldon*; Marple, Cheshire, *G. A. Holt*. 10. Bingley, *W. West*; Saltersgate Beck, *S. Anderson*; Blaeberry Gill, *M. B. Slater*; Bolton Woods, *Dr. Carrington*, *G. A. Holt*. 12. About Staveley; Naddle Forest; Foulshaw Moss, among *Sphagna*; Witherslack; Wildboar Fell, Westmorland, *G. Stabler*; Borrowdale, Cumberland, *Dr. Carrington* & *W. H. P.*; Isle of Man, *G. A. Holt*. 13. Whitehill, *C. Scott*; Kelton and Lochar Moss, *J. Cruickshank*. 15. Strachan, Aberdeenshire, *T. Sim*. 16. Glen Finnan, *Dr. Carrington*; Moidart, West Inverness, *S. M. Macvicar*.

I. Banks and rocks in mountain situations, Dublin and Wicklow, Conemore, *Dr. Taylor*; Antrim; Benbulbin, Sligo; Galtymore, Tipperary, *Dr. D. Moore*. Rare at Killarney, *Dr. Carrington*; Slieve Glah, Co. Cavan, *D. McArdle*; Ballykill, Hill of Howth, *D. McArdle*.

Found on the Continent and in North America.

Var. *Whiteheadii*. 9. Near Woodhead, Cheshire, *John Whitehead*, 1877.

Obs.—This is a very variable species and a great number of varieties have been named by Lindenberg and Nees.

With reference to *Jungermania porphyroleuca*, N., I am constrained by the examination of an extensive series of specimens to consider it only a variety of *Jung. ventricosa*; the form growing on rotting wood might be accounted distinct enough, if the characters depended upon were only constant, but when the bracts vary from bifid to quadrifid with the bracteoles simple or bifid, connate or free, with segments more or less deep, the examination of a large series can lead to no other conclusion than that they are forms of one species. This is all the more confirmed by the fact

that in the Herbarium of Nees, are found specimens of both forms and of parocious species, along with *Jung. alpestris* under the name of *Jung. porphyroleuca*.

A peculiar type of this species has been collected by the late John Whitehead near Woodhead, Cheshire, which is chiefly remarkable for the extremely large number of pistillidia; I have counted 37, 54 and 57 in three involucre, in this character approaching *Jung. Mildei*, G., with which it has other characters somewhat in common—bracts broadly ovate, unequally trifid or quadrifid and perianth plicate. *Jung. Mildei*, G., differs, however, from it, in its yellowish-brown colour not a bluish-green, with the extremities of the leaves tinged violet, the leaves almost vertically inserted and densely imbricated, not semi-vertically and loosely imbricated; the lobes of the leaves of the young branches are almost equal, not very unequal, and the cells smaller, with large trigones. It has much the habit of *Jung. capitata*, Hook., in its crowded upper leaves, but is dioicous. It affords a striking example of a transition from one species to another.

To distinguish *J. ventricosa* from allied dioicous ones is easy. *Jung. incisa* has a lighter green colour, leaves almost transversely inserted, upper leaves irregularly toothed. *Jung. bantricensis* and its variety *Muelleri*, have stipules and different bracts and shaped perianth. From *Jung. alpestris*, see notes under that species.

DESCRIPTION OF PLATE CXL.—Fig. 1. Plants natural size. 2. Fertile plant $\times 16$ (Tunbridge Wells, Dr. Spruce). 3. Male stem $\times 16$ (C. & P. n. 171). 4. Leaf $\times 24$ (Llanberis, W.H.P.). 5. Ditto (Cwm Bychan, E. M. Holmes). 6. Ditto (C. & P. n. 171). 7. Ditto (C. & P. n. 185). 8. Portion of leaf $\times 290$ (Sussex, G. Davies). 9, 10. Bracts $\times 24$ (Hastings, Bloomfield). 11. Bract $\times 16$ (Isle of Man, Holt). 12. Young bract $\times 24$ (G. & R. n. 185). 13. Bracteole $\times 85$ (G. & R. 185). 14. Pistillidium $\times 85$ (ditto). 15. Perianth $\times 24$ (Hastings, Bloomfield). 16. Spores and elater $\times 290$ (Sussex, G. Davies). 17. Perigonial bract $\times 24$ (C. & P. n. 171). 18. Antheridium $\times 85$ (ditto). 19. Gemmæ $\times 290$ (Bingley, West).

DESCRIPTION OF PLATE CXLI.—*Jungermania ventricosa*, var.

porphyroleuca (N.).—Fig. 1. Leaves $\times 17$ (After Gottsche, G. & R. n. 288). 2, 3. Sub-bracts $\times 17$ (ditto). 4, 5. Bracts $\times 17$ (ditto). 6, 7. Ditto (Sweden, Lindberg). 8. Perianth $\times 17$ (After G. in G. & R. 288). *Jungermania centricosa*, var. *Whiteheadii* (*Jung. Whiteheadii*, Pears. MSS). 9. Leaf $\times 24$ (Woodhead, J. Whitehead). 10, 11. Sub-bracts $\times 24$ (ditto). 12, 13. Bracts $\times 24$ (ditto).

20. *Jungermania alpestris*, *Schleich.*

Jungermania alpestris, Schleicher, Exsicc. 2 cent. n. 59 (1804 ?); Web. Prod. p. 81 (1815).

Jungermania sudetica, Nees in Hueben. Hep. Germ. p. 142 (1834).

Jungermania Goepertiana, Hueben. Hep. Germ. p. 254 (1834).

Cephalozia alpestris, Cogn. Hep. Belg. p. 35 (1872).

Dioicous, growing in flat, closely entangled, often spreading tufts, or straggling amongst mosses, small, from green, when young, to reddish-yellow, brown or dark brown in colour. Stems suberect, simple or furcately branched, brown, when old dark brown, serpentine, flexuose, somewhat rigid; radiculose, rooting up to apex of stem, rootlets close, pale brown, often reddish or reddish-purple. Leaves obliquely semi-vertically inserted, horizontal, spreading or secund, sub-complicate and semi-amplexicaul near the apex of fertile stems, antical margin slightly decurrent, imbricate or approximate, gemmiparous, roundish-ovate, ovate or subquadrate, concave, bidentate, sinus wide, very shallow ($\frac{1}{10}$ to $\frac{1}{7}$ deep), obtuse, segments unequal, acute or obtuse; texture firm, epidermis smooth, cells smallish, 4-, 5-, and 6-sided, roundish-quadrate, trigones very small but distinct, marginal cells slightly thickened and quadrate. No stipules. Bracts larger and broader than the stem leaves, roundish, margin entire or slightly irregular, bifid from $\frac{1}{8}$ to $\frac{1}{4}$, sinus acute or obtuse, not so wide. Bracteole simple, lingulate or rarely oblong and slightly retuse, connate with the adjoining bract or rarely free. Perianth terminal, projecting about $\frac{1}{2}$ beyond the bracts, oblong or oval, smooth, slightly obtusely folded near the apex, mouth obtusely complicate, margin

dentate. Pistillidia 5-8. Capsule roundish-oval. Spores small, yellowish-brown, elaters reddish-brown, not much broader than the spores. Male plants usually growing in separate tufts or more rarely mixed with fertile, male stems slender, often furcate, branches short, ♂ terminal or middle of the stem, 3-6 pairs of bracts, with 2 (rarely 3) antheridia at the base, perigonial bracts clasping the stem, bifid with a narrow sinus, ventricose at the base, antheridia roundish-oval. Growing with the antheridia are often leafy paraphyses. Gemmæ often abundant, at the ends of the uppermost leaves, 3-5 angled, brown or purplish-brown.

Fruits April, May, June.

DIMENSIONS.—Stems from $\frac{1}{2}$ to 1 inch long, .2 mm. diam., with leaves 1 mm. to 2 mm. wide; leaves 1.3 mm. long \times 1.2 mm. broad, segments .25 mm., 1.3 mm. \times 1.3 mm., seg. .25 mm., .8 mm. \times .7 mm., seg. .1 mm., .7 mm. \times .7 mm., seg. .05 mm., .7 mm. \times .7 mm., seg. .05 mm., .6 mm. \times .6 mm., seg. .05 mm.; cells .02 mm. \times .025 mm., .025 mm. \times .025 mm., .02 mm. \times .03 mm.; bracts 1.7 mm. long \times 1.5 mm. broad, 1.1 mm. \times 1 mm. (including bracteole), seg. .2 mm., .3 mm., .8 mm. \times .8 mm., seg. .1 mm., .8 mm. \times .7 mm., seg. .2 mm., 1 mm. \times .8 mm., seg. .1 mm., .8 mm. \times .9 mm. (including bracteole), seg. .1 mm.; bracteole 1 mm. long \times .6 mm. broad, .6 mm. \times .6 mm.; pistillidia .16 mm. long \times .06 mm. broad; perianth 2.5 mm. long \times 1.1 mm. broad, 2.2 mm. \times 1.1 mm., 2.1 mm. \times .8 mm., 1.8 mm. \times 1 mm.; perigonial bracts .8 mm. long \times .7 mm. broad; antheridia .16 mm. \times .14 mm.; gemmæ .0125 mm. \times .01 mm., .01 mm. \times .015 mm.

HAB.—Growing in alpine and subalpine situations, on rocks or earth, often in dry and exposed places. Rare.

7. Glyders, Carnarvonshire, *W. Wilson*. Cwm Idwal, Carnarvonshire, *W. H. P.* Cader Idris, Merionethshire, *W. H. P.* Nr. Dolgelly, Merionethshire, *Dr. Carrington & W. H. P.*
 12. Staveley, Westmorland, *G. Stabler*. Rydal, Westmorland, *G. Stabler*. 15. Ben Mac Dhui, *W. West, T. Rogers*. Ben Lawers, *Sadler*. Tillylair, *J. Sim*. 16. Ben Nevis, *Dr. Carrington, W. West, J. Whitehead*. Moidart, West Inverness, *S. M. Maccicar*.

I. Slieve Glah, Co. Cavan, *D. McArdle*; Benbulbin, Co. Sligo, *D. McArdle*.

Found on the Continent and in North America.

Obs.—This species is nearly related to *Jungermania ventricosa* (Dicks.), and its var. *porphyroleuca* (Nees), on the one hand, and *Jungermania bantriensis* var. *acuta* (Lindenb.), on the other.

On examination of numerous specimens from several collectors, and those given in different Fasciculi, I am confirmed in the opinion that some uncertainty exists as to its characters. In my copy of Austin's Hep. Am-Bor., the specimens would refer better to a form of *Jungermania ventricosa*, which may have been given in mistake, for I have good typical specimens from the same station (White Mountains, Oakes). According to Crypt. Bad. n. 962, *Jungermania alpestris* a. *latior* is a form also of *Jungermania ventricosa*, having the violet cortical stem layer, subquadrate leaves with more acute segments, but exactly the same type is given in G. & R. Hep. Eur. n. 304 and n. 264 as *Jungermania ventricosa*.

To add to the confusion, I have specimens from Schleicher's Cent. n. 59, which are (*ex parte*) the original *Jung. alpestris*, but my specimens are *Jungermania bantriensis* var. *Muelleri* (Nees), having the subulate stipules on all the stems. In Carr. & Pears. Hep. Brit. Fasci. II. n. 110 is given a small form of *Jungermania alpestris* as var. *gelida* (Tayl.), but since it was published I have had the opportunity of examining the original specimens of Taylor, and am inclined to look upon the type as quite a distinct species (see *Jungermania gelida*, Tayl.).

From *Jungermania ventricosa* Dicks. and its var. *porphyroleuca* (Nees), *J. alpestris* may be distinguished by its often slenderer and more graceful stems, with smaller leaves, which are rounder, not subquadrate, with a wider and shallower sinus, the cortical layer of the stem being destitute of the violet colouring, the bracts only bifid, perianth narrower.

Jungermania bantriensis var. *acuta* (Lindenb.) is more delicate, of a darker green colour, leaves more oval, with narrow sinus,

larger cells, no bracteole, perigonial bracts with usually an antical basal tooth.

DESCRIPTION OF PLATE CXLII.—Fig. 1. Plants natural size. 2. Fertile stem $\times 24$ (C. & P. n. 109). 3. Male stem $\times 16$ (G. & R. n. 265). 4. Leaf $\times 24$ (Dolgelly, Dr. C. & W. H. P.). 5. Ditto (Staveley, G. Stabler). 6–9. Ditto (Ben Nevis, Dr. Carington). 10. Portion of leaf $\times 290$ (Staveley, G. Stabler). 11. Bract $\times 24$ (Dolgelly, Dr. C. & W. H. P.). 12, 13. Ditto (C. & P. n. 109). 14. Bracteole $\times 24$ (ditto). 15. Ditto $\times 16$ (Dolgelly, Dr. C. & W. H. P.). 16. Pistillidium $\times 85$ (Ben Nevis, Dr. C.). 17. Perianth $\times 24$ (Dolgelly, Dr. C. & W. H. P.). 18. Spores $\times 290$ (ditto). 19. Elaters $\times 290$ (ditto). 20, 21. Perigonial bracts $\times 24$ (C. & P. n. 109). 22. Antheridium $\times 85$ (ditto). 23. Gemmæ $\times 290$ (G. & R. n. 190).

21. *Jungermania gelida*, *Tayl.*

Jungermania gelida, Taylor, Journ. of Bot. p. 277, n. 5 (1845); G. L. N. Syn.

Hep. p. 676 (1847); Dum. Hep. Eur. p. 79 (1874).

Jungermania alpestris, var. *gelida*, Cooke, Handb. Brit. Jung. p. 185 (1894).

Dioicous, growing intertwined in tufts of *Cesia concinnata*, small, reddish-brown at the apices, below, and old stems brown in colour. Stems creeping, or ascending, simple or innovant near apex, flexuose, filiform, graceful, 10 cells in diameter, cortical cells 20–30, somewhat similar to the inner ones; radiculose, rootlets plentiful, long, whitish. Leaves approximate, erecto-patent, secund, subrotund, bifid to $\frac{1}{5}$ or $\frac{1}{4}$, rarely trifid, segments acute, unequal, incurved, sinus obtuse or acute; cells small (large for size of plant), roundish; lumen filled with brownish granules; walls thick, angles thickened. No stipules. ♂ and ♀ not been seen.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, diam. .15 mm., with leaves .5 mm, leaves .5 mm. \times .4 mm., sinus .1 mm., .8 mm. \times .6 mm., sinus .2 mm., .7 mm. \times .7 mm., sinus .2 mm., .7 mm. \times .6 mm., sinus .15 mm., cells .02 mm.

HAB.—Scotch Alps growing intertwined with *Cesia concinnata*,

Drummond. 16. Ben Nevis, *Dr. Greville.* Roshven, West Inverness, *S. M. Macvicar.*

Obs.—This is a pretty little species, and though it may possibly be only a form of *Jung. alpestris* Schleich., yet its habit, small, secund, acutely bifid leaves with acute segments and different cell structure lead me to look upon it as distinct.

DESCRIPTION OF PLATE CXLIII.—Fig. 1. Plants natural size. 2. Plant \times 24. 3–8. Leaves \times 24. 9–14. Ditto \times 31. 15. Portion of leaf \times 290 (*Scotch Alps, Drummond original, Herb. Tayl.*).

22. *Jungermania incisa, Schrad.*

Jungermania incisa, Schrad., Syst. Samml. krypt. Gew. 2 p. 5 (1797); Hook. Brit. Jung. t. 10 (1816).

Lophozia incisa, Dum. Recueil, p. 17 (1835).

Dioicous, caespitose, small to medium in size, of a pleasant, bright, light green colour. Stems prostrate or suberect, very thick for the size of plant, frontally compressed, 9 and 10 cells by 14, of a brown colour beneath, the postical cortical layer of cells ligneous and indistinctly cellular, the antical cortical cells smaller and delicate, inner hexagonal, thin walls, with numerous dark granules in each cell; radiculose, rootlets very copious, on all the under side of stem, whitish, thick, long; simple or furcately branched, branches often arising from base of perianth. Leaves succubous, horizontally inserted, ascending, imbricating or accrescent, closer and larger near the apex, subcomplicate, obovate, deltoid, broadly ovate, bifid or irregularly trifid to about the middle, margin entire or irregularly dentate or erose, segments acute or somewhat obtuse, often dentate about the middle, sinus rounded or acute; texture somewhat coarse, epidermis smooth; cells rather large, 4-, 5-, and 6-sided, lumen filled with chlorophyl granules giving the plant a character distinct from its allies, walls moderately firm, trigones small. No stipules. Braets larger than the leaves, bifid with large lateral segments, segments irregularly and coarsely dentate. Bracteole none. Perianth project-

ing about half beyond the bracts, obovate, oval-rotund or oblong-oval, slightly plicate near the mouth, mouth hyaline with 4 or 5 irregular segments, furnished with about 20 long or short cilia, which are 1, 2, or 3 cells long, incurved; their irregularity gives the mouth a lacerated appearance. Calyptra mitriform, cells delicate, yet regular and well defined, not so delicate and indistinct as in some allied species. Capsule oval, dark reddish-brown, valves dividing down to the base. Spores light brown, elaters purplish-brown, bispiral. Male stems similar to others, sometimes more slender, perigonial bracts accrescent, crowded, forming small capitula, ventricose, bifid with incurved basal lateral segments, dentate; antheridia spherical, large, one or two in each bract.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .5 mm. diam., leaves 1.3 mm. long \times 1. mm. broad, segments .7 mm., 1.2 mm. \times 1.2 mm., seg. .6 mm., 1.2 mm. \times .7 mm., seg. .7 mm., 1.1 mm. \times 1.2 mm., seg. .6 mm., .6 mm. \times .5 mm., seg. .4 mm.; cells .05 mm. \times .04 mm., .05 mm. \times .03 mm., .04 mm. \times .04 mm., .03 mm. \times .03 mm.; bracts 1.7 mm. long \times 1.9 mm. broad, segments .6 mm., .5 mm., 1.5 mm. \times 1.8 mm., seg. .8 mm., seg. .4 mm., 1.5 mm. \times 1.5 mm., seg. .6 mm., .3 mm.; sub-bract 1.3 mm. long \times 1.1 mm. broad, segment .5 mm.; perianth 2.7 mm. long \times 1.5 mm. broad, 2. mm. \times 1.1 mm., 1.8 mm. \times 1.3 mm.; cilia .15 mm. long, .12 mm., .07 mm.; capsule .25 mm. diam.; pedicel .08 mm. diam.; spores .015 mm. diam.; elaters .12 mm. long \times .01 mm. broad; perigonial bracts .7 mm. long \times 1.1 mm. broad, segments .4 mm., 1. mm. \times .8 mm., seg. .4 mm.; antheridia .16 mm. diam.

HAB.—Growing in large patches on heaths, banks, rocks, or amongst mosses on moors; most frequent in subalpine localities. Generally distributed.

1, 3-5, 7, 8, 10-16. I.

Found on the Continent and in North America.

Obs.—This is an easily recognised species, and from any of the allied dioicous species may be distinguished by the remarkably

frontally flattened upper portion of stem, its pleasant light green colour, the crisped, dentate leaves, and the leaf cells filled with numerous granules. When dry the specimens do not retain their distinctive colour, but, on the contrary, turn a dingy black.

DESCRIPTION OF PLATE CXLIV.—Fig. 1. Plants natural size. 2. Portion of male stem $\times 16$ (Bettws-y-Coed, W. H. P.). 3. Upper portion of fertile stem $\times 16$ (France, Du Buysson). 4-6. Leaves $\times 24$ (487 G. & R.). 7. Leaf $\times 24$ (Ben Nevis, West). 8. Ditto $\times 24$ (Du Buysson). 9. Portion of leaf $\times 290$ (487 G. & R.). 10, 11. Bracts $\times 24$ (Du Buysson). 12. Ditto $\times 16$. 13. Sub-bract $\times 24$ (ditto). 14. Perianth $\times 16$ (228 G. & R.). 15. Mouth of perianth $\times 16$ (Du Buysson). 16. Cilia from mouth of perianth $\times 85$. 17. Spores $\times 290$. 18. Elaters $\times 290$. 19, 20. Perigonial bracts $\times 24$. 21. Antheridium $\times 85$ (ditto).

23. *Jungermania exsecta*, Schmid.

Jungermania exsecta, Schmidel, Ic. et anal. p. 241, t. 62, f. 2 (excl. f. fructif. et 19, 20), (1747); Hook. Brit. Jung. t. 14 et suppl. t. 1 (1816).
Lophozia exsecta, Dum. Recueil, p. 17 (1835).

Dioicous, cæspitose, small, of a green, yellowish or light brown colour. Stems prostrate or suberect, simple or slightly branched; radiculose, rootlets few, dull white, sterile stems often depauperate, apex gemmiparous. Leaves equitant, distichous, imbricate, approximate or distant, horizontal or slightly ascending, sometimes secund, convolute-complicate, concave; outline, when explanate sub-ovate, antical lobe small, broadly subulate, acute or apiculate, postical lobe much larger, semi-ovate, entire or bidentate, segments acute, minutely bidentate or erose, margin entire; texture guttulate, cells very small, roundish-quadrate, near central base oblong, walls thick, angles thickened, no trigones. No stipules. Bracts roundish or roundish-quadrate in outline, when explanate; tri- or quadrifid, segments acute; convolute-complicate like the leaves. No bracteole. Perianth projecting about half beyond the bracts, terminal, oblong, oblong-obovate or cylindrical,

composed of a single layer of cells, about 200 round, upper portion obtusely 5-plicate, mouth somewhat contracted, laciniate-ciliate, cilia 20 to 30, 2 to 3 cells long, incurved. Capsule oval, dark brown. Spores small, pale brown. Elaters dark reddish-brown. Male stems growing in the same tufts, perigonial bracts terminal, few, closely imbricate, bifid or trifid, antical lobe broadly oval, incurved, ventricose at the base, enclosing one or two oval, large antheridia.

Gemmæ at the apex of the stems or ends of the leaves, plentiful, brick-red or yellowish.

Fruits April.

DIMENSIONS.—Stems from $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .2 mm. to .3 mm. diam., with leaves about 2. mm. wide; leaves, explanate, 1.25 mm. long \times 1. mm. broad, 1.25 mm. \times .9 mm., 1.1 mm. \times .8 mm.; cells .015 mm., .01 mm., .02 mm. \times .01 mm.; sub-bract 1.25 mm. long \times 1. mm. broad; bracts 1.1 mm. long \times 1.1 mm. broad, 1.1 mm. \times 1. mm.; perianth 2. mm. long \times .85 mm. broad; cilia at mouth .1 mm. long; capsule .75 mm. \times .6 mm.; pedicel .25 mm. diam.; spores .01 mm. diam.; elaters .135 mm. long \times .01 mm. broad; perigonial bracts, postical lobe .8 mm. long \times .65 mm. broad, antical lobe .5 mm. high \times .4 mm. broad; antheridia .2 mm. \times .15 mm.

OBS.—This is a very distinct species and not likely to be confused with any other, the curiously convolute-complicate leaves, which in the common form are usually bidentate, readily enabling us to recognise it. A large, more erect form has been found on the Continent, and also at Tyn-y-Groes, North Wales, by Mr. Holt; it has leaves usually tridentate, but no other character of importance has yet been observed.

HAB.—Growing on rotting wood, heaths or rocks, in woods or shady places. Somewhat rare, very rare in fruit.

3. Joyden's Wood, near Bexley, Kent, *E. M. Holmes*.
 4. Westleton Heath, Tuddenham; Holt and Edgefield Heaths (where it was for the first time discovered in England by *Rev. R. B. Francis*); Mousehold Heath, Norfolk, *Dr. W. J. Hooker*; Herringfleet, Suffolk, *Dr. W. J. Hooker*. 7. Tyn-y-Groes,

Merioneth, *G. A. Holt, W. H. P.* 9. Risley Moss, Cheshire, *W. Wilson*. 10. Strensall Common, *Dr. Spruce, G. Stabler, M. B. Slater*; near Gomire Lake, Yorks., *M. B. Slater*. 12. Naddle Forest, Mardale, Westmorland, *G. Stabler*. 13. Rennan Hill, Ballingear Wood, New Galloway, *J. McAndrew*. 15, 16. Glen Finnan, *Dr. Carrington*; Moidart, West Inverness, *S. M. Macvicar*.

I. Bantry, Co. Cork, *Miss Hutchins*; on dry banks common, *Dr. Taylor*; Rotton logs, Cromaglowm, *Dr. Carrington*; Ballinhassig Glen, Co. Cork, *I. Carroll*; Gleniff, Leitrim; Sillaghbraes, Antrim, *Dr. D. Moore*.

Found on the Continent and in North America.

DESCRIPTION OF PLATE CXLV.—Fig. 1. Plants natural size. 2. Stem \times 31 (Strensall Common, Yorks., *G. Stabler*). 3-6. Leaves \times 24 (Germany, *Hampe*). 7. Portion of leaf \times 290 (*Spruce, Hep. Pyr. n. 17*). 8. Sub-bract \times 31 (Germany, *Hampe*). 9, 10. Bracts \times 31 (ditto). 11. Perianth \times 24 (ditto). 12. Portion of the mouth of perianth \times 85 (British Columbia, *Macoun*). 13. Perigonial bract \times 24 (*Spruce, Hep. Pyr. n. 17*).

24. *Jungermania Lyoni, Taylor.*

Jungermania quinqueidentata, *Web. et Mohr, Bot. Taschenb. p. 430 (1807); Eng. Bot. 2517.*

Jungermania Lyoni, *Tayl. in Trans. Bot. Soc. Edin. 1, p. 116, t. 7 (1844); Dum. Hep. Eur. p. 73 (1874); Husn. Hep. Gall. p. 40, f. 66 (1875-81).*

Dioicous, loosely caespitose, medium in size, dark green in colour. Stems simple or slightly ramose, often innovant at the apex, procumbent or ascending, thick, greenish, postical side usually reddish; radiculose, rootlets copious, close, long or short, pale brown or whitish. Leaves sub-vertically inserted, horizontal, alternate, approximate or distant, spreading or complicate-concave, roundish-quadrate, upper part rounded, entire, lower unequally tridentate to about a fourth, uppermost segment largest, sinuses acute or rounded, segments acute or mucronate; texture firm,

cells small, roundish-quadrangle, walls thin, trigones distinct. Stipules none; sometimes pseudo ones are found near the branches of the stem; then subulate, entire, or bidentate. Bracts subrotund, tridentate to about $\frac{1}{3}$ to $\frac{1}{3}$, sinuses and segments acute, margin slightly dentate; bracteole small, ovate, bifid, sinus and segments acute. Perianth terminal, oblong-obovate or oblong-oval, upper portion 4-, 5-, and 6-plicate, nearly all antical, one fold often running down to the base, mouth contracted, ciliolate, from 40 to 50 cilia, which are 2, 3, and 4 cells long. Capsule roundish-oval, reddish-brown; spores and elaters reddish-brown, elaters twice as broad as the spores.

Male stems often smaller, perigonal bracts terminal, about 4 or 5 pairs, closely imbricate, subrotund, tridentate, basal segment incurved, ventricose; antheridia oval with short bearers, 2 or 3 in each bract.

Fruits March, April.

DIMENSIONS.—Stems 1 to 2 inches long, .3 mm. diam., with leaves 2 mm. to 2.5 mm. wide; leaves 1.25 mm. long \times 1.1 mm. broad, segments .3 mm., 1 mm. \times 1 mm., seg. .25 mm., 1 mm. \times .8 mm., seg. .25 mm.; cells .02 mm. \times .03 mm., .02 mm. \times .02 mm., .015 mm. \times .02 mm., .0175 mm. \times .0225; bracts 1.5 mm. long \times 1.75 mm. broad, segments .3 mm., 1.25 mm. \times 1.5 mm., seg. .5 mm.; bracteole .75 mm. long \times .5 mm. broad, seg. .2 mm.; perianth 3 mm. long \times 1.75 mm. broad, 2.75 mm. \times 1.25 mm., 1.75 mm. \times 1 mm., 2 mm. \times 1 mm.; cilia at the mouth of perianth .1 mm.; perigonal bract 1 mm. long \times 1.15 mm. broad; antheridia .2 mm. \times .175 mm.

HAB.—Growing in spreading patches, somewhat entangled with the long rootlets, or creeping amongst mosses on shady walls or rocks, partial to limestone, but not peculiar to it. Not uncommon.

1. Penzance, *W. Curran*. 7. Penmaenpool, *E. M. Holmes*; Tyn-y-Groes, *Holt & Wild*; Arthog, *W. H. P.*; Cader Idris, Merionethshire, *W. H. P.*; Caerwys, Flintshire, *J. H. Lewis*; Bettws-y-Coed, *M. B. Slater, C. J. Wild*. 8. Miller's Dale, Derbyshire, *G. A. Holt, W. H. P.* 9. Easegill, near Leck, West

Lane., *A. Wilson*. 10. Ingleboro, *Dr. Carrington*; near Todmorden, *John Nowell*; Teesdale, *Dr. Spruce*. 11. 12. Whitbarrow; Heversham Head c. fr.; Witherslack; Low Wood, Windermere; Bow Fell; Naddle Forest; Kentmere, Westmorland, *G. Stabler*. 13. North side of Black Craig, New Galloway; Grey Mare's Tail, *W. Nichol*; Dalscairth & Moffat, *J. Cruickshank*. 15. Ben Lawers, Perthshire, *T. Rogers*; Banks of the Clyde, *W. Lyon*. 16. Moidart, West Inverness, *S. M. Maccicar*.

I. Glenmaluer, Co. Wicklow, *Dr. D. Moore*.

Found on the Continent and in North America.

Obs.—This is the *Jungermania quinqueidentata*, Web., of Continental authors, but it is absurd to call a plant which has uniformly only 3 teeth "*quinqueidentata*"; certainly all the authors write of it as having leaves with 3 to 5 and bracts with 4 or 5 segments, but in all Continental and British specimens examined I find them uniformly tridentate, without exception.

It is also the *Jungermania Lyoni* of Taylor, and, since there is a great uncertainty as to what the early authors understood, I use Dr. Taylor's name.

Dr. Spruce wrote me: "*Jung. quinqueidentata* Huds. is no doubt what we call *J. barbata*."

This, the most distinct species of the "*barbata*" group, has the lower (antical) margin of the leaf tridentate, and the upper (postical) margin is rounded and plane, which characteristics distinguish it at once from any of the others.

The perianth often appears to be lateral by the production at its base of robust, subpostical branches.

DESCRIPTION OF PLATE CXLVI.—Fig. 1. Plant natural size. 2. Portion of stem antical view $\times 16$ (Theden. Musc. Suec. n. 144). 3. Ditto $\times 16$ (Miller's Dale, W. H. P.). 4, 5. Leaves $\times 24$ (Bettws-y-Coed, M. B. Slater). 6. Portion of leaf $\times 290$ (Arthog, W. H. P.). 7. Bract $\times 24$ (*Jung. Lyoni*, Tayl. Clyde, Hb. Tayl.). 8. Ditto (Arthog, W. H. P.). 9. Bracteole $\times 24$ (*Jung. Lyoni*, Tayl. Clyde, Hb. Tayl.). 10. Perianth $\times 16$ (ditto). 11. Portion of the mouth of perianth $\times 85$ (Arthog, W. H. P.). 12. Perigonial bract $\times 24$ (Bettws-y-Coed, M. B. Slater). 13. Antheridium $\times 85$ (ditto).

25. *Jungermania gracilis*, Schleich.

Jungermania gracilis, Schleicher, Pl. crypt. Helv. Cent. 3, n. 60 (1804).

Jungermania barbata, var. *minor*, Hook. Brit. Jung. t. 70, figs. 18-20 (1816).

Jungermania barbata, var. *attenuata*, Mart. Fl. crypt. Erl. p. 177, t. 6, f. 50, c. (1817).

Jungermania attenuata, Lindenb. Hep. Eur. p. 48, n. 44 (1829).

Dioicous, loosely caespitose, small to medium in size, of a green or brown colour. Stems simple or furcate, or innovantly branched, suberect, flexuose, branches subpostical-lateral, proceeding from apex of stem, filiform, attenuate, with small closely appressed leaves; radiculose, rootlets plentiful, long, whitish. Leaves imbricate or approximate, obliquely inserted, patent or erect-patent, oval-quadruplicate, quadruplicate, concave, bifid, trifid, or rarely quadruplicate, from about $\frac{1}{4}$ to $\frac{1}{3}$ deep; leaves on the attenuate branches small, closely appressed, erect, imbricate, erose by the development of gemmæ; cells small, 4-, 5-, and 6-sided, lumen filled with chlorophyllose granules, walls moderately thin, trigones small, distinct. Stipules wanting or minute, linear, subulate, near the bracts distinct (sub-bracteoles), ovate-lanceolate, bifid to about the middle, margin entire. Bracts larger than the leaves, spreading, quadruplicate or broadly roundish-quadruplicate, trifid or quadruplicate to about $\frac{1}{3}$, segments acute, unequal. Bracteole ovate-lanceolate, bifid to about the middle, connate with an adjoining bract, rarely free. Perianth terminal, projecting about $\frac{1}{2}$ beyond the bracts, cylindrical, oval-oblong, oval or ovate, upper half acutely 5-plicate, lower half slightly folded, 2 layer of cells thick at the base, higher one cell thick, mouth contracted, ciliolate. Calyptra 2 cells thick at the base, one higher where it is thin and delicate. Capsule oval, reddish-brown. Spores round, brown. Elaters bispiral.

Male stems spicate; perigonial bracts usually terminal, transversely inserted, closely imbricate, 5-6 pairs, ventricose, conduplicate, bifid with a large tooth on the antical side (trifid), apices incurved; antheridia one or two in each bract, oval. Gemmæ terminal at the ends of the leaves, yellowish-red or green, irregular, oval or angular.

Fruits April, May.

DIMENSIONS.—Stems from $\frac{1}{2}$ to 1 inch long, rarely more, with leaves from 1 mm. to 1.5 mm. wide, attenuated portion .4 mm. wide, diam. of stem .2 mm.; leaves .8 mm. long \times .8 mm. broad, segments .25 mm., .9 mm. \times .9 mm., seg. .3 mm.; upper leaves .55 mm. \times .5 mm., .5 mm. \times .4 mm., .45 mm. \times .4 mm., .4 mm. \times .25 mm.; cells .02 mm.; bracts 1 mm. long \times .9 mm. broad, 1 mm. \times 1 mm., seg. .4 mm.; bracteole .8 mm. long \times .5 mm. broad, seg. .4 mm.; sub-bracteole .8 mm. \times .5 mm., seg. .4 mm.; perianth 2 mm. long \times .9 mm. broad; cilia .075 mm.; perigonal bracts .5 mm. long \times .7 mm. broad; antheridia .2 mm. \times .15 mm.

HAB.—Growing in loose tufts or creeping amongst mosses, on heaths or in woods, in the plains or subalpine localities.

1. Near Penzance, *Wm. Curnow*. 3. Abbey Wood, Kent, *E. M. Holmes*. 4. Holt, Norfolk, *Rev. R. B. Francis*. 5. Walls, Alton Towers; Ramshorne; Dimmings Dale; Star Wood, Oakamore, Stafford, *J. E. Bagnall*. 7. Cwm Bychan, Merioneth, *E. M. Holmes*. Barmouth; Cader Idris, Merioneth, *W. H. P.* 8. Charlesworth Coombs, Derbyshire; near Woodhead, Derbyshire, *G. A. Holl*. 9. Alderley Edge, Cheshire, *C. J. Wild*. Staley Brushes, Cheshire, *G. A. Holl*. 10. Bolton Woods, *Dr. Carrington*, Ingleboro'; Penyghent; Bingley; Baildon, Yorks., *W. West*. 12. Westmorland, *G. Stabler*; Skiddaw, *Rev. C. H. Binstead*. 13. Crichepe Linn, Kirkeudbrightshire, *C. Scott*. 15. Kinnordy, *C. Lyell*. 16. Moidart, West Inverness, *S. M. Maccicar*.

I. South of Ireland, *Miss Hutchins*. Near Dublin, *Dr. Taylor*. Ballykill; Howth demesne, *D. McArdle*.

C. Piemont et Grosnez, *Aug. Martin*.

Found on the Continent and in North America.

Obs.—This is a very polymorphous species, and varies much in size; it is not likely to be confused with any other species on account of the singular attenuated stems. I should like to have adopted the characteristic name of Martius, *Jung. barbata* var. *attenuata* (*Jung. attenuata* (Mart.) Lindenb.), but Schleicher's name has the priority, and is quoted by Nees, "Eur. Leber."

vol. 2 p. 164, as a variety. If there be any difference, Martius's name should be the varietal, but Lindberg, who has seen the original, states they are the same.

DESCRIPTION OF PLATE CXLVII.—Fig. 1. Plants natural size. 2. Stem $\times 16$ (Abbey Wood, Kent, Holmes). 3, 4. Leaves $\times 31$ (Sweden, Lindberg). 5. Leaf $\times 31$ (Kent, Holmes). 6–10. Leaves from attenuated stem $\times 24$ (Canada, Macoun). 11. Portion of leaf $\times 290$ (Kent, Holmes). 12. Stipule, free. 13. Sub-bracteole $\times 24$ (Sweden, Lindberg). 14, 15. Bracts $\times 31$ (ditto). 16. Bracteole $\times 31$ (ditto). 17. Perianth $\times 24$ (ditto). 18. Portion of mouth of perianth $\times 85$ (ditto). 19–21 Perigonial bracts $\times 31$ (ditto).

26. *Jungermania barbata*, Schreb.

Jungermania barbata, Schreber, F. Lip. p. 107 (1771); Hook. Brit. Jung. t. 70, ff. 7, 8 (1816).

Jungermania barbata, var. *Schreberi*, Nees, Nat. Eur. Leb. 11, p. 189 (1836).

Lophozia barbata, Dum. Recueil, p. 17 (1835).

Dioicous, loosely cæspitose, medium size, green or brownish-yellow in colour. Stems prostrate or suberect, thick, brown, simple or slightly branched; radiculose, rootlets close, whitish, copious. Leaves semi-vertically inserted, horizontal, spreading or secund, alternate, slightly imbricate or approximate, plane, sub-quadrate, subcuneate or digitate, antical margin decurrent, divided into 3, 4 rarely 5 subequal, acute or obtuse segments, sinuses rounded or acute; texture somewhat firm, cells small, 5- and 6-sided, walls thin, but with numerous chlorophyl granules attached, apparently thick, trigones very small. Stipules simple or bifid, variable, segments lanceolate or subulate, entire or with few, long teeth. Sub-bracteole oblong-quadrate, bifid, with several other smaller segments. Bracts roundish quadrate, quadridentate to $\frac{1}{3}$, with a smaller segment on both sides, segments and sinuses acute. Bracteole oblong-roundish-quadrate, with 4–6 large segments. Perianth terminal, projecting about $\frac{2}{3}$ beyond the bracts, oblong-oval, oblong-obovate or cylindrical, near apex

6-plicate, folds short, mouth contracted, ciliolate-dentate, 50-60 ciliola. Capsule roundish-oval, elaters and spores brown.

Male stems little different from others, perigonal bracts terminal, 4, 5 pairs, closely imbricate, subcomplicate, slightly ventricose, antheridia oval, large paraphyses frequently mixed with the antheridia.

Fruits April, May.

DIMENSIONS.—Stems from 1 to 1½ inches long, .3 mm. to .4 mm. diam., with leaves 2.75 mm. to 3 mm. broad; leaves 1.8 mm. long × 1.5 mm. broad, segments .6 mm., 1.4 mm. × 1.25 mm., seg. .5 mm., 1.25 mm. × 1.25 mm., seg. .4 mm.; cells .03 mm. × .02 mm., .025 mm., .02 mm.; trigones .005 mm.; stipules 1.5 mm. long × .4 mm. broad; sub-bracteole 1.7 mm. long × 1 mm. broad; bracts 1.9 mm. long × 1.7 mm. broad, seg. .6 mm.; bracteole 1.9 mm. long × 1.6 mm. broad; perianth 4.25 mm. long × 1.75 mm. broad; cilia at mouth of perianth .1 mm. long; perigonal bracts 1.25 mm. long × 1 mm. broad, seg. .3 mm.; antheridia .25 mm. × .2 mm., .2 mm. × .175 mm.; paraphyses .25 mm. long × .075 mm. broad.

HAB.—Growing in loose tufts or creeping amongst mosses on damp shady rocks, walls or banks. Somewhat rare.

1. Trevaylor Bottom, Cornwall, *J. Ralfs*. 7. Tyn-y-Groes, *C. J. Wild* & *G. A. Holt*; Barmouth, Merioneth, *W. H. P.* 8, 9. Longridge Fell, *J. A. Wheldon*; Udale, West Lane., *Wheldon* & *A. Wilson*. 10. Malham, *W. West*. 11, 12. Patterdale, *C. Lyell*; Black Crag near Staveley; Witherslack; Windermere; Kentmere; Barbon Fell, Westmorland, *G. Stabler*. 13. Crichope Linn, *C. Scott*; Dalbeattie Wood, *C. Scott*; Craigs, *J. Cruickshank*; Moffat, *J. Cruickshank*. 14, 15. Ben Lawers, *C. J. Wild*. 16. Moidart, West Inverness, *S. M. Maericar*.

I. "General in Ireland," *Dr. D. Moore*; Hill of Howth, *D. McArdle*; Slieve Glah, Co. Cavan, *D. McArdle*.

Found on the Continent and in North America.

OBS.—Easily distinguished from other species of the same group by the plane, digitate leaves, which have neither basal teeth nor cilia.

DESCRIPTION OF PLATE CXLVIII.—Fig. 1. Plants natural size. 2. Portion of stem $\times 16$ (142, Thed. Musc. Suec.). 3. Leaf $\times 24$ (Vosges, Schimper). 4. Portion of leaf $\times 290$, (142, Thed.). 5. Stipule $\times 64$ (Vosges, Schimper). 6. Bract $\times 24$ (ditto). 7. Bracteole $\times 24$ (ditto). 8. Sub-bracteole $\times 24$ (ditto). 9. Perianth $\times 11$ (Helsingfors, Lindberg). 10. Cross-section of perianth, near the base $\times 11$ (ditto). 11. Ditto, near the apex $\times 11$ (ditto). 12. Cilia from mouth of the perianth $\times 85$ (ditto). 13. Perigonial bract $\times 24$ (British Columbia, Macoun). 14. Antheridium $\times 31$ (ditto).

27. *Jungermania lycopodioides*, Wallroth.

Jungermania lycopodioides, Wallr. Fl. crypt. Germ. 111, p. 76 (1831).

Jungermania barbata, var. *lycopodioides*, Nees, Nat. Eur. Leb. 11, p. 185 (1836).

Lophozia lycopodioides, Cogn. Hep. Belg. p. 31 (1872).

Dioicous, caespitose, medium to largish in size, pale or dark green in colour, turning brown when old. Stems simple or furcate, somewhat thick, greenish or brown, prostrate, firm; radiculose, rootlets whitish. Leaves semi-vertically inserted, horizontal, imbricate, orbicular or broadly subquadrate, 3, 4, rarely 5 dentate to about $\frac{1}{3}$, sinuses acute, segments mucronate, undulate, postical base of leaf ciliate, cilia very long, hyaline; texture somewhat delicate, cells from small to medium size, roundish-quadrate or oblong, walls somewhat thin, trigones very distinct. Stipules large, bipartite, segments lanceolate, ciliate. Bracts subquadrate, to about $\frac{1}{3}$ quadridentate, sinuses acute, segments mucronate, one or two cilia near the base of bract; bracteole narrowly subquadrate or cuneate, quadridentate to about $\frac{1}{3}$, sinuses acute, segments mucronate. Perianth terminal, oval or oval-oblong, upper portion 5-plicate, mouth contracted, ciliolate or dentate, cilia distant, unequal. Pistillidia 8–10, cylindrical. Calyptra oval, delicate. Pedicel moderately thick, white. Capsule almost round, dark brown. Spores pale brown. Elaters bispiral, pale brown. Perigonial bracts 4–6 pairs, closely imbricate, smaller than stem leaves, broader than long, ventricose; antheridia numerous, 4 or 5

in each bract. oval, bearer long. Gemmæ sometimes present, brownish-red.

Fruits March, April.

DIMENSIONS.—Stems 1 to 2 inches long, diam. .4 mm., .5 mm., with leaves 3' mm. broad; leaves 2.5 mm. long \times 2.5 mm. broad, segments 1' mm. long, 2' mm. \times 2.25 mm., seg. .75 mm.; basal cilia 1' mm. long; cells .025 mm., .025 mm. \times .03 mm., .04 mm. \times .02 mm., .03 mm.; trigones .0075 mm.; stipule 1' mm. high \times 1' mm. broad, segments .075 mm.; perianth 3' mm. long \times 1.25 mm. broad; cilia at the mouth .2 mm., .1 mm., .05 mm.; bracts 2.5 mm. long \times 2.5 mm. broad, segments 1' mm.; bracteole 2.25 mm. long \times 1.25 mm. broad, segments .75 mm.; perigonial bract 1.25 mm. long \times 1.75 mm. broad; antheridia .2 mm. \times .275 mm.

HAB.—Growing in somewhat large tufts on banks or walls, in hilly districts. Rare.

7, 10, 13. Near Hannahstown Bridge, New Galloway, *J. McAndrew*. 15. Strachan, Aberdeenshire, *J. Sim*. 16. Very rare, Roshven Hill, Moidart, West Inverness, at 2500 ft. in a tuft of *Saxifraga hypnoides*, *S. M. Macvicar*.

Found on the Continent, in North America, and Northern Asia.

Obs.—Easily separated from allied species by the large cilia at the postical base of leaf, and the mucronate leaf segments.

Distinguished from the variety *Floerkii* by its much larger size.

DESCRIPTION OF PLATE CXLIX.—Fig. 1. Plants natural size. 2. Portion of young, slender stem, antical view \times 16 (Strachan, Sim). 3. Leaf \times 16 (ditto). 4. Cilia from postical base of leaf \times 85 (ditto). 5. Portion of leaf \times 290 (ditto). 6. Stipule \times 24 (Canada, Macoun). 7. Bract \times 16 (Sweden, Lindberg). 8. Bracteole \times 16 (ditto). 9. Perianth. 10, 11. Cilia from mouth of perianth \times 85 (Sweden, Lindberg). 12. Perigonial bract \times 31 (ditto). 13. Antheridium \times 31 (ditto).

28. *Jungermania lycopodioides*, Wallr., var. **Floerkii**
(Web. et Mohr.).

Jungermania Floerkii, Web. et Mohr, Bot. Taschenb. p. 410 (1807).

Jungermania barbata, var. *Floerkii*, G. L. N. Syn. Hep. p. 123 (1844).

Jungermania lycopodioides, var. *Floerkii*, Lindb. Muse. Scand. p. 7 (1879).

Dioicous, cæspitose, small to medium in size, pale or dark green to greenish-brown in colour. Stems erect or procumbent, arcuate serpentine, rigid, simple or furcate; radiculose, rootlets whitish, few. Leaves sub-vertically inserted, horizontal, imbricate, subrotund, tridentate (very rarely bi-quadridentate) to about $\frac{1}{3}$, sinuses acute or rounded, segments acute, margin of leaf entire with the exception of a small postical basal tooth; texture somewhat firm, cells smallish, roundish-quadrate, walls firm, trigones small, distinct. Stipules simple, bifid or bipartite, with one or two longish cilia or teeth near the base, segments linear-lanceolate, entire. Bracts quadrifid, undulate. Bracteole broadly ovate, bidentate. Perianth terminal, oblong, acutely plicate above.

Male plant not seen.

DIMENSIONS.—Stems $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, diam. .3 mm. to .4 mm., with leaves 2 mm. broad; leaves 1.2 mm. long \times 1.3 mm. broad, segments .3 mm., 1 mm. \times 1 mm., seg. .3 mm., .9 mm. \times 1.1 mm., seg. .3 mm.; cells .03 mm., .02 mm., .03 mm. \times .025 mm.; stipules .7 mm. long \times .3 mm. broad at the base, .7 mm. \times .25 mm., .35 mm. \times .2 mm.

Obs.—There is little doubt that this is merely a variety of *Jungermania lycopodioides*, Wallr., from which it is distinguished by its smaller size, segments not mucronate, and, instead of being furnished with large basal cilia, a short simple segment only is evident. The stipules are not so ciliate.

I have seen neither ♂ or ♀, the description of bracts, bracteole and perianth being taken from Nees "Eur. Leber."

A number of forms are described by Nees, the most striking being var. *Naumanniana*, N., which is found with us; except in the largeness of its size, I see nothing to separate it from var. *Floerkii*.

HAB.—Growing on rocks and walls, moderately rare, usually in subalpine localities.

5. Stream above Flash; Roaches, Staffordshire, *J. E. Bagnall*.
 7. Cwm Bychan, Merioneth, *E. M. Holmes*; Tyn-y-Groes, Merioneth; Barmouth, Merioneth, *W. H. P.*; Crib Coch, Carnarvonshire, *Wild & Holt*; Llanberis, Carnarvonshire, *W. H. P.*
 8. Kinder Scout; Charlesworth Coombs; near Woodhead, Derbyshire, *G. A. Holt*; Benseliff, Leicestershire, *F. T. Moll*. 9. Staley Brushes, Cheshire, *G. A. Holt*; Longridge Fell; Tootle Height, West Lanc., *J. A. Wheldon*. 10. Bingley; Baildon, Yorks., *W. West*. 12. Isle of Man, *G. A. Holt*; Staveley; Grayrigg Forest, *G. Stabler*; Kentmere, Westmorland, *Rev. C. H. Binstead*. 13. North side of Black Craig, New Galloway, *J. McAndrew*; Crichepe Linn and Terragles, *C. Scott*. 15. Ben Lawers, *G. A. Holt*; Ben Mac Dhui, *J. Whitehead*.

I. Muckish, Co. Donegal, *Dr. D. Moore*.

Found on the Continent and in North America.

- DESCRIPTION OF PLATE CL.—Fig. 1. Plants natural size.
 2. Portion of stem $\times 16$ (Todmorden, *G. A. Holt*). 3–5. Leaves $\times 24$ (Ben Mac Dhui, *J. Whitehead*). 6. Leaf $\times 24$ (Woodhead, Cheshire; *Whitehead & Pearson*). 7, 8. Leaves $\times 24$ (Ben Lawers, *G. A. Holt*). 9. Portion of leaf $\times 290$ (Helsingfors, *S. O. Lindberg*). 10, 11. Stipules $\times 85$ (Ben Lawers, *G. A. Holt*). 12. Stipules $\times 85$ (Isle of Man, *G. A. Holt*). 13. Ditto $\times 24$ (Ben Mac Dhui; *J. Whitehead*).

29. *Jungermania Kunzeana*, *Huebener*.

Jungermania Kunzeana, Hueben. Hep. Germ. p. 115 (1834).

Dioicous, growing in loose patches or amongst mosses, medium in size, of a reddish-brown colour. Stems simple or dichotomously branched, ascending or erect, firm; radiculose, rootlets long, hyaline. Leaves subhorizontal to patent-divergent, sub-vertical to obliquely inserted, bifarious, subrotund, broadly rotund or subquadrate, margin entire, often unidentate at the base, bifid to about a third, lobes erect or spreading, ovate or broadly ovate,

obtuse, incurved, sinus narrow, rounded, cells small, subquadrate, 4-, 5-, and 6-sided, walls thick, angles thickened, no trigones. Stipules usually bipartite almost to the base, rarely simple, segments subulate, lanceolate, divergent, entire, sometimes unidentate at base. Bracts larger than the leaves, subquadrate, quadrifid, sometimes unidentate near base, segments widely subulate, acuminate or acute, margin entire; bracteole free, narrowly subquadrate, dentate-spinose near base, bifid to about the third, segments widely subulate, acuminate, entire, sinus narrow. Perianth terminal, projecting beyond the bracts, oblong-oval or oblong-ovate, terete, upper half plicate, mouth slightly constricted, laciniate, dentate or denticulate. Pistillidia about 12.

Male stems more slender, leaves more erect, perigonial bracts often trifid, segments incurved, terminal or in the middle of the stem, antheridia oval.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inches long, .3 mm. diam., 1.75 mm. wide with the leaves; leaves .9 mm. high \times 1. mm. broad, segments .45 mm., .9 mm. \times .9 mm., seg. .3 mm., .75 mm. \times .85 mm., seg. .35 mm., .7 mm. \times .6 mm., seg. .25 mm.; cells .0175 mm., .02 mm., .0225 mm.; stipules .4 mm. long \times .275 mm. broad at base, segments .35 mm., .35 mm. \times .175 mm., seg. .3 mm., .35 mm. \times .125 mm., seg. .3 mm.; bracts 1.25 mm. \times 1. mm., segments .4 mm., .5 mm., .6 mm.; bracteole 1.25 mm. \times .65 mm., seg. .55 mm.; perianth 2.5 mm. long \times 1.25 mm. broad; laciniæ at mouth of perianth .1 mm. long; pistillidia .2 mm. long \times .05 mm. broad.

HAB.—Grows on rocks and heaths in alpine localities. Very rare. Scotch Alps, *Drummond* (Herb. Taylor).

Found in alpine districts on the Continent and in North America.

Obs.—This extremely rare alpine British species is abundantly distinct from any other by its colour, shape of leaves, bracts and stipules.

DESCRIPTION OF PLATE CLI.—Fig. 1. Plants natural size. 2. Portion of stem \times 16 (Scotland, Drummond, Hb. Taylor). 3. Portion of male stem \times 16 (ditto). 4-6. Leaves \times 24

(Norway, Kaalaas). 7-9. Ditto \times 24 (Lapland, Hb. Lindb.). 10. Portion of leaf \times 290 (Scotland, Drummond). 11. Portion of leaf, showing basal tooth \times 64 (Norway, Kaalaas). 12, 13. Stipules \times 64 (ditto). 14. Stipule \times 85 (Lapland, Hb. Lindb.). 15, 16. Bracts \times 24 (Finland, Hb. Lindb.) 17. Bracteole \times 24 (ditto). 18. Perianth \times 16 (Scotland, Drummond). 19. Portion of mouth of perianth \times 85 (Finland, Hb. Lindb.). 20. Pistillidium \times 85 (ditto).

30. *Jungermania Helleriana*, Nees.

Jungermania Helleriana, Nees in Lindenb. Syn. Hep. Eur. p. 64 (1829).

Diplophyllum Hellerianum, Dum. Recueil, p. 16 (1835).

Jungermania verruculosa, var. *Helleri*, Lindb. Musc. Scand. p. 8 (1879).

Cephalozia Helleri, Lindb. Medd. af Soc. F. Fenn. 14, p. 65 (1887); Kaalaas Leverme. Norge, p. 161 (1893).

Dioicous, growing in matted tufts, small, of a pale yellow, yellowish-brown or reddish-brown colour. Stems slender, flexuose, simple, or slightly branched, with slender, small-leaved innovations produced from below the perianth; densely radiculose, rootlets short. Lower leaves small, distant, upper larger and crowded near the apex, bifarious, secund above, transversely inserted, semi-amplexicaul, subquadrate, ovate or oval in outline, divided to about $\frac{1}{3}$ into two equal acute, sometimes cuspidate, rarely obtuse segments, sinus acute, narrow; cells small, roundish, roundish-oblong or oblong-quadrate, guttulate, cell-walls thick, angles thickened, no trigones, upper leaves and perianth distinctly verrucose. Stipules rarely present, subulate. Bracts larger than the leaves, subquadrate, 2-3-lobed, segments acute, spinose-dentate, sinus acute, sub-bracts bifid to about $\frac{1}{4}$ or $\frac{1}{3}$, segments acute, margin entire. Bracteole simple, narrowly oblong, subquadrate, laciniate, sparingly dentate, or obovate, subquadrate, bifid, dentate, connate on one side to adjacent bract or free. Perianth projecting about $\frac{1}{2}$ beyond the bracts, ovate or oval, slightly plicate above, mouth a little constricted, laciniate-ciliate or laciniate-dentate. Male stems rather more slender, perigonial bracts middle or end

of the stem, several pairs, ventricose; antheridia single, roundish, bearers of equal length.

Gemmiparous; gemmiparous stems with leaves closely imbricate, erect, bifid or sub-entire, erose, gemmæ small, quadrate, crimson to purple, terminal in buds.

DIMENSIONS.—Stems about $\frac{1}{2}$ inch long, .1 mm. diam., with leaves .5 mm. broad; upper leaves .45 mm. \times .35 mm., segments .175 mm., .45 mm. \times .3 mm., seg. .15 mm., .375 mm. \times .25 mm., seg. .1 mm.; middle leaves .25 mm. \times .2 mm., seg. .125 mm.; lower leaves .2 mm. \times .15 mm., seg. .075 mm.; cells .03 mm. \times .02 mm., .025 mm. \times .02 mm., .02 mm. \times .02 mm., .02 mm. \times .0175 mm., .02 mm. \times .015 mm., .0175 mm. \times .015 mm.; subbract .4 mm. \times .375 mm., seg. .125 mm.; bracts .45 mm. \times .35 mm., seg. .275 mm.; bracteole .45 mm. \times .3 mm., seg. .275 mm.; perianth 1 mm. \times .5 mm.; laciniae at mouth of perianth .075 mm.; pistillidia .125 mm. \times .025 mm.

HAB.—Growing on decaying wood, in subalpine districts. Very rare. Discovered in this country by *Mr. George Stabler*.

12. Mardale, Westmorland, May 12, 1882, *George Stabler*.

15. Balmoral, April 16, 1884, *J. Michie*; on dead trunk of *Pinus sylvestris*, Braemar, July, 1884, *G. Stabler*.

Found on the Continent and in North America.

OBS.—This very rare and small species is not likely to be confounded with any other; it grows on rotting wood, which is its only habitat.

Lindberg reduced it to a variety of his *Jung. verruculosa* (1874), but as it is a very distinct and fully developed species, I do not see any reason why Nees's name *Jung. Helleriana* (1829) should have been superseded. Later (Medd. Soc. F. Fenn. 14, p. 65 (1887), he removed it to *Cephalozia*, in which he has been followed by Dr. Kaalaas.

DESCRIPTION OF PLATE CLII.—Fig. 1. Plants natural size. 2. Fertile stem \times 31 (Herb. Lindb.). 3, 4. Upper leaves \times 64 (ditto). 5–8. Middle and lower leaves \times 64 (ditto). 9–11. Upper leaves \times 64 (Braemar, G. Stabler). 12. Erose leaf \times 64 (ditto). 13. Portion of leaf \times 290 (Herb. Lindb.). 14, 15.

Stipules free (Canada, Macoun). 16, 17. Sub-bracts $\times 64$ (Herb. Lindb.). 18. Bracts and connate bracteole $\times 64$ (ditto). 19. Bracteole $\times 64$ (ditto). 20. Perianth $\times 31$ (ditto). 21. Portion of mouth of perianth $\times 85$ (ditto). 22. Pistillidium $\times 85$ (ditto).

Subgenus 4. *SPHENOLOBUS*, Lindb.

Jungermania, sect. *c. Sphenolobus*, Lindb. Musc. Scand. p. 9 (1879).

Dioicous, stems simple, furcate or dichotomously branched, leaves transversely inserted, bilobed; stipules absent; bracts quadrifid; perianth oval or obovate, upper portion 5-, 6-plicate.

31. *Jungermania minuta*, Crantz.

Jungermania minuta, Crantz ex Dicks. Pl. crypt. Brit. fasc. 11, p. 13 (1790);

Hook. Brit. Jung. t. 41 (1816); Sm. Eng. Bot. t. 2231.

Jungermania bicornis, Web. et Mohr Bot. Taschenb. p. 123 (1807).

Jungermania Weberi, Mart. Fl. crypt. Erlang. p. 157, t. 5, f. 33 (1817).

Diplophyllum minutum, Dum. Recueil, p. 16 (1835).

Dioicous, growing in loose or entangled patches, or amongst mosses, small to medium in size, of a brownish or yellowish-green colour. Stems creeping, suberect or erect, simple or dichotomously branched, branches produced from the axils of the leaves, between lateral and postical, more postical, filiform, rigid, flexuose, somewhat brittle when dry, cortical and next inner layer of cells dark brown, inner white, indistinct, small; radiculose, rootlets few, long, hyaline. Leaves bifarious, distant, contiguous or imbricate, pectinate, transverse or patent-divergent (70°), outline subquadrate or ovate when flattened out, subconduplicate, margin quite entire, bilobed to about $\frac{1}{3}$, sinus acute or rounded, segments unequal, antical slightly smaller, acute or rarely obtuse, sometimes apiculate; texture firm, epidermis slightly verruculose, cells minute to rather minute, subquadrate, near base of leaf sometimes a little elongate, walls thick, no trigones, guttulate. No stipules. Bracts larger than the leaves, two, quadrifid, one bract often with a large

tooth near the base, sometimes one bract will be quadrifid and the other only bifid, divided to about the middle, rarely only to about $\frac{1}{3}$ or $\frac{1}{4}$, segments lanceolate, acutate or acute, margin quite entire. Perianth projecting beyond the bracts, oval, terete, upper half 5-plicate, composed of a single layer of cells, about 150 cells round, mouth constricted, laciniate-denticulate. Spores pale brown, elaters dark reddish-brown.

Male stems similar to others, perigonal bracts middle of stem, concave, ventricose at base, 3 to 4 pairs, antheridia roundish-oval, with long bearers.

Gemmiparous, gemmæ whitish.

Fruits May.

DIMENSIONS.—Stems from $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, .125 mm. diam., with leaves 1 mm. wide; leaves .8 mm. \times .7 mm., segments .4 mm., .75 mm. \times .5 mm., seg. .3 mm., .8 mm. \times .6 mm., seg. .4 mm.; cells .015 mm.; bracts 1.1 mm. broad \times .95 mm. high, .95 mm. \times .95 mm., seg. .5 mm.; perianth 2.35 mm. \times .75 mm.; spores .01 mm. diam.; elaters .1 mm. long \times .01 mm. broad.

HAB.—On rocks and heaths in alpine and subalpine districts. Somewhat rare.

7. Borthwen, *Rev. T. Salway*; Cwm Bychan, Merionethshire, *W. H. P.* 8. Kinder Scout, Derbyshire, *Whitehead & Holt*. 9. Clougha, West Lanc., *Wheldou & A. Wilson*. 10. Near Greenfield, *W. Wilson*; Ribbleshead, *Dr. F. A. Lees*; Haworth, *Dr. Carrington*; near Todmorden, *John Nowell*. 11, 12. Mardale; Brunt Knot; Kentmere, Westmorland, *G. Stabler*. 13. Frequent on banks and on the hills, New Galloway, *J. McAndrew*. 15. Strachan, Aberdeenshire, *J. Sim*; Ben Lawers, *C. J. Wild*. 16. Common among rocks in peaty soil, rare on the hills, where it was observed at 1800 ft. Moidart, West Inverness, *S. M. Maccicar*.

I. Mangerton, *Dr. Carrington*; Loch Bray, Co. Wicklow, *Dr. D. Moore*, *D. M'Ardele, cum per.*; Seven Churches, Co. Wicklow, *Dr. D. Moore*.

Found on the Continent, North America, Mexico, Africa.

OBS.—This species is distinguished from *Jung. saxicola* by its smaller cells, in addition to the other characters mentioned under

that species. In its sterile state it may be confounded with some forms of *Marsupella emarginata* or *Marsupella Funckii*, but if bracts be found it is at once identified.

DESCRIPTION OF PLATE CLIII.—Fig. 1. Plants natural size. 2. Portion of stem $\times 31$ (G. & R. 629). 3–6. Leaves, flattened out, $\times 32$ (Loch Bray, M'Ardle). 7. Leaves $\times 31$ (ditto). 8, 9. Leaves, flattened out, $\times 31$ (G. & R. 629). 10. Leaf $\times 31$ (Loch Bray, M'Ardle). 11. Portion of leaf $\times 290$ (G. & R. 629). 12, 13. Bracts $\times 31$ (Loch Bray, M'Ardle). 14. Perianth $\times 24$ (ditto). 15. Cross-section of upper part of perianth $\times 31$ (ditto). 16. Portion of the mouth of perianth $\times 85$ (ditto). 17. Perigonal bract free, after Carrington.

32. *Jungermania saxicola*, Schrad.

Jungermania saxicola, Schrad. Syst. Samml. krypt. Gew. n. 97 (1797).

Diplophyllum saxicolum, Dum. Recueil p. 16 (1835).

Dioicous, growing in thick patches or amongst mosses, medium to largish size, of a brown, yellowish, red-brown, or rarely of an olive-green colour. Stems simple or furcate, somewhat robust, firm, branches proceeding from below the leaves, sub-postical, between lateral and postical, but more postical; about 15 cells in diam.; cortical cells dark and firm, about 40 to 50 cells round, inner white, somewhat firm and distinct, walls firm; radiculose, rootlets long, close, hyaline, some stems destitute. Leaves horizontally inserted, equitant, imbricate or contiguous, regular, almost of equal size, somewhat oblique, amplexicaul, not decurrent, subconduplicate, broadly ovate, bifid to the middle, rarely trifid, lobes unequal, antical a little smaller than the postical, segments subacute, obtuse or roundish, margin quite entire; cells smallish, roundish, roundish-oblong or subquadrate, cell walls thick, angles thickened. No stipules. Bracts larger than the leaves, 2 to 4-lobed to near the middle, segments acute, dentate. Bracteole bifid to below the middle, segments acute, dentate; sub-bracts broadly ovate or subquadrate, bifid to about the middle, segments roundish, irregularly dentate; sub-bracteole very small, obovate, entire, or retuse. Perianth projecting about half beyond the

bracts, oblong-ovate or obovate, cylindrical, upper part plicate, mouth contracted, laciniate-dentate, about 30 fine teeth, pistillidia very numerous.

Perigonial stems more slender, growing in separate tufts, perigonial bracts terminal, containing 1 to 3 antheridia.

DIMENSIONS.—Stem 1 to 2 inches long, diam. $\cdot 2$ mm., with leaves $1\cdot 25$ mm. broad; leaves, antical lobe $\cdot 75$ mm. \times $\cdot 55$ mm., postical lobe $\cdot 85$ mm. \times $\cdot 55$ mm., antical $\cdot 75$ mm. \times $\cdot 5$ mm., postical $\cdot 9$ mm. \times $\cdot 7$ mm.; cells $\cdot 025$ mm., $\cdot 03$ mm., $\cdot 04$ mm. \times $\cdot 02$ mm.; sub-bract $1\cdot 25$ mm. \times $1\cdot 25$ mm. (both lobes); sub-bracteole $\cdot 4$ mm. \times $\cdot 35$ mm.; bracts $1\cdot 5$ mm. \times $1\cdot 25$ mm., segments $\cdot 75$ mm.; bracteole 1 mm. \times $\cdot 55$ mm., segments $\cdot 6$ mm.; perianth $2\cdot 25$ mm. \times $1\cdot 1$ mm.

HAB.—An alpine species, growing on rocks or amongst mosses; very rare. Rhonas Hill, Shetland, *Dr. Greville*.

Found on the Continent and in North America.

OBS.—This extremely rare British species is not likely to be confounded with any other native hepatic. From *Jung. minuta*, Crantz, its nearest congener, it is distinguished by its robustness, the more obtuse lobes of the leaves and its dentate bracts; from *Jung. Kunzeana*, Hüb., by the absence of stipules, &c.

DESCRIPTION OF PLATE CLIV.—Fig. 1. Plants natural size. 2. Portion of stem $\times 24$ (Shetland, Greville). 3, 4. Leaves $\times 24$ (Finland, Lindberg). 5, 6. Leaves, flattened out, $\times 24$ (ditto). 7. Portion of leaf $\times 290$ (ditto). 8. Sub-bracts and sub-bracteole $\times 24$ (ditto). 9, 10. Bracts $\times 24$ (ditto). 11. Bracteole $\times 24$ (ditto). 12. Perianth $\times 16$ (ditto). 13. Cross-section of perianth $\times 16$ (ditto). 14. Mouth of perianth, flattened out, $\times 16$ (ditto).

Subgenus 5. *ANASTREPTA*, Lindb.

Jungermania, sect. *Anastrepta*, Lindb. Bot. Not. (1889).

Dioicous, plants moderate size, cæspitose, or creeping singly amongst mosses; stem erect, radiculose, simple or innovantly

branched; leaves obliquely inserted, emarginate, margin remarkably recurved; stipules absent; perianth laterally compressed, upper portion plicate, mouth constricted.

33. *Jungermania orcadensis*, Hook.

Jungermania orcadensis, Hook. Brit. Jung. t. 71 (1816).

Mesophylla (?) *orcadensis*, Dum. Syll. Jung. p. 80 (1831).

Mesophylla orcadensis, Dum. Hep. Eur. p. 130 (1874).

Dioicous, loosely caespitose, largish, brownish-green or dark reddish-brown in colour. Stems simple, or with a few innovant branches arising from the postical side of axil of leaf-subpostical, or truly postical, arising from the postical side of stem; outer layers of stem dark coloured, inner white; erect or ascending, flexuose, filiform, reddish-brown in colour; radiculose, rootlets short, dense, ascending to apex of stem, dull white. Leaves obliquely semivertically inserted, closely imbricate, or when young, smaller and approximate, horizontal or slightly ascending, spreading or secund, semi-amplexicaul, antical margin decurrent, broadly ovate to cordate, emarginate, sinus shallow, rounded, segments acute, margin entire, upper (remarkably so) and lower recurved, concave at base; texture somewhat thin but firm; epidermis smooth; cells small, roundish to roundish-oblong, guttulate, walls thick, angles thickened, no trigones. Stipules wanting, except where the innovant branches arise, irregular in shape, much broader than long, usually 4-laciniate, the two middle segments often long and acute. Bracts 2, large, recurved above, the outer one embracing the inner, usually trilobate (2-4), sinus somewhat acute, segments more or less acute. Bracteole large, very broad, surrounding the lower half of the perianth, deeply 4-laciniate (often with 6 laciniae), segments unequal, some triangular, others smaller and more acute, the smallest and most acute at the margins. Perianth projecting somewhat beyond the bracts, slightly arcuate, narrowly oblong (below somewhat narrower than above), distinctly laterally compressed, upper third portion deeply plicate, with 5, sometimes more, rounded folds,

which are not all equally deep and perfect; mouth constricted, ciliate (cilia 3 cells long), between the cilia are short teeth. Androecia situated on the middle of stem, 3–5 pairs of perigonial bracts, which are very different from the stem leaves, they are hardly half the size, saccate at the base, obtusely bilobed, lobes broad and obtuse; antheridia 2, shortly stipitate.

DIMENSIONS.—Stems 2 to 3 inches long, diam. $\cdot 3$ mm., with leaves $2\cdot$ mm. broad; leaves $1\cdot 25$ mm. long \times $1\cdot 1$ mm. broad, segments $\cdot 3$ mm., $1\cdot 2$ mm. \times $\cdot 9$ mm., seg. $\cdot 2$ mm.; cells $\cdot 02$ mm., $\cdot 0225$ mm. \times $\cdot 0125$ mm.

HAB.—Growing in loosely matted patches or straggling amongst other mosses and hepatics, in alpine or subalpine localities. Rare.

7. Snowdon, Carnarvonshire, *W. Wilson*. 12. Ambleside, Westmorland, *C. Lyell*; Naddle Forest, &c., Westmorland, *G. Stabler*. 15. Clova Mountains, *Dr. Greville*; Ben Mac Dhui, *W. West*. 16. Catlow Hills, Kinnordy, *C. Lyell*; Loch Maree, *Dr. Carrington*; Glen Finnan, *Dr. Carrington*; Moidart, West Inverness, *S. M. Macvicar*. 18*b*. Orkney Isles, *Dr. Hooker*.

I. Brandon Mountain, *Dr. Taylor*.

Found on the Continent.

The *Jung. orcadensis* recorded from the Himalaya is a different species, insertion of leaves more transverse, different in shape, segments more obtuse, cells larger, &c.

OBS.—This is a very distinct species, easily recognised by the remarkably recurved margins of the leaves.

No ♂ or ♀ plants have yet been met with in this country. Dr. E. Jorgensen has found them in Norway and I have taken my description and figures of them from his interesting paper in “Bergens Museums Aarbog,” 1894–95, No. xviii.

DESCRIPTION OF PLATE CLV.—Fig. 1. Plants natural size. 2. Portion of stem, antical view $\times 16$. 3. Portion of stem, postical view $\times 24$. 4. Leaf $\times 24$. 5. Portion of leaf $\times 290$. (All from original specimen, Clova, Herb. Hooker.) 6. Stipule $\times 30$. 7. Bract $\times 30$. 8, 9. Bracteoles $\times 30$. 10. Perianth $\times 30$. (After E. Jorgensen, Berg. Mus. Aar. 1894–5, No. xviii.)

Subgenus 6. *CEPHALOZIOPSIS*, Spruce.

Jungermania, subgenus *Lophozia*, sect. *Cephaloziosis*, Spruce, Hep. Am. et And. p. 511 (1885).

Plants small, leaves minute, somewhat similar to *Cephalozia* but ramification different and perianth, which when only trigonous has the third angle antical; stipules normally absent; flowers monandrous.

34. *Jungermania Pearsoni*, Spruce.

Jungermania Pearsoni, Spruce, Journal of Botany, n. s. vol. 10 (1881).

Dioicous, depresso-caespitose, small, lurid green to reddish-brown in colour, apex often with a reddish-purple tinge. Stems flexuose, flaccid, when dry somewhat rigid and brittle, once or twice (rarely more) furcate, sometimes swollen at apex, no postical branches; radiculose, rootlets few. Leaves almost equal the whole length of the stem, distant, rarely subcontiguous, horizontal to patent-divergent, broadly cuneate or subquadrate, segments suberect, subparallel with the stem, somewhat plane, ovate, subacuminate, acute or subobtuse, sometimes the antical lobe is furnished with a small tooth at the base, otherwise margin entire; texture firm, epidermis slightly rough, cells very small, quadrate or a little elongate, opaque or subpellucid, walls thick, no trigones or thickened angles. Stipules subulate-linear, usually more frequent near the apex, sometimes wanting.

Female inflorescence not met with.

Andrœcia on the middle of the stem or branches, perigonial bracts larger than the adjoining leaves, swollen at the base, sometimes with an incurved antical tooth at the base, antheridia roundish-oval, solitary, stipe long.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, with leaves .4 mm. broad, diam. .05 mm. to .075 mm.; leaves .35 mm. long \times .3 mm. broad, segments .175 mm., .3 mm. \times .275 mm., seg. .15 mm., .3 mm. \times .225 mm., seg. .125 mm.; cells .015 mm. \times .02 mm., .015 mm.,

·01 mm.; stipules ·175 mm. long × ·03 mm. broad at the base, ·225 mm. × ·02 mm.; perigonial bract ·4 mm. long × ·3 mm. broad; antheridia ·125 mm. × ·11 mm., ·125 mm. × ·1 mm.

HAB.—Growing in the interstices, or on the shady side of rocks, in subalpine localities. Very rare.

7. Glyder Vawr, *W. H. P.* May 1877; on boulders interspersed with the immense broken rocks, at the foot of Twl Dhu, Cwm Idwal, Carnarvonshire, *W. H. P.* August 1884. 12. Brown Ghyll, Langdale, Westmorland, *George Stabler & W. H. P.* 1881; Bleak Rigg, Easdale, Westmorland, *Rev. C. H. Binstead*, 1886. 13. North side of Black Crag, New Galloway, *J. McAndrew*, 1884. 16. On a travelled granite boulder in a ravine, Resipol, Sunart, West Inverness, *S. M. Maccicar & W. H. P.* 1899.

OBS.—“Somewhat similar in appearance to *Cephalozia divaricata* (Sm.) but larger. It is at once distinguished from that and every other species of *Cephalozia* by the forked branching, and the entire absence of the postical branches characteristic of *Cephalozia*. From *Marsupella* (*Sarcoscyphus*) it differs in wanting the rhizomatous base, in the ramification, the deeply cloven leaves and their texture, and (so far as I have seen) in the absence of oil-granules from the cells. As we have only the male plant, which has monandrous bracts, its place among other bifid-leaved *Jungermaniæ* is not easy to assign. It is not unlike small forms of *J. minuta*, Schrad., and *J. rigida*, Lindberg; but its nearest allies are doubtless *J. opacula*, n. sp., gathered by myself in the Andes, between Rioamba and the Plateau of Chimborazo, on the rocks shattered by the great earthquake of 1796; and *J. intricata*, Lindenb. et G., found by Liebmann in Mexico, near Oaxaca, where it grew closely interwoven with *J. colorata*.”—Dr. Spruce.

The description is taken from notes by Dr. Spruce in “*Journ. of Bot.*” Feb. 1881.

DESCRIPTION OF PLATE CLVI.—Fig. 1. Plants natural size. 2. Portion of stem, antical view, × 85 (Glyder Vawr; May 1877, *W. H. P.*). 3. Leaf × 85 (Easdale, *Rev. C. H. Binstead*). 4. Leaf, with stipule × 85 (ditto). 5. Leaf, explanate, and

stipule $\times 85$ (ditto). 6-13. Leaves, explanate, $\times 85$ (Glyder Vawr, W. H. P.). 14. Portion of leaf with antical tooth $\times 85$ (ditto). 15. Portion of leaf $\times 290$ (Easdale, Binstead). 16, 17. Stipules $\times 85$ (ditto). 18. Perigonial bract with antheridium $\times 85$ (ditto). 19. Antheridium $\times 85$ (ditto).

Subgenus 7. *ANASTROPHYLLUM*, Spruce.

Jungermania, subgenus *Anastrophyllum*, Spruce, Journ. of Bot. p. 235 (1876);
Hep. Am. et And. p. 513 (1885).

Plants large, rufescent or purpurecent, assurgent, slightly ramose, subradiclose, rarely flagelliferous. Leaves large, succubous, assurgent-secund, ovate, concave, apex bifid (very rarely entire), segments unequal, antical slightly smaller, more or less acute, often incano-cuspidate, quite entire or denticulate, antical base sometimes laciniate. Cells small, angles distinctly thickened, cuticle scaberulous. Stipules absent. Inflorescence dioicous. Female flowers terminal, rarely innovant. Bracts ♀ more deeply divided than the leaves (rarely 3-4-fid) denticulate or at both sides of the base sparsely laciniate. Perianth rosy-purple, apex canescent, large, elongate, when young subulate, when mature fusiform or below narrowly cylindrical, from almost the base deeply 3-, 5-, or 8-plicate, mouth constricted, fimbriate. Calyptra delicate. Capsule shortly pedicellate, oblong-cylindrical, rarely subglobose, dividing to about the base into 4 valves, valves sometimes bifid. Flowers ♂ 2-4-androus.

35. *Jungermania Doniana*, Hook.

Jungermania Doniana, Hook. Brit. Jung. t. 39 (1816).

Pleuroschisma Doniana, Dum. Syll. Jung. p. 72 (1881).

Jungermania (*Anastrophyllum*) *Doniana*, Spruce, Journ. of Bot. p. 235 (1876),
Hep. Am. et And. p. 513 (1885).

Jungermania Donii, Hook. Kalaas Læverm. Norge, p. 378 (1893).

Dioicous, caespitose, medium to large in size, reddish-brown to dark brown in colour. Stems simple or slightly branched,

branches few, postical-lateral, arising from the postical axil of leaf; a cross-section shows 12 by 16 cells in diam., with 40 to 50 cortical, all somewhat similar, walls firm, dark; flexuose, erect or procumbent, rigid and brittle when dry, somewhat ligneous, opaque, rootlets few. Leaves closely imbricate or approximate, subhorizontal or slightly ascending, semi-obliquely inserted, bifarious, subsecund, slightly falcate, succubous, concave, canaliculate, ovate-acute or oblong-ovate-acute, apex bifid to about $\frac{1}{10}$, sinus acute, segments acute, unequal, margin incurved, quite entire; texture firm, cells guttulate, rather minute, sinuate, roundish-hexagonal, elongate and larger near the middle base, lumen containing a few nucleate bodies, cell walls very thick, pale golden brown, no trigones. Stipules wanting. Bracts usually a little larger than the leaves, broadly ovate, acute, bifid from $\frac{1}{10}$ to $\frac{1}{7}$, sinus acute, segments acute and unequal, margin quite entire. No bracteole. Perianth projecting about $\frac{2}{3}$ beyond the bracts, terminal, reddish-brown, cylindrical or oblong-obovate, terete below, 5-7-plicate above, mouth contracted, laciniate-ciliate, cilia hyaline, delicate, 2-4 cells long.

Male plants not seen.

DIMENSIONS.—Stems 1 to 3 inches long, diam. .2 mm. to .3 mm., with leaves 3 mm. wide; leaves 1.4 mm. long \times 1 mm. broad, segments .1 mm., 1.3 mm. \times 1.2 mm., seg. .125 and .15 mm.; cells .02 mm. \times .01 mm., .01 mm., .03 mm. \times .0125 mm.; bracts 1.4 mm. long \times 1.1 mm. broad, segment .2 mm., 1.3 mm. \times 1.2 mm., seg. .15 mm.; perianth 2.25 mm. long \times .75 mm. broad, 2 mm. long \times .85 mm. broad; cilia .1 mm. long; pistillidia .2 mm. long \times .06 mm. broad.

HAB.—Growing in rather small and loosely entangled tufts in alpine situations. Rare.

15. Rocks above Loch Avon, Clova, with perianths, *Dr. Greville*; Braemar, *A. Croall*; Ben Mac Dhuì, *G. Stabler*. 17?

Europe, Danubian Provinces, *vide Dr. Spruce*. Norway, *Kaalaas*.

OBS.—A very distinct species and not likely to be mistaken for any other British one; the dark colour of the plant with the

remarkably incurved margin of the leaves, remove it far from any other of the British species.

DESCRIPTION OF PLATE CLVII.—Fig. 1. Plants natural size (Eng. Bot.). 2. Portion of fertile stem $\times 16$ (Clova, Dr. Greville). 3, 4. Leaves $\times 24$ (Ben Mac Dhui, G. Stabler.) 5. Portion of leaf $\times 290$ (ditto). 6, 7. Bract $\times 24$ (Clova, Dr. Greville). 8. Perianth $\times 24$ (ditto). 9. Cross-section of perianth, lower portion, $\times 24$ (ditto). 10. Ditto, upper portion (ditto). 11, 12. Portions of the mouth of perianth $\times 85$ (ditto). 13. Pistillidium $\times 85$ (ditto).

Genus 32. **NARDIA**, *Gr. & Benn.*

Jungermania, Schrad. Syst. Samml. crypt. Gew. 2, p. 4 (1797); Sm. Engl. Bot. 21 (1805); Lyell in Hook. Brit. Jung. t. 63 (1816); Nees Hep. Eur. 1, p. 275 (1833).

Nardia, Gray & Benn. Nat. Arr. Brit. Pl. p. 694 (1821).

Mesophylla, Dum. Comm. Bot. p. 112 (1822).

Alicularia, Cord. in Opiz Beitr. 1, p. 652 (1829).

Southbya, Spruce, Muse. Pyr. in Trans. Bot. Soc. Edinb. 5, 3, p. 197 (1850).

Plants medium size, rarely large, caespitose. Stems prostrate or suberect, simple or furcate, branches proceeding from the postical angle of the leaves, rootlets usually numerous, pale or reddish, flagella absent, except in *N. compressa*. Leaves alternate, succubous, or somewhat close and subtransverse, orbicular or reniform, entire or retuse, very rarely bilobed, margin quite entire; cells medium size, subquadrate, walls rarely thickened, lumen sometimes filled with chlorophyllose granules. Stipules present, subulate or lanceolate; in the subgenus *Eucalyx* absent. Inflorescence dioicous or paroicous; female flowers terminal, often sterile on innovations. Involucre (in subgenus *Eunardia*) urceolate; bracts 2–5-pairs, opposite, connate with the bracteole. Perianth (in *Eunardia*) slightly laterally compressed and concrete with the innermost bracts and connective tissue of the receptacle to form the urceolate involucre, apex free, ovoid or conoid, obscurely 3–5-carinate, apex often at first closed, afterwards dividing into

several lobes. Calyptra free, obovate, delicate, surrounded at its base by 10–12 sterile pistillidia. Capsule shortly pedicellate, oval-globose, coriaceous, dividing to about the base into 4 valves. Elaters moderately long, bispiral. Spores small, asperulous. Andrœcia subspicate, on the middle or end of stem or branch; perigonial bracts 6–10 pairs, somewhat similar to the leaves, 2–4-androus.

Subgenus 1. *EUCALYX*, *Lindb.*

Nardia, sect. 1 *Eucalyx*, *Lindb.* in *Bot. Not.* p. 167 (1872).

Stipules absent. Bracts 1–2 pairs, innermost adnate at the base to the perianth. Perianth projecting, moderately firm, acutely 3–8-carinate, mouth constricted, sometimes tubular.

1. *Nardia hyalina* (*Lyell*), *Carr.*

Jungermania hyalina, *Lyell* in *Hook. Brit. Jung.* t. 63 (1816).

Aplozia hyalina, *Dum.* *Hep. Eur.* p. 58 (1874).

Nardia hyalina, *Carr.* *Brit. Hep.* p. 35, pl. 11, f. 36 (1874).

Nardia (Eucalyx) hyalina, *Lindb.* *Musc. Scand.* p. 8 (1879).

Dioicous, broadly caespitose, small to medium size, of a light green colour, often with a rosy tinge. Stems procumbent or suberect, simple or innovantly branched, branches lateral, produced from the axil of the leaves or bracts; radiculose, rootlets claret or dull purple coloured, very rarely dull white, copious, long, produced from the postical side of stem, base of the leaves and perianth. Leaves obliquely inserted, horizontal, subimbricate, contiguous or distant and smaller below, broadly rotund, orbicular or broadly oval, semi-amplexicaul, sometimes subcomplicate, undulate or plane, margin entire; texture somewhat tender; cells largish, roundish, walls thin, trigones distinct. Stipules absent. Bracts larger than the leaves, adnate to the lower portion of perianth, sometimes almost free, erect, enclosing perianth, subrotund, entire. Perianth oval, oblong or ovate, upper portion 4–6-plicate, contracted, mouth small, margin

composed of elongate, hyaline cells. Pistillidia 15–20. Capsule oval, dark brown. Spores pale brown. Elaters bispiral, brown. Male stems slender, distinct, perigonial bracts smaller, antical side incurved, saccate at the base, ♂ all the length, antheridia 2–3 in each bract, oval, stipitate.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, diam. .25 mm., with leaves 2 mm. to 3 mm. broad; leaves 1.4 mm. long \times 1.6 mm. broad, 1.3 mm. \times 1.6 mm., 1.4 mm. \times 1.2 mm., 1.2 mm. \times 1.3 mm., 1.1 mm. \times .1 mm.; cells .05 mm.; trigones .01 mm.; bract 1.6 mm. high \times 2.25 mm. broad; perianth 2 mm. \times .75 mm., 1.75 mm. \times .75 mm.; pistillidia .15 mm. long \times .03 mm. broad; perigonial bracts .7 mm. \times .7 mm.

HAB.—Growing in large patches on damp, clayey banks, usually near streams, sometimes on wet rocks. Moderately rare.

1. Lower Ninnis, Madron, Cornwall, *E. D. Marquand*. 2. New Forest, Hants, *C. Lyell*. 5. Dove Dale; Star Wood, Oakamore; Chartley Moss, Staffordshire, *J. E. Bagnall*. 7. Near Snowdon, Carnarvonshire, *W. Wilson*; Dolgelly, Merionethshire, *W. H. P.* 8, 9, 10. Eskdale, *Dr. Spruce*; Banks of the Rye, *J. G. Baker*; Hebden Bridge, *G. E. Hunt*. Whitby; Ingleboro, *Dr. Carrington*. Cleveland, *W. Mudd*. 12. Stock Ghyll Force, Ambleside, Westmorland, *C. Lyell*; Naddle Forest; Long Sleddale; Kentmere; Barrow Field, Helsington, *G. Stabler*; Scandale, Westmorland, *W. West*. 13. Routen Bridge; Closeburn; near Moffat Spa Well, *J. Cruickshank*. 15. Dumbarton, *A. McKinlay*; Glen Esk, Forfar, *Dr. Greville*; Braemar, *A. Croall*; Kinnordy, *C. Lyell*. 16. Not uncommon on damp loamy banks and at the side of ravines, Moidart, West Inverness, *S. M. Macvicar*.

I. Aoreagh River near Sneem, Co. Kerry, *Dr. Taylor*; Brandon, *W. Wilson*; Luggielaw and Seven Churches, *Dr. D. Moore*; Slieve Glah, Co. Cavan, *D. M. Ardle*; Seefing Mountain, Dublin, *Dr. D. Moore*.

Found on the Continent, in the Canary Islands and North America; *Dr. Spruce* also found it in South America.

OBS.—The only other round-leaved *Jungermania* which has

coloured rootlets is *Nardia* (*Eucalyx*) *obovata* (Nees), from which it is distinguished by its dioicous inflorescence, broader leaves and bracts, and slightly larger cells; from *Nardia scalaris* (Schrad.) by absence of stipules; from other round-leaved species by its bracts being adnate with the lower half of the perianth.

Jungermania crenulata, Sm., has been placed by Lindberg and others in the section *Eucalyx* of *Nardia* on account of the sometimes, although very rarely, slight attachment of the bracts to the lower portion of the perianth, this so rarely happens and is so slight that I have placed it next to *Jung. sphaerocarpa*, Hook., in the subgenus *Aplozia* of *Jungermania*, which seems to me to be its most natural position.

DESCRIPTION OF PLATE CLVIII.—Fig 1. Plants natural size. 2. Portion of stem, antical view $\times 16$ (Original, Lyell). 3. Portion of fertile stem, antical view, $\times 24$ (Salem, Jack.). 4–7. Leaves $\times 16$ (Original, Lyell). 8. Leaf $\times 24$ (Finland, Lindberg). 9. Portion of leaf $\times 290$ (Original, Lyell). 10. Bract $\times 16$ (ditto). 11. Perianth $\times 24$ (ditto). 12. Pistillidium $\times 85$ (Finland, Lindberg). 13. Perigonial bracts $\times 24$ (Salem, Jack.).

2. *Nardia obovata* (Nees), Carr.

Jungermania obovata, Nees, Nat. Eur. Leb. 1 p. 332 (1833).

Eucalyx obovata, Lindb. Bot. Not. (1872).

Southbya obovata, Dum. Hep. Eur. p. 133 (1874).

Nardia obovata, Carr. Brit. Hep. p. 32, pl. 11, f. 35 (1874).

Nardia (*Eucalyx*) *obovata*, Lindb. Musc. Scand. p. 8 (1879).

Paroicous, cæspitose, flagelliferous; flagella small, radiculose; small, of a dark green colour. Stems procumbent, or suberect, simple or ramose; branches lateral, subpostical, proceeding from the axil of the leaves or bracts; radiculose, rootlets purple in colour, short, ascending to apex of stem, often arising from base of leaves and postical side of the perianth. Leaves obliquely inserted, horizontal, slightly decurrent anticallly, alternate, imbricate or contiguous, gradually becoming more distant and smaller lower down, in sterile stems they become smaller and

more distant near to the apex also, plane or slightly concave, upper leaves on fertile stems subcomplicate, obovate or ovate, margin entire; texture somewhat flaccid, cells roundish or subquadrate, of medium size, chlorophyllose, walls thin, trigones distinct, marginal cells quadrate. Stipules absent. Bracts similar to the leaves only larger, erect, appressed, adnate to the lower half of the perianth. Bracteole absent. Perianth almost hidden by the bracts, oval to obovate, upper portion 5-6-plicate, cells elongate, mouth contorted, contracted, small, lacinate, denticulate. Pistillidia 15-30. Male bracts below the perianth, more complicate, saccate at base, antheridia oval.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, diam. .2 mm. to .3 mm. with leaves 2 mm. to 2.5 mm. wide; leaves 1.3 mm. long \times 1 mm. broad, 1.2 mm. \times .9 mm., 1.1 mm. \times .9 mm.; cells .025 mm., .03 mm., .03 mm. \times .04 mm.; trigones, .01 mm.; bracts 1.75 mm. long \times 1.25 mm. broad; perianth 2.25 mm. long \times 1.25 mm. broad, 2 mm. \times 1 mm.; spores .02 mm. diam.; elaters .15 mm. long \times .01 mm. broad; perigonial bracts .9 mm. \times .7 mm.; antheridia .11 mm. \times .1 mm.

HAB.—Grows on shaded wet rocks, usually in subalpine districts. Rare.

7. Dolgelly, Merioneth, *Dr. Carrington & W. H. P.*; Snowdon, Carnarvonshire, *W. Wilson*; Llanberis, Carnarvonshire, *G. E. Hunt*. 9. Bamford Wood; Clifton Junction, Lanc., *G. A. Holt*; Longridge Fell, West Lanc., *J. A. Wheldon*; Easegill, near Leek, West Lanc., *A. Wilson*. 10. Kildale, N. York., *W. Mudd*. 12. Kentmere; Little Langdale; Harter Fell; Mardale; Long Sleddle, Westmorland, *G. Stabler*. 13. Opposite Waulk Mill, New Galloway, *J. McAndrew*. 15. Glen Esk, *A. Croall*; Banks of Forfar Burn, *A. Croall*; Strachan, Aberdeenshire, *J. Sim*. 16. Common on wet rocks, especially at the sides of streams, ascends to 2500 feet, Moidart, West Inverness, *S. M. Macvicar*.

I. Killarney, *W. Wilson*; Tore Waterfall, *W. Wilson*, *Dr. Carrington*; Ravine near Hunting Tower, Cromaglow, *Dr. Carrington*.

ton; Connor Hill, Co. Kerry, *Dr. D. Moore*; Kylesmore, Co. Galway, *Dr. D. Moore*; Loch Bray, Co. Wicklow, *Dr. D. Moore*; Slieve Glah, Co. Cavan, *D. M'Arde*.

Found on the Continent, and doubtfully in North America.

OBS.—Only to be mistaken for *Nardia* (*Encalyx*) *hyalina* (Lyell), which see. In addition to other distinguishing characters mentioned there, the rootlets are usually fewer and darker coloured, the bracts adnate higher up the perianth.

The specimens published in C. & P. Hep. Brit. Ex. n. 100, as *Nardia hyalina* belong to this species.

DESCRIPTION OF PLATE CLIX.—Fig. I. Plants natural size. 2. Portion of stem, antical view $\times 24$ (Vosges, Mougeot). 3. Portion of fertile stem with perianth $\times 16$ (C. & P. Hep. Brit. Ex. n. 100). 4. Portion of stem, antical view, $\times 16$ (Killarney, Wilson). 5. Portion of stem, postical view, $\times 16$ (G. & R. Hep. Eur. n. 266). 6. Leaf $\times 24$ (Vosges, Mougeot). 7. Leaf $\times 24$ (C. & P. Hep. Brit. Ex. n. 100). 8. Leaf $\times 24$ (Vosges, Mougeot). 9. Portion of leaf $\times 290$ (Vosges, Mougeot). 10, 11. Bracts $\times 16$ (C. & P. n. 100). 12. Perigonal bract $\times 24$ (Vosges, Mougeot). 13. Antheridium $\times 85$ (ditto).

Subgenus 2. *EUNARDIA*, Lindb.

Eunardia, sect. *Mesophylla* (Dum.), Lindb. Musc. Scand. p. 8 (1879).

Eunardia, Spruce, Hep. Am. et And. p. 519 (1885).

Mesophylla (Dum.), Lindb., Kaalaas Lev. Norg. p. 388 (1893).

Stipules present, small, subulate. Perianth immersed, delicate, obscurely carinate, adnate to the lower half of the bracts.

3. *Nardia compressa* (Hook.), Gr. & Benn.

Jungermania compressa, Hook. Brit. Jung. t. 58 (1816).

Nardia compressa, Gr. & B. Nat. Arr. Brit. pl. p. 694 (1821).

Mesophylla compressa, Dum. Comm. Bot. p. 112 (1822).

Alicularia compressa, G.L.N. Syn. Hep. p. 12 (1844).

Dioicous, caespitose, flagelliferous; flagella leafless, slightly radiculose; from medium to large in size, pale green colour

with a purple or claret tinge. Stems simple or branched, innovant, suberect, laterally compressed, cortical cells large, hyaline, 35 to 50, inner very small, densely crowded, 20 to 25 in diam. ; radiculose, rootlets few, white. Leaves closely imbricate, erect, horizontally inserted, decurrent, appressed to stem laterally, plane or slightly concave, reniform or subrotund, entire; texture pellucid, thin, cells medium size, roundish-quadrangle, walls thin, firm, reddish, lumen with few oil corpuscles, trigones distinct. Stipules small, triangular, irregular, dentate, rarely subulate. Bracts similar to the leaves, only larger and more distinctly reniform. Bracteole ovate, irregular. Perianth immersed in the bracts, delicate, conoid, lower portion adnate to the innermost bracts, mouth twisted, dentate, teeth small, few. Capsule oval. Spores brown. Elaters bispiral, brown.

Andrœcia terminal, 2-3 pairs of bracts, but little different from the stem leaves, slightly ventricose at the base; antheridia large, oval, 2-3 in each bract.

Fruits April, May.

DIMENSIONS.—Stems $\frac{1}{2}$ to 2 inches long, .3 mm. diam., with leaves 2 mm. wide, leaves 1.4 mm. \times 1.8 mm., 1.5 mm. \times 2.0, 1.25 mm. \times 1.75 mm.; cells .05 mm. \times .03 mm., .035 mm. \times .03, .03 \times .04 mm., .03 mm. \times .03 mm.; stipules .6 mm. \times .3 mm., .55 \times .2; perigonal bracts 1.4 mm. \times 1.8 mm., 1.3 \times 1.75 mm.; antheridia .225 mm. \times .2 mm.

HAB.—On wet rocks and stones by or in alpine or subalpine rivulets. Somewhat rare.

1. Dartmoor, Devonshire, *E. M. Holmes*. 7. Glyder Vawr, Carnarvonshire, *W. Wilson*, *G. A. Holt*, *W. H. P.* Snowdon, Carnarvonshire, *Dr. Carrington*; Pass of Llauberis, Carnarvonshire, *W. H. P.*; Cader Idris, Merionethshire, *W. H. P.* 9. Staley Brushes, Cheshire, *G. A. Holt*; Carr Meadows, Derbyshire, *G. A. Holt*; Kinder Scout, Derbyshire, *Whitehead & Holt*. 10. Near Todmorden, *J. Nowell*, *G. A. Holt*; Ingleboro, *Dr. Carrington*; Blaeberry Gill, *M. B. Slater*; Falling Foss, Little Beck, North Yorks., *M. B. Slater*; Cleveland, *W. Mudd*. 12. Little Langdale; Oxendale, Great Langdale, Westmorland, *G. Stabler*;

Borrowdale, Cumberland, *W. H. P.* 13. New Galloway, *J. McAndrew.* 15. Succoth Hill, Arroquhar, *A. McKinlay*; Ben Sligott, *C. Howie*; Ben Mac Dhui, *G. E. Hunt, J. Whitehead*; Glen Clunie, Aberdeen, *J. Whitehead*; Ben Laoigh, *T. Rogers.* 16. Moidart, West Inverness, 600 feet, *S. M. Macvicar.*

I. Bantry, *Miss Hutchins*; Aooereagh River near Sneem, *Dr. Taylor*; abundant at Upper Lough Bray, *Dr. D. Moore*; Luggielaw and Seven Churches, *Dr. D. Moore*; Connemara, near Kylemore, Galway, *Dr. D. Moore*; Kelly's Glen, Dublin; Killarney, *Dr. Carrington*; Co. Wicklow, *Prof. S. O. Lindberg.*

Found on the Continent, also in Greenland.

Obs.—This species, being semi-aquatic, sometimes grows to the length of 4 or 5 inches, and forms in some subalpine rivulets large patches over which the water is constantly flowing.

In drier alpine situations a small variety is found, of a deep purple colour, stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, simple, leaves orbicular, closely imbricate, stipules dentate.

From *Nardia scalaris* (*Schrad.*) it is distinguished by its reniform, closely laterally appressed leaves, which are also thinner and more delicate, and its large cortical stem cells.

From *Jamesoniella Carringtoni* (*Balf.*), *Spruce*, see notes under that species.

DESCRIPTION OF PLATE CLX.—Fig. 1. Plants natural size. 2. Portion of stem $\times 16$ (Ireland, S.O.L.). 3–5. Leaves $\times 16$ (ditto). 6. Portion of leaf $\times 290$ (ditto). 7, 8. Stipules $\times 24$. (ditto). 9. Stipule $\times 24$ (Cader Idris, W. H. P.). 10, 11. Longitudinal sections of bracts and perianth (*Dr. Gottsche, G. R. Hep. Eur. 443*). 12, 13. Perigonal bracts $\times 16$ (Ireland, S.O.L.) 14. Antheridium $\times 85$ (ditto).

4. *Nardia scalaris* (*Schrad.*), *Gr. & B.*

Jungermania scalaris, *Schrad. Syst. Samml. Krypt. Gew. 2, p. 4 (1797).*

Nardia scalaris, *Gr. & B. Nat. Arr. Brit. pl. p. 694 (1821).*

Mesophylla scalaris, *Dum. Comm. Bot. p. 112 (1822).*

Alicularia scalaris, *Corda in Opiz Nat. p. 653 (1829).*

Dioicous, loosely or densely cæspitose, eflagelliferous, small,

pale, or dark to brownish green, rarely reddish in colour. Stems creeping or suberect, simple or furcate, slightly laterally compressed, cortical cells smaller and darker than the inner, which are large and distinct, about 9×9 cells in diam.; radiculose, rootlets plentiful, dull white. Leaves distichous, imbricate, succubous, erecto-patent or patent, obliquely inserted, appressed or spreading, orbicular or rotund, slightly concave, entire or slightly retuse, lower smaller and distant; texture somewhat thick; cells smallish, roundish quadrate, walls moderately firm, trigones large, distinct; lumen containing several oil corpuscles. Stipules large and distinct, subulate or triangular-subulate, entire. Involucre obovate, laterally compressed, composed of two bracts and bracteole; bracts much larger than the stem leaves, orbicular, entire or emarginate, bracteole triangular-subulate, connate at the lower half of the bracts. Perianth immersed in the bracts, the lower half adnate with the innermost bracts, composed of more delicate cells, conoid, mouth contorted. Capsule oval-spherical. Spores brown, elaters bispiral, brown. Andrœcia terminal or on the middle of stem; perigonial bracts closely imbricate, smaller than the leaves, ventricose, enclosing 2 roundish oval, small antheridia.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .2 mm. to .25 mm. in diam., with leaves 1' to 1.5 mm. wide; leaves .6 mm. \times .8 mm., .7 mm. \times .9 mm., .7 mm. \times .7 mm., .6 \times .75 mm.; cells .03 mm., .025 mm., .035 mm. .02 mm.; stipules .225 mm. \times .125 mm. at the base, .25 mm. \times .125 mm., .35 mm. \times .075 mm.; bracts 1.25 mm. \times 1.1 mm.; bracteole 1' mm. \times .6 mm.; pistillidia .15 mm. \times .075 mm.; perigonial bracts .6 mm. \times .6 mm., .6 mm. \times .7 mm., .5 mm. \times .6 mm.; antheridia .11 mm. \times .1 mm., .11 mm. \times .08 mm.

HAB.—Grows in loose or dense patches on damp banks, moors, rocks, or stones; generally distributed 1 to 18. I.

Common on the Continent.

Found in North America.

Obs.—A common species, easily recognised, even when barren, by the presence in the leaf-cells of several oil corpuscles, from any

of the other round-leaved *Jungermania*, except *Nardia compressa*, which has them also. This is a larger species; stem with large cortical cells, leaves broader and more closely compressed.

Nardia hyalina and *N. obovata* have reddish or purplish rootlets, which at once distinguishes them.

DESCRIPTION OF PLATE CLXI.—Fig. 1. Plants natural size. 2. Sterile stem $\times 24$ (Cader Idris, W. H. P.). 3. Portion of fertile stem $\times 24$ (Dalarne, S. O. L.). 4, 5. Leaves with stipules $\times 24$ (Cader Idris, W. H. P.). 6–10. Leaves $\times 24$ (ditto). 11. Portion of leaf $\times 290$ (ditto). 12, 13. Stipules $\times 85$ (ditto). 14. Stipule $\times 85$ (Sweden, S. O. L.). 15, 16. Bracts $\times 24$ (Sweden). 17. Bracteole $\times 24$ (ditto). 18. Pistillidium $\times 85$ (ditto). 19, 20. Perigonial bracts $\times 24$ (Sweden, S. O. L.). 21. Antheridia $\times 85$ (ditto).

5. *Nardia silvrettæ* (*Gottsche*).

Syn. *Jungermania Silvrettæ*, Gottsche in G. R. Hep. Eur. Ex. n. 470 (1869).

Sarcoscyphus anomalus, Jack in lit. Dr. Gottsche, G. R. Hep. Eur. Ex. n. 470 (1869).

Marsupella (?) *silvrettæ*, Dum. Hep. Eur. p. 128 (1874).

Alicularia minor, Limpr. p.p. in Cohn Krypt. Fl. Schles. p. 251–433 (1876).

Nardia hæmatosticta, var. *suberecta*, Lindb. Musc. Scand. p. 8, n. 153 (1879).

Nardia geoscypha, var. *suberecta*, Mass. Epat. delle Alp. Penn. in Nuov. Giorn. Bot. Ital. vol. xiv. tab. xiii.

Exsicc. Theden. Musc. Suec. Ex. n. 136 (as *Jung. scalaris*); G. R. Hep. Eur. dec. 42 et 44, n. 416 (as *Alicularia scalaris*, var. *minor*); dec. 45 et 47, n. 470 (as *Jung. Silvrettæ*); Husn. Hep. Gall. n. 101 (as *Alicularia geoscyphus*).

Paroicous, cæspitose, small, light to dark or brownish green in colour. Stems simple or furcate, with often single slender innovations arising from below the involucre, suberect, fleshy, somewhat fragile, on a transverse section oval, frontally compressed, cortical layer of cells smaller, darker, about 30, inner large, hyaline, 12 cells $\times 9$ or 10; densely radiculose, rootlets white or purplish. Leaves alternate, subdistichous, obliquely inserted, patent, horizontal or suberect, lower smaller, distant, upper larger

accrescent, concave, orbiculate, broadly ovate or ovate, emarginate, rarely entire, sinus shallow, $\frac{1}{5}$ to $\frac{1}{4}$ deep, obtuse or rarely acute, segments obtuse, rarely acute; texture somewhat thick, cells moderately large, roundish subquadrate, lumen with oil corpuscles as in *N. scalaris*, trigones distinct. Stipules subulate, entire, or with one, two, or three irregular segments on one or both sides. Involucre oval or clavate, composed of two large bracts with bracteole (irregularly cuneate) behind, which is overlapped by the bracts, connate with them at the base; bracts 2 to 3 pairs, larger than the leaves, subrotund, emarginate, margin irregular, crisped, ventricose at the base. Perianth immersed, composed of elongate, hyaline cells, mouth irregular, contorted, lower half adnate to the innermost bracts. Calyptra delicate, cells irregular in shape, walls very thin; at its base are 8–10 barren pistillidia. Capsule brown. Spores smooth, light brown. Elaters darker brown than the spores, bi-trispiral. Antheridia roundish-oval, stipitate, usually two in each bract below the perianth.

Fruits March, April.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, diam. $\cdot 4 \times \cdot 3$ mm., with leaves 2 mm. wide; leaves 2 mm. \times 1.1 mm., segments $\cdot 3$ mm., 1.1 mm. \times $\cdot 9$ mm., seg. $\cdot 2$ mm., $\cdot 9$ mm. \times $\cdot 9$ mm., seg. $\cdot 2$ mm., $\cdot 9$ mm. \times $\cdot 7$ mm., seg. $\cdot 2$ mm., $\cdot 8$ mm. \times $\cdot 8$ mm., seg. $\cdot 2$ mm., $\cdot 8$ mm. \times $\cdot 7$ mm., seg. $\cdot 2$ mm., $\cdot 5$ mm. \times $\cdot 4$ mm., seg. $\cdot 15$ mm.; cells $\cdot 04$ mm.; stipules $\cdot 4$ mm. \times $\cdot 1$ mm. at base, $\cdot 35$ mm. \times $\cdot 125$ mm., $\cdot 275$ mm. \times $\cdot 1$ mm.; bracts 1.1 mm. \times 1 mm., segments $\cdot 2$ mm., $\cdot 3$ mm.; sub-bracteoles $\cdot 6$ mm. \times $\cdot 25$ mm. at the base; bracteole $\cdot 6$ mm. \times $\cdot 35$ mm. at the base, $\cdot 4$ mm. \times $\cdot 15$ mm.; involucre 2.5 mm. \times 1 mm.; cells of perianth $\cdot 06$ mm. \times $\cdot 02$ mm.; pistillidia $\cdot 175$ mm. \times $\cdot 05$ mm.; valves of capsule $\cdot 8$ mm. \times $\cdot 6$ mm.; spores $\cdot 02$ mm. diam.; elaters $\cdot 15$ mm. \times $\cdot 01$ mm.

HAB.—Grows on banks and moors. Rare.

9. Gorpley Clough, Todmorden, Lanc., *G. A. Holt*. Alderley Edge, Cheshire, *G. A. Holt*. 10. Strensall Common, Yorks., *G. Stabler*. Baildon Moor, Yorks., *W. West*. 16. Moidart, West Inverness, *S. M. Macvicar*.

Found on the Continent.

Obs.—The history of this hepatic is somewhat curious. Nees, in his admirable “Nat. Eur. Leb.,” vol. 11, p. 453, speaks of a form of *Jungermania scalaris* (var. *minor*) which may prove to be a distinct species and to which he would give the name *Jung. hæmatosticta*. To this Professor Lindberg referred the *Alicularia geoscyphus* of de Notaris. Herr Limpricht objects to the name as being inappropriate, for the plant varies very much in colour, according to exposure, shade, &c., and he promotes Nees’ varietal name *minor* to specific rank.

To a large, suberect form of this, Professor Lindberg has given the name var. *suberecta*, which he had previously supposed to be the *Jung. scalaris* var. *repanda*, Hüb., and as such published it as *Nardia repanda*, but an examination of Hübener’s original specimens showing it to be dioicous, the species *repanda* was dropped.

In 1869 Herr Jack forwarded to Dr. Gottsche specimens of this var. *suberecta* under the name *Sarcoscyphus anomalus*, which the Doctor published in G. R. Hep. Eur n. 470 as *Jung. Silvretta*; as the specific name of Herr Jack is used for another hepatic, I adopt Gottsche’s name, which should have priority over the others, if we raise it to the rank of a species.

A peculiarity about this species is that the stem is slightly frontally compressed, not laterally as in *Nardia compressa* and partially in *N. scalaris*. Transverse sections cut from all my specimens give 12 cells \times 9 or 10.

Distinguished from *Nardia scalaris* (Schrad.) by its paroicous inflorescence, and the emarginate leaves and bracts.

Nardia geoscypha (de Not.), of which I have not seen British specimens, agrees with this species in its inflorescence, but is much smaller, has a curious creeping habit, is without stipules, and the bracts are not so irregularly margined.

DESCRIPTION OF PLATE CLXII.—Fig. 1. Plants natural size 2, 3. Stems \times 16 (Thed. Musc. Suec. Ex. n. 136). 4. Cross-section of stem \times 31 (Todmorden, G. A. Holt). 5, 7. Leaves \times 24 (Baildon, W. West). 6, 8-10. Ditto \times 24 (Todmorden, Holt). 11. Portion of leaf \times 290 (ditto). 12, 13, 15, 16. Stipules \times 85 (ditto). 14. Ditto \times 85 (Baildon, West). 17.

Bract \times 24 (Todmorden, Holt). 18 Ditto \times 31 (Strensall, G. Stabler). 19. Sub-bracteole \times 31 (ditto). 20. Portion of innermost bract and connate bracteole \times 16 (Theol., 136). 21. Bracteole \times 31 (ditto). 22. Pistillidia \times 85 (Baildon, West). 23. Antheridium (ditto). 24, 25. Spores and elater \times 290 (Todmorden, Holt).

Genus 33. *Marsupella*, *Dum.*

Jungermania, Ehrh. Beitr. 3 p. 80 (1788).

Nardius, Gr. & B. Nat. Arr. Brit. Pl. 2 p. 694 (1821).

Marsupella, Dum. Comm. Bot. p. 114 (1822). Spruce "Rev. Bryol." p. 92 (1881).

Sarcoscyphus, Cord. in Opiz Beitr. 1 p. 652 (1829).

Nardia, Carr. in Trans. Bot. Soc. Edin. x. p. 309 (1870); Brit. Hep. p. 10 (1874).

Nardia, sect. c. *Marsupella*, Lindb. Hep. in Hib. p. 531 (1874).

Stem (with leaves) frontally compressed, usually with rhizomes and flagella proceeding from the base subleafless. Leaves transverse, imbricating or spreading, canaliculate-concave, sub-complicate or carinate, always bilobed. Cauline stipules always wanting. Fructification terminal. Bracts few or several pairs, innermost (1-2 pairs) connate; also at the base with the perianth, bracteole normally wanting. Perianth frontally compressed, mouth 5-7 lobed. Calyptra included. Capsule 4-valved. Elaters bispiral. Androecia subspicate; antheridia in the saccate base of the perigonal bracts.

1. *Marsupella emarginata* (*Ehrh.*), *Dum.*

Jungermania emarginata, Ehrh. Beitr., 3, p. 80 (1787-92).

Jungermania macrorhiza, Dicks. Crypt. Brit. f. 2, p. 16, t. 5, f. 10 (1785).

Marsupella emarginata, Dum. Comm. Bot. p. 114 (1822).

Sarcoscyplus Ehrharti, Corda in Opiz Nat. p. 632 (1828).

Diocious, densely caespitose, flagelliferous, small to large, varying very much in colour, from pale or dark green to brown, reddish-brown, bright red or purple to almost black. Stems slightly or intricately branched, suberect or erect, firm, cortical

cells larger and darker than the inner; radiculose, rootlets long, white or purplish, thick. Leaves spreading, suberect or erect, closely or loosely imbricate, cordate, subrotund or ovate, emarginate to about $\frac{1}{5}$ th, sinus acute or obtusate, segments broad, acute or obtuse; texture firm or lax; cells smallish, roundish, walls firm, angles thickened, no trigones, marginal cells smaller, quadrate. No stipules. Bracts larger than the leaves, subrotund, emarginate to about $\frac{1}{5}$ th, segments and sinus acute or obtuse. Perianth usually smaller than the innermost bracts, adnate to them for about half its height, mouth 4, 5-lobate. Capsule spherical, pedicel short, spores brown, elaters bispiral.

Andrœcia terminal, 2-4 pairs of bracts, which are closely imbricate, ventricose at the base, somewhat similar to stem leaves, enclosing 3, 4, large, oval antheridia, with long stipes (10-24 cells long).

Fruits March, April, May.

DIMENSIONS.—Stems $\frac{1}{2}$ to 3 inches long, diam. .1 mm. to .4 mm., with leaves 1. mm. to 1.5 mm. wide; leaves .75 mm. \times .75 mm., segments .2 mm., .75 mm. \times .6 mm., seg. .2 mm., .9 mm. \times .8 mm., seg. .2 mm., 1. mm. \times 1. mm., seg. .2 mm., 1.75 \times 2. mm., seg. .2 mm.; cells .03 mm., .025 mm., .025 mm. \times .02 mm.; bracts 1.5 mm. \times 1.5 mm., seg. .3 mm.; perianth 1.5 mm. long; antheridia .225 mm. \times .15 mm., .2 mm. \times .125 mm.; stipe .15 mm. long.

HAB.—Grows on rocks or at the base of stone walls, from the plains to alpine regions, most frequently in or by the side of subalpine rivulets. 1, 3, 7, 10 to 17. I.

Found on the Continent and in North America.

Var. *robusta* Glyder Vawr, *W. H. P.*

Var. *saccata* (?) Killin, Perthshire, *G. A. Holt.*

OBS.—A very variable species in size, colour, and shape of leaves; several varieties have been named by Nees and other authorities, and some have been esteemed species by Lindberg and others. Two of the most remarkable are var. *robusta* (*Marsupella robusta*, Lindb.) and one which I believe is var. *saccata* of Nees; the former is distinguished by its large size, firm texture

of stem and leaves, subrotund leaves, with shallow sinus and broad rotundate¹ segments. Var. *saccata* N. (?) is a very graceful form, leaves orbicular, sinus shallow, segments broad, rotundate.

From the dioicous *M. sphacelata*, *Fuehckii*, and *Cesia alpina*, see notes under those species for distinguishing characters.

DESCRIPTION OF PLATE CLXIII.—Fig. 1. Plants natural size. 2. Portion of fertile stem $\times 24$ (Mael Tarmachan, C. J. Wild). 3. Leaf $\times 24$ (Langdales, G. Stabler & W. H. P.). 4–6. Leaves $\times 24$ (Snowdon, Nuttall). 7. Leaf $\times 24$ (Festiniog, W. H. P.). 8–10. Leaves $\times 24$ (Arthog, J. Whitehead). 11. Portion of leaf $\times 290$ (Mael Tarmachan, C. J. Wild). 12, 13. Bracts $\times 16$ (ditto). 14, 15. Innermost bracts with portions of perianth adhering. 16. Antheridium $\times 85$ (Arthog, J. Whitehead).

DESCRIPTION OF PLATE CXLIV.—Fig. 1, 2. *Marsupella emarginata* var. *robusta*. Leaves $\times 24$ (Glyder Vawr, W. H. P.). 3–5. Ditto $\times 24$ (Finland, S. O. Lindberg). 6. Perigonial bracts with antheridia $\times 24$ (Glyder Vawr, W. H. P.).

Fig. 7. *Marsupella emarginata* var. *saccata* Nees ?. Portion of stem $\times 16$ (Killin, G. A. Holt). 8–10. Leaves $\times 24$ (ditto).

2. *Marsupella sphacelata* (Gieseke), Dum.

Jungermania sphacelata, Gieseke in Lindenb. Syn. Hep. p. p. 76 t. i. f. 9–12 (1839–44).

Marsupella sphacelata, Dum. Recueil Jung. p. 24 (1835).

Sarcoscyphus sphacelatus, Nees Eur. Leberm. i. p. 129 (1833).

Nardia sphacelata (Gieseke), Carr. Trans. Bot. Edin. 5, 10, p. 878 (1870).

Dioicous, loosely caespitose, from medium to large in size, pale or dark green, with apices tinged brown, or sometimes black in colour. Stems simple or slightly ramose, flagelliferous, leafless below, erect or procumbent, slender, flexuose, rootlets few. Leaves usually distant, erect-patent, decurrent, amplexicaul at the base, concave, cordate, bilobed to about $\frac{1}{5}$, sinus obtusate or acute,

segments rotundate; texture lax, delicate, cells smallish, 4-5 and 6-sided; walls reddish, firm, trigones more or less distinct. No stipules. Bracts erect, somewhat similar to the leaves, only larger and longer. Perianth delicate, small, about $\frac{2}{3}$ the height of the bracts with which it is adnate, mouth laciniate-dentate. Male stems more slender, antheridia terminal or in middle of the stem; perigonal bracts imbricate, turgid; antheridia 1, 2, or 3 at the base of each bract, oval.

DIMENSIONS.—Stems from 1 to 3 inches long, diam. .15 mm. to .2 mm., with leaves 1.5 mm. to 2. mm. wide: leaves 1.75 mm. long \times 1.25 mm. broad, segments .5 mm., 1.5 mm. \times 1 mm., seg. .3 mm., .9 mm. \times .7 mm., seg. .2 mm.; cells .02 mm. \times .02 mm., .02 mm. \times .03 mm.; bracts 2 mm. long \times .75 mm. broad; segments .3 mm.; perigonal bracts 1.25 mm. long \times 1 mm. broad, segments .2 mm.; antheridia .4 mm. \times .3 mm., .3 \times .25 mm.

HAB.—Growing in extensive patches in wet situations, by the margin of pools or streams in alpine situations.

7. Glyder Vawr, *G. A. Holt*; Margin of Llyn Bodlyn, Cwm Idwal, *W. H. P.* 15. Ben MacDhui, *G. E. Hunt, John Whitehead*; Loch Kandor, *G. E. Hunt.* 16. Moidart, West Inverness, *S. M. Macvicar*, 1899. 18c. Uist, *J. Sim.* I. Loch Bray, *Lindberg*; *D. McArdle.*

Found on the Continent and in North America.

OBS.—From all forms of *Marsupella emarginata* (Ehrt.) it may be distinguished by its colour and lax texture and the narrow, decurrent base of leaf.

Marsupella sparsifolia, Lindb., approaches nearest to small forms of *M. sphacelata*, but the former is paroicous.

DESCRIPTION OF PLATE CLXV.—Fig. 1, 2. Plants natural size. 3. Fertile stem \times 16 (Glyders, *G. A. Holt*). 4. Stem \times 16 (ditto). 5, 6. Leaves \times 16 (Ben MacDhui, *J. Whitehead*). 7-9. Ditto \times 31 (Glyders, *G. A. Holt*). 10. Portion of leaf \times 290 (Ben MacDhui, *J. Whitehead*). 11. Bracts \times 24 (Glyders, *G. A. Holt*). 12, 13. Perigonal bracts \times 16 (Sweden, *S. O. Lindberg*).

Marsupella Funckii (*Web. et Mohr*) *Dum.*

Jungermania excisa, Funck Samml. crypt. gew. n. 118 (nec. Dicks. (1806-38).

Jungermania Funckii, Web. et Mohr. Deuts. krypt. p. 422 (1807.)

Sarcoscyphus Funckii, Nees Eur. Leberm. t. i., p. 135 (1833).

Marsupella Funckii, Dum. Recueil Jung. p. 24 (1835).

Dioicous, densely caespitose, stoloniferous, stolons leafless, radiculose; small, lurid or dark brown colour. Stems erect or procumbent, innovantly fasciculately ramose; radiculose, rootlets few, wanting on the ascending branches. Leaves imbricate, on young plants or innovations distant, patent to erecto-patent, concave, subrotund, obovate or oval, emarginate from $\frac{1}{4}$ to $\frac{1}{3}$, sinus and segments acute; texture firm, cells rather minute to small, 4, 5 and 6-sided, walls thick, angles thickened. No stipules. Bracts larger than the leaves, broadly ovate, emarginate from $\frac{1}{4}$ to $\frac{1}{3}$, sinus acute, segments acute or obtusate. Perianth smaller than the innermost bracts to which it is adnate for about half its length, free margin 4, 5 dentate; pistillidia 5-7. Capsule small, brown; spores pale brown; elaters a little darker, bispiral.

Andrœcia terminal on chief stem or branches, 4, 5 pairs of bracts, closely imbricate, tumid; antheridia solitary, oval, stipitate.

Fruits April, May.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, diam. .1 mm., with leaves .75 mm. wide; leaves .6 mm. \times .5 mm., segments .2 mm., .5 mm. \times .5 mm., seg. .2 mm., .6 mm. \times .6 mm., seg. .2 mm., .5 mm. \times .4 mm., seg. .15 mm.; cells .015 mm. \times .015 mm., .0225 mm. \times .0175 mm., .02 mm. \times .02 mm.; sub-bract .8 mm. \times .8 mm., seg. .2 mm.; bracts .9 mm. \times .8 mm., seg. .25 mm.; perianth .75 mm. high; perigonial bracts .5 mm. \times .5 mm., seg. .2 mm.; antheridia .15 mm. \times .12 mm.; spores .01 mm.; elaters .15 mm. \times .015 mm.

HAB.—Grows usually on subalpine and alpine pathways, or on rocks on which there is a layer of soil, rarely on the bare rock.

2. Tilgate Forest, *G. E. Davies*. 7. Bettws-y-Coed, *Dr. Carrington*. Cader Idris, *W. H. P.*; Tyn-y-Groes, *G. A. Holt*,

W. H. P. 12. Bow Fell, *G. Stabler*. Borrowdale, *W. H. P.*
 13. Milyea; North of Black Craig; Ballingear Woods, New
 Galloway, *J. McAndrew*. 15. Loch-na-Gar, *J. Sim*; Ben Challum,
 Breadalbane, *A. O. Black*; Ben Voirlich, Craig-na-Gour, and
 Ben Lawers, *A. McKinlay*; Loch Kandor, Ben MacDhui, *G. E.*
Hunt. 16. Moidart, West Inverness, *S. M. Macvicar*.

I. Black Mountains, *Dr. Moore*.

Found on the Continent.

OBS.—Distinguished from *M. emarginata* (Ehrh.) by its usually darker colour, by its never cordate leaves, with segments more acute. *Cesia alpina* (Gotts.) has polished leaves of a different texture.

DESCRIPTION OF PLATE CLXVI.—Fig. 1. Plants natural size.
 2. Fertile stem × 31 (Llanberis, *W. H. P.*). 3. Male stem ×
 31 (ditto). 4–8. Leaves × 24 (*Tyn-y-Groes*, *W. H. P.*). 9.
 Leaf × 31 (Llanberis, *W. H. P.*). 10. Portion of leaf × 290
 (ditto). 11. Sub-bract × 31 (ditto). 12, 13. Bracts with
 portions of perianth × 31 (ditto). 14–17. Perigonial bracts × 31
 (ditto). 18. Antheridium × 85 (ditto). 19. Spores × 290 (ditto).

4. *Marsupella olivacea*, *Spruce*.

Marsupella olivacea, *Spruce* in "Rev. Bryol." p. 97 (1881).

Synœious and paroœious, cœspitose, small, olive green colour. Stems rigid, rhizomatous, stolons long, creeping, leafless or clothed with minute leaves, radiculose, erect, subsimple, or innovantly elongate—rarely repeatedly ramose, apices of the fertile stems clavate, sterile stems filiform-small-leaved. Leaves small, subimbricate, erect, appressed—upper sometimes subpatent at the apex—at the base decurrent-vaginate, oblong, canaliculate-concave, hardly subcarinate, bilobed from $\frac{1}{4}$ to $\frac{1}{3}$, sinus obtuse, lobes obtuse, rarely abruptly subacute; texture thick, opaque; cells minute, walls thickened, angles thickened, no trigones, cells of the upper portion of the leaf and middle subequal, near the base larger, a little elongate, marginal cells quadrate. Bracts terminal, fusiform, 3–4 pairs, broadly ovate, canaliculate-concave, at the apex very shortly ($\frac{1}{10}$ to $\frac{1}{8}$) bilobed, lobes incurved,

obtuse, rarely rotundate; inner bracts twice as large or larger than the leaves, slightly connate at the base, apex sometimes divided to $\frac{1}{5}$. In the axils of all the bracts are large, stipitate solitary (rarely two) antheridia, sometimes in the same receptacle with the pistillidia. Pistillidia about 5, rarely about 10. Perianth very variable, sometimes as long as the bracts, oblong, apex rarely closed and symmetrical, very often cucullate, sometimes shorter and open at the side, mouth, then plurilacinate, concrete from the base to about $\frac{1}{2}$ high with the bracts, sometimes only at the base, rarely free. Calyptra smaller, oval-globose, 2 cells thick, at the base and for a little way up adnate with the perianth, to above the middle strewn over with 4-9 sterile pistillidia. Capsule oblong-globose, composed of two layers, inner layer composed of semiannular fibres. Spores brown. Elaters reddish-brown.

Fruits March, April, May.

DIMENSIONS.—Stems $\frac{1}{8}$ to $\frac{1}{4}$ inch long, .1 mm. diam., with leaves .4 to .5 mm. wide; leaves .5 mm. long \times .3 mm. broad, seg. .1 mm., .4 \times .3 mm., seg. .075 mm., .4 \times .25 mm., seg. .075 mm., .3 \times .2 mm., seg. .05 mm., .2 mm. \times .15 mm., .5 mm. \times .3 mm.; cells, near the middle .01 mm., .0125 mm., .01 mm. \times .0125 mm., near the base .0125 mm., .01 mm. \times .02 mm., .01 \times .0125 mm., .015 mm. \times .015 mm.; perigonal bracts .5 mm. \times .45 mm.; seg. .1 mm., .525 mm. \times .4 mm., seg. .1 mm.; bracts .65 mm. \times .6 mm.; antheridia .15 mm. \times .1 mm., bearer .5 mm. long; pistillidia .075 mm. \times .035 mm.; capsule .4 mm. \times .325 mm.; pedicel .1 mm. diam.; spores .0175 mm.; elaters .075 mm. long \times .01 mm. broad.

HAB.—Growing on rocks in alpine localities. Very rare.

7. Clogwyn-du-Arddu, Snowdon, Carnarvonshire, *W. H. P.*
 12. Little Langdale; Bow Fell, Westmorland, *G. Stabler*. "This species grows along with *Marsupella Stableri* on the large stones and rocks immediately to the left of the track from the top of Rosset Ghyll to Angle Tarn," *G. Stabler*. 16. Moidart, West Inverness, *S. M. Macvicar*.

Found on the Continent, Riesengebirge, Germany, *G. Limpricht*.

Obs.—This rare species, discovered on Bow Fell by Mr. George Stabler, is distinguished from any of the *Cesiæ* by the presence of a true perianth, from *Marsupella ustulata* (Hübener.) by its closer appressed leaves, which are more oval, with shallower sinus and more obtuse segments. For further interesting notes see Dr. Spruce's excellent paper in *Revue Bryologique* for 1881.

DESCRIPTION OF PLATE CLXVII.—Fig. 1. Plants natural size. 2. Portion of fertile stem $\times 64$ (Bow Fell, G. Stabler). 3, 4. Leaves $\times 85$ (Snowdon, W. H. P). 5, 6. Ditto $\times 64$ (Bow Fell, G. Stabler). 7. Upper leaf $\times 85$ (ditto). 8. Portion of leaf near middle $\times 290$ (ditto). 9. Ditto, near the base (ditto). 10. Sub-bract $\times 85$ (ditto). 11, 12. Perigonal bracts $\times 85$ (ditto). 13. Bract and portion of perianth $\times 85$ (ditto). 14. Portion of perianth $\times 85$ (Snowdon, W. H. P).

5. *Marsupella ustulata* (Hübener.), Spruce.

Jungermania ustulata, Hübener. Hep. Germ. p. 132 (1834).

Marsupella ustulata, Spruce in "Rev. Bryol." p. 100 (1881).

Marsupella ustulata (Hübener.), Spruce in litt.

Paroicous, shallowly cæspitose, minute, reddish or purplish brown, in shady places green, in exposed alpine situations purplish black in colour. Rhizomes creeping; radiculose, rootlets frequent, intricately flexuose, stoloniferous. Stems suberect or erect, simple or slightly branched; fertile clavate, leaves accrescent, subimbricate or imbricate, sterile small, equal, distant or approximate, patent or erecto-patent, broadly oval, ovate or subrotund, sometimes subovate, laxly complicate, carinate, from $\frac{1}{4}$ to $\frac{1}{3}$ bilobed, sinus acute, rarely obtuse, lobes acute, rarely obtuse; texture firm, cells very small to small, roundish-quadrangle, walls firm, angles slightly thickened, sometimes slightly trigonous, basal cells a little larger and elongate. Inflorescence terminal. Bracts ♀ 2–5 pairs, almost twice as large as the lower or sterile stem leaves, broadly ovate, orbiculate, perigonal bracts subcordate, ventricose and antheriferous at the base, $\frac{1}{3}$ to $\frac{1}{5}$ bilobed, lobes acute or obtuse, innermost longer and erect, margin reflexed or undulate, more or less connate at the base, lobes often obtuse, rarely acute. Anthe-

ridia 1 or 2 in the axil of the bracts, oval. Perianth small, immersed, delicate, composed of larger cells than the leaves, oval-globose or tubular, 4, 5 laciniate, sometimes composed of 2 bilobed leaves rarely with a further segment, adnate from the base to nearly the middle with the innermost bracts, very rarely free to the base. Calyptra oval-globose, surrounded about the base by 6-8 sterile pistillidia. Capsule globose, composed of two layers, inner with semi-annular fibres. Spores small, brown. Elaters as wide as the spores, same colour, bispiral, rarely trispiral.

DIMENSIONS.—Stems 2' to 5' mm. long, '075 to '15 mm. diam., with leaves (fertile) '65 mm. wide (sterile) '35 mm; leaves '3 mm. \times '25 mm., seg. '11 mm., '6 mm. \times '5 mm., seg. '15 mm., '5 mm. \times '4 mm., seg. '1 mm., '25 mm. \times '25 mm., '35 mm. \times '3 mm., '4 mm. \times '33 mm., '55 mm. \times '45 mm.; cells '02 mm. \times '0125 mm., '015 mm. \times '015 mm., '0175 mm. \times '0175 mm., '02 mm. \times '015 mm.; sub-bract '4 mm. \times '475 mm.; seg. '1 mm; bracts 1' mm. \times 1' mm.; seg. '225 mm., '5 mm. \times '5 mm., '65 mm. \times '5 mm., '85 mm. \times 1'1 mm., 1'1 mm. \times 1'1 mm.; perianth '75 mm. high; pedicel 2' mm. long; capsule '3 mm.; spores '01 mm. diam.; elaters '1 mm. long \times '01 mm. broad.

HAB.—Grows in very thin shallow patches on soft sandstone rocks in moist situations, in the plains or in subalpine or alpine localities. Rare.

2. Blackdown, Sussex, *Jenner, George E. Davies*. 7. Fairy Glen, Bettwys-y-Coed, *Dr. Carrington*; Snowdon, Carnarvonshire, *W. H. P.*; Tyn-y-Groes, *Dr. Carrington & W. H. P.*; Cader Idris, Merionethshire, *Wild & Holt*. 10. Park Quarry, Castle Howard, Yorks., *Dr. Spruce, M. B. Slater, G. Stabler*. 12. Harter Fell; Bow Fell; Oxendale, Westmorland, *G. Stabler*. 16. Moidart, West Inverness, *S. M. Maccicar & W. H. P.*

Found on the Continent and in North America.

OBS.—*Marsupella sparsifolia*, Lindb., which is also paroicous, is a much larger and robust species, of a darker colour, with lobes of the leaves obtuse.

Marsupella olivacea, Spruce, has more oval leaves, with shallower sinuses,

DESCRIPTION OF PLATE CLXVIII.—Fig. 1. Plants natural size. 2. Fertile stem $\times 24$ (Hercynia, Hampe). 3. Ditto $\times 64$ (Castle Howard, Dr. Spruce). 4. Portion of sterile stem $\times 64$ (ditto). 5. Leaf $\times 64$ (Bettws-y-Coed, Dr. Carrington). 6. Ditto $\times 64$ (Hercynia, Hampe). 7. Ditto $\times 85$ (Bettws-y-Coed, Dr. Carrington). 8. Portion of leaf $\times 290$ (ditto). 9. Sub-bract perigonal, $\times 64$ (ditto). 10, 11. Bracts with portion of perianth $\times 24$ (Castle Howard, Dr. Spruce). 12. Antheridium $\times 85$ (Hercynia, Hampe).

6. *Marsupella sparsifolia* (Lindb.), Dum.

Sarcoscyphus sparsifolia, Lindb. in Not. pro F. Fl. Fenn. Förh. 1, p. 280, No. 13 (1868).

Nardia (*Marsupella*) *sparsifolia*, Lindb. in Not. pro F. Fl. Fenn. Förh. xiii., p. 270 (1874).

Marsupella sparsifolia, Dum. Hep. Eur. p. 123 (1874); Pears. in "Journ. of Bot." p. 225 (1884).

Paroicous, cæspitose, stoloniferous, stolons without or with a few leaves; small, sphacelate, olive or blackish-brown colour. Stems creeping, intricately entangled, shoots simple or rarely irregularly furcate, annotinous, often one, two or three innovations on a single stem, erect; rootlets short, purple, mostly on the postical side of the creeping stems and stolons, rarer on erect shoots. Leaves 12–20 pairs, distichous or subsecund, alternate, clasping the stem at the decurrent base, ascending, lower leaves approximate or somewhat distant, vaginate, the few leaves nearest apex more closely imbricating, roundish-ovate, cordate-orbulate, obcordate, subquadrate, some leaves narrow at the base, emarginate, sinus $\frac{1}{4}$ to $\frac{1}{3}$ deep, obtusely angular, wide, rarely acute, segments broad, obtuse, divergent in the lower leaves, postical lobe larger; epidermis not polished, cells smallish, roundish-quadrate, 4, 5, and 6-sided, walls thick, reddish-brown through transmitted light, trigones indistinct or wanting. Perigonal bracts 2–5 pairs, below the perianth, broadly orbiculate, bifid to about $\frac{1}{4}$ or $\frac{1}{3}$, sinus and segments obtusate or acute. Innermost bracts large, ovate, subquadrate, bifid to $\frac{1}{4}$,

sinus and segments acute. Perianth of much more delicate cell-structure, with distinct trigones, adnate with the lower third of the innermost bracts, divided for half its length into 5 irregular, denticulate segments, terminal cells elongate, hyaline. Antheridia oval, stipitate, two in each bract. Pistillidia 8, surrounding base of calyptra. Capsule small, dark brown, almost spherical, walls composed of two layers.

Fruits in Summer.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .16 mm. \times .13 mm. diam., with leaves 1 mm. wide; cells of stem, cortical layer .02 mm. \times .025 mm., interior .015 mm.; leaves .8 mm. \times .8 mm., sinus .25 mm. deep, .85 mm. \times .65 mm., sinus .25 mm.; cells .02 mm. \times .03 mm., .02 mm.; bracts 1.2 mm. \times 1.1 mm., sinus .4 mm.; perigonial bracts .9 mm. \times .9 mm., sinus .2 mm.; innermost bracts 1.6 mm. \times 1.1 mm., sinus .5 mm., 1.5 mm. \times 1.3 mm., 1.4 mm. \times 1.1 mm.; perianth 1.2 mm. high, segments .4 mm.; pedicel .21 mm. diam.; capsule .5 mm.; antheridia .02 mm. \times .0125 mm.

HAB.—Grows on rocks in alpine situations. 15. Loch-nagar, Aberdeenshire, *J. & T. Sim*, August 14, 1876. Only known British station.

Found on the Continent in Norway, Sweden, Lapland, Austria, and Switzerland; also in North America.

Obs.—This is a very distinct species, although it has been confused even by Lindberg himself with *M. ustulata* (Hübner.), who has distributed both species under the name of *M. sparsifolia*.

It is a much larger species than *M. ustulata*, with which it agrees only in its inflorescence; the lobes of the leaves are rounder, habit much more flaccid.

It is very similar in appearance to *M. sphaecelata* (Giesecke), but differs in being parocious.

It is not very unlike some small forms of *Jung. inflata* Huds., and might easily be mistaken for it; but this species is dioicous and has a perfect perianth.

DESCRIPTION OF PLATE CLXIX.—Fig. 1. Plants natural size. 2. Stem \times 24 (Norway, Norrlin, S. O. L.). 3–5. Leaves \times 31

(Loch-na-gar, J. & T. Sim). 6. Portion of leaf \times 290 (ditto). 7, 8. Bracts \times 31 (Norway, Norrlin, S. O. L.). 9. Innermost bracts with portion of perianth \times 31 (ditto). 10. Perigonial bract \times 31 (Lago Lucendro, G. Davies). 11. Bract \times 16 (Loch-na-gar, J. & T. Sim).

7. *Marsupella Stableri*, Spruce.

Marsupella Stableri, Spruce, "Revue Bryol." p. 76 (1881).

Dioicous, densely cæspitose, small, from brownish green to purple, often with the apices of the stems of a beautiful rosy-purple colour. Stems intricately entangled, suberect or creeping, rhizomatous; radiculose, rootlets few, short, white, substoloniferous, microphyllous, rarely aphyllous; filiform, ramose, branches fastigiate, subequally foliose, female clavate, below the flowers often dichotomous or innovantly fasciculate. Leaves subimbricate, subpellucid, erect, appressed, broadly ovate-quadrate, carinate-complicate, to $\frac{1}{3}$ rarely to about the middle bilobed, lobes acute, rarely subacuminate, entire or rarely furnished with one or two teeth; cells rather minute, 4, 5 and 6-sided, roundish-quadrate or hexagonal, walls firm, angles thickened, no trigones. Leaves of the lower portion of the stems and of all sterile branches minute, very closely appressed. Bracts abruptly much larger than the leaves, 3, 4 pairs, not so close, appresso-imbricate, innermost shortly connate, broadly ovate, below ventricose, pale, above carinate and of a beautiful rosy colour, in the sterile flower almost to $\frac{1}{2}$, in fertile only from $\frac{1}{5}$ to $\frac{1}{3}$ bilobed; lobes plane, ovate, subacuminate, repand-denticulate, spinulose or entire, laxly reticulate (towards the base especially); cells subequilateral-hexagonal, marginal cells small, quadrate, trigones very small but distinct. Bracteole usually wanting, when present small, oval-lingulate, adnate to the base of the perianth. Outer bracts but little smaller than the innermost, less deeply bilobed, laxly complanate, subentire. Perianth terminal, slightly complanate when young, smaller than the bracts, ovate-tubular, at the base free or shortly adnate to the

bracts, mouth ciliolate, rose colour, when mature but little shorter than the bracts, and adnate to the same to $\frac{1}{2}$ or $\frac{3}{4}$, mouth fimbriate, afterwards ruptured, delicate, laxly reticulate. Calyptra not much smaller, globose, delicate, sometimes of a purple tinge, cells large, 4-, 5-, and 6-angled, elongate, base constricted; barren pistillidia surrounding the base. Capsule exerted on a short pedicel, moderately large, oblong-globose. Spores smooth, same diameter as the elaters, which are bispiral. Androecia terminal or situated in the middle of the stem or branches; bracts 3 pairs (rarely more), large, 2 to 3 times larger than the adjacent leaves, very ventricose, bilobed to $\frac{1}{3}$. Antheridia large, pedicellate, solitary, rarely two.

Fruits in Summer.

DIMENSIONS.—Stems from $\frac{1}{2}$ to $\frac{2}{3}$ inch long, .075 mm. in diam., with leaves .2 mm. wide; lower leaves .15 mm. long, .275 mm. long \times .125 mm. broad; segments .1 mm., upper leaves .4 mm. long \times .225 mm. broad; seg. .125 mm., .425 mm. \times .325 mm., seg. .1 mm.; cells .02 mm. \times .02 mm., .0175 mm. \times .0175 mm., .02 mm. \times .0175 mm., .015 mm. \times .015 mm.; outer bract .5 mm. \times .3 mm., seg. .2 mm.; bract .55 mm. \times .45 mm., seg. .15 mm., .6 mm. \times .45 mm., seg. .25 mm., .7 mm. \times .7 mm., .75 mm. \times .75 mm.; perianth .5 mm. long \times .25 mm. broad, .65 mm. long; capsule .35 mm. \times .25 mm.; perigonial bracts .375 mm. \times .4 mm.; antheridia .15 mm. \times .1 mm.

HAB.—Growing often in large patches on damp, decaying rocks in subalpine or alpine localities. Very rare. 7. Cader Idris, Merionethshire, *G. A. Holt*; Y Tryfan, Carnarvonshire, *W. H. P.* 12. Oxenden, Westmorland, *G. Stabler*; Langdale, Westmorland, *G. Stabler* & *W. H. P.*; Nan Beild, Mardale, Westmorland, *G. Stabler*; Bow Fell, Westmorland, *G. Stabler*; Honister Pass, Cumberland, *W. H. P.* 15. Ben MacDhui, *G. Stabler*. Scotland, *Dr. Carrington*, vide letter from Dr. Spruce. 16. Moidart, West Inverness, *S. M. Macvicar* & *W. H. P.*

Obs.—One of the most beautiful and distinct of hepatics, discovered by Mr. George Stabler, of Levens, on Bow Fell, in 1875, and named after its discoverer by Dr. Spruce.

It is to be deeply regretted that, owing to ill-health and the loss of one of his eyes, this most acute and genial of naturalists was compelled to relinquish working among the hepaticæ, for there were few better qualified to carry on the work left unfinished by the late Dr. Carrington.

It will always be a pleasure to remember that his name is associated with one of the gems of his Lakeland.

A remarkably distinct species, distinguished by its rosy purple colour from most others; the only one with which it can be confounded being *Eremonotus myriocarpus* (Carr.), with which it agrees in habit, and often grows with it. This species never has the purple colour of *M. Stableri*, is furnished with numerous leafless stolons, stem leaves are smaller, divided to the middle, bracts quadrate, not broadly ovate, closely complicate, always free, lobes obtusate, entire, perianth rounder, carinate, protruding beyond and quite free from the bracts.

M. Stableri is distinguished from the small purple form of *Cephalozia divaricata* (Sm.) without stipules, by its more imbricate, appressed leaves in its sterile state, and when fertile by its very different perianth.

The description is taken from Dr. Spruce's contribution to "Rev. Bryol." for 1881.

DESCRIPTION OF PLATE CLXX.—Fig. 1. Plant natural size. 2. Portion of fertile plant $\times 24$ (Oxenden, G. Stabler). 3. Portion of stem $\times 85$ (Mardale, G. Stabler). 4–9. Leaves $\times 85$ (Langdale, G. Stabler & W. H. P.). 10. Portion of leaf $\times 290$ (Mardale, G. Stabler). 11. Outer bract $\times 85$ (Langdale, G. Stabler & W. H. P.). 12. Bract $\times 85$ (Oxenden, G. Stabler). 13. Ditto (Langdale, G. Stabler & W. H. P.). 14. Perianth $\times 85$ (Bow Fell, G. Stabler). 15. Cross-section of perianth $\times 85$ (Langdale, G. Stabler & W. H. P.). 16. Perigonial bract $\times 85$ (ditto). 17. Antheridium $\times 85$ (ditto).

8. *Marsupella nevicensis* (Carrington), Kaalaas.

Jungermannia nevicensis, Carr. in C. & P. Hep. Brit. Exsicc. n. 85 (1879);

Carrington in Trans. Bot. Soc. Edinb. (1880).

Sarcoseyphus capillaris, Limpr. in Jahresh. Schles. Gesellsch. vaterl. Cult. 58, p. 182 (1880) (*vide* Kaalaas).

Hygrobiella nevicensis (Carr.), Spruce on Cephalozia, p. 77 (1882).

Nardia latifolia, Lindb. ap. Soc. F. Fl. Fenn. die 2 Decr. (1882).

Marsupella latifolia, Lindb. in Meddel. soc. F. Fl. Fenn. 13, p. 238 (1886).

Marsupella nevicensis (Carr.), Kaalaas, Leverm. Norge, p. 117 (1893).

Dioicous, caespitose, flagelliferous, small, pale green, here and there with a slight reddish tinge, when dry a dull yellow colour. Stems simple or slightly branched, flexuose, scorpioidal at the apex, naked below, 12 cells in diam., cortical cells 24, rather larger than the inner; rootlets wanting or extremely sparse, reddish-purple tinge. Leaves distant, alternate, small, scarcely broader than the stem on sterile specimens, vaginate, upper ones erect, roundish-ovate, lower erecto-patent, ovate, subquadrate, complicate-concave, rounded at the base, or subcordate, apex boat-shaped, $\frac{1}{4}$ to $\frac{1}{3}$ acutely bidentate, lobes acute, sinus acute; cells small, 4-, 5-, and 6-sided, walls moderately thick but weak, without trigones in the British imperfect specimens, in perfect ones fully developed trigones distinct. No stipules. Bracts larger than the leaves, suborbicular to subquadrate, bifid to almost the middle, segments acute, sinus acute. Perianth small, delicate, hidden in the bracts, and adnate to about the middle to them, mouth lacinate, sterile pistillidia surrounding base of calyptra. Andrœcia terminal on main stem, 2, 3 pairs of leaves, imbricate, roundish, bifid to $\frac{1}{3}$, complicate, ventricose, enclosing 1 or 2 large, oval antheridia.

DIMENSIONS.—Stems $\frac{1}{2}$ to $\frac{3}{4}$ inch long, .1 mm. to .2 mm. diam., leaves .35 mm. × .35 mm., .375 mm. × .35 mm., .7 mm. × .7 mm., segments .2 mm.; cells .0125 mm., .015 mm., .017 mm., .02 mm., .02 mm. × .03 mm.; bract 1. mm × .9 mm., seg. .5 mm.; perigonial bracts .5 mm. × .5 mm., seg. .15 mm.; antheridia .15 mm. × .125 mm.

HAB.—Discovered on moist shelving rocks, near the last spring below the summit of Ben Nevis, July 1875, by the late *Mr. John Whitehead*. This is the only known British station.

Found on the Continent.

Obs.—With only imperfect sterile British specimens collected, this species has been a puzzle to our leading authorities, but since good fertile ones have been met with on the Continent the difficulty has been solved, and it turns out to be a true *Marsupella*. No doubt the specimens collected by *Mr. Whitehead* were growing in a very moist situation, and had differentiated in a remarkable manner from the perfect state. A distinct species, and not likely to be confused with any other when met with.

DESCRIPTION OF PLATE CLXXI.—Fig. 1. Plants natural size (Ben Nevis, John Whitehead). 2. Portion of fertile stem \times 24 (Norway, S. O. Lindberg). 3. Portion of δ stem \times 31 (ditto). 4. Sterile stem \times 31 (Ben Nevis, J. Whitehead). 5–8. Leaves \times 64 (ditto). 9–12. Ditto \times 24 (Norway, S. O. Lindberg). 13. Portion of stem with leaves \times 120 (Ben Nevis, J. Whitehead). 14. Portion of leaf \times 290 (Norway, S. O. Lindberg). 15. Bract \times 24 (ditto). 16. Portion of involucre, showing portion of bract and perianth \times 31 (ditto). 17–19. Perigonal bracts \times 31 (ditto). 20. Antheridium \times 85 (ditto).

Genus 34. **CESIA**, *Gr. & B.*

Jungermania, Lightf. Fl. Scot. 2, p. 786 (1777).

Cesius, Gr. & Benn. Nat. Arr. Brit. Pl. i., p. 705 (1821).

Gymnomitrium, Corda in Opiz Beitr. 1, p. 651 (1829).

Acolea, Dum. Syll. Jung. Eur. p. 76 (1831).

Cesia, Lindb. Musc. Scand. p. 9 (1879).

Stems fasciculate, ascending or erect, creeping at the base, flagella radiculose; glaucous green, reddish brown, or almost black. Leaves succubous, distichous, closely imbricated, emarginate-bidentate. Stipules wanting. Perianth wanting. Involucre double, inner shorter, composed of two or more involute deeply cleft and dentate free bracts, which enclose the short campanulate

calyptra. Base of the young fruit immersed in the hollow apex of the stem. Capsule globose, 4-valved, when empty reflexed. Elaters bispiral, caducous. Andrœcia distinct. Antheridia oval, stipitate, seated in the axils of the perigonial bracts.

Section 1. *HOMOCRASPIS*, Lindb.

S. O. Lindberg, 1886, Schiff. Engl. & Prantl, Pflanzenf. 91 & 92 Lief. p. 77 (1893).

Habit similar to *Marsupella*, but differs usually in the absence of a true perianth.

1. *Cesia alpina* (Gottsch.), Lindb.

Sarcoscyphus alpinus, Gottsch. in G. & R. Hep. Eur. n. 535 (1872).

Cesia alpina, Lindb. in Meddel. soc. F. Fl. Fenn. 13, p. 251 (1886).

Dioicous, broadly cæspitose, small, dark olive-green to reddish-brown, through transmitted light of a golden-brown colour. Stems creeping or suberect, simple or innovantly fastigiata, 10-12 cells in diameter; 2, 3 outer layers brownish-yellow, inner hyaline; radiculose, rootlets very short, white, or with a slight purplish tinge. Leaves loosely inserted, alternate or regularly pectinate, patent-divergent to patent ($80^{\circ} - 40^{\circ}$), somewhat distant, near apex imbricate, subamplexicaul, decurrent at the base, ovate, cordate-ovate, cordate-orbicular, emarginate to $\frac{1}{5}$ or $\frac{1}{4}$, lobes obtuse or obtusate, slightly unequal, sinus obtuse; texture firm, epidermis polished, cells small, hexagonal, containing 2 or 3 nucleate granules, walls thick, angles thickened, no trigones. No stipules. Bracts ovate-cordate, emarginate from $\frac{1}{5}$ to $\frac{1}{6}$ deep, segments and sinus obtusate; sometimes there is present an ovate lanceolate bracteole connate with the bracts. Perianth delicate, adnate with the bracts at the lower half or free, trilobate, margin irregular. Pistillidia about 10. Spores seen through transmitted light pale brown. Elaters bispiral, short, 4-6 turns of the spiral, dark brown. Andrœcia terminal, crowded, 3-4 pairs of bracts,

which are broadly ovate, slightly swollen at the base, containing 1-3 oval antheridia.

Fruits May, June.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .15 mm. diam., with leaves 1 mm. wide; leaves .55 mm. \times .35 mm., segments .125 mm., 1 mm. \times .75 mm., .8 mm. \times .625 mm.; cells .02 mm. \times .025 mm., .02 mm. \times .0275 mm.; sub-bracts .85 mm. \times .65 mm., .85 mm. \times .75 mm.; bract 1.1 mm. \times .7 mm., .8 mm. \times .6 mm., segments .15 mm.; perianth .8 mm. long; pistillidia .1 mm. \times .04 mm.; pedicel .1 mm. \times .16 mm.; capsule .5 mm. \times .45 mm.; spores .0125 mm., .015 mm.; elaters .1 mm. \times .01 mm.; perigonal bracts .65 mm. \times .55 mm., segments .125 mm.

HAB.—Grows in broad patches on slanting rocks, usually unmixed with other species in alpine or subalpine situations.

7. The Glyders, Carnarvon, *E. M. Holmes*; Pass of Llanberis, Carnarvon, April 1876, *C. J. Wild & W. H. P.*; Snowdon, near the Capel Curig Path, about 2500 ft., April 1878, *W. H. P.* 12. Bow Fell, Cumberland, June 1881, *George Stabler & W. H. P.* (♂ and ♀ fruit). 15. Glen Callater, Braemar, Aberdeen, July 1871, *G. E. Hunt*; Loch Kandor, Aberdeen, *G. E. Hunt*; Tillylair, Aberdeen, May 1874, *J. Sim*; Loch-na-gar, Aberdeen, October 1876, *J. & T. Sim*; Ben MacDhui, Aberdeen, 3500 ft., August 1880, *W. West*; Ben Lawers, Perthshire, *A. O. Black*. 16 Moidart, West Inverness, *S. M. Macvicar & W. H. P.*

Found on the Continent.

Obs.—Easily distinguished from all forms of *M. emarginata* by its colour, and the polished epidermis and close texture of its leaves; and from *M. Funckii* by the same characters and its obtuse lobes. These are the most likely species which it could be mistaken for, without a careful study of the involucre. Sometimes the perianth is a true one, and adnate to the lower portion of the bracts, but generally it is free and not perfectly tubular.

DESCRIPTION OF PLATE CLXXII.—Fig. 1. Fertile plant, natural size. 2. Male plant, natural size. 3. Portion of stem \times 24 (Ben MacDhui, W. West). 4-8. Leaves \times 24 (Bow Fell, G. Stabler & W. H. P.). 9-12. Ditto \times 64 (ditto). 13. Por-

tion of leaf $\times 290$ (ditto). 14. Bract $\times 64$ (ditto). 15. Perianth, spread out $\times 24$ (ditto). 16. Pistillidia $\times 85$ (ditto). 17. Spores $\times 290$ (ditto). 18. Elater $\times 290$ (ditto). 19. Perigonial bracts $\times 24$ (Ben MacDhui, W. West). 20. Antheridium $\times 85$ (ditto).

2. *Cesia revoluta* (Nees), Lindb.

Sarcoscyphus revolutus, Nees, Nat. Eur. Leberm. 11, p. 419 (1836).

Nardia revoluta, Lindb. Revis. crit. Fl. Dan. p. 113 (1871); Carr. in Grevillea, 2, p. 88 (1873).

Marsupella revoluta, Lindb. in Meddel. Soc. F. Fl. Fenn. 13, p. 238 (1886).

Cesia revoluta, Lindb. in Arn. & Lindb. Musc. Asiae bor. p. 65 (1888).

Gymnomitrium revolutum, Philib. Revue Bryol. (1890); Carr. & Pears. Hep. Brit. Exsicc. n. 4 (1890).

Dioicous, densely caespitose, small, black in colour. Stems erect, simple, or slightly dichotomously branched, rhizomatous, stolons with minute leaves; radiculose, rootlets few; leafless below. Leaves approximate or subimbricate, accrescent on fertile stems, distichous, patent to patent-divergent, semi-amplexicaul at their narrow base, complicate-concave, oval or obovate, bifid to about $\frac{1}{3}$, sinus acute or obtuse, segments acute, margin of the whole leaf remarkably revolute; texture firm, epidermis papillose on both sides, cells small, subquadrate or oblong-quadrate, walls firm, no trigones nor thickened angles. Bracts larger than the leaves, ovate, emarginate to about $\frac{1}{2}$ or $\frac{1}{4}$, sinus and segments obtuse, innermost bracts several, smaller, ovate, pale, delicate, obtusely and irregularly lobed or subentire, margin plane. Calyptra large, sterile pistillidia surrounding its base, never on its apex. Pedicel exserted. Capsule spherical.

Fruits Summer.

DIMENSIONS.—Stems from $\frac{1}{4}$ to an inch long, $\cdot 2$ mm. diam., with leaves 1 mm. to 2 mm. wide; leaves $\cdot 9$ mm. long \times $\cdot 7$ mm. broad, segments $\cdot 3$ mm., 1 mm. \times $\cdot 75$ mm., seg. $\cdot 3$ mm., $\cdot 75$ mm. \times $\cdot 6$ mm., seg. $\cdot 2$ mm.; cells $\cdot 02$ mm., $\cdot 025$ mm. \times $\cdot 0175$ mm., $\cdot 015$ mm., $\cdot 025$ mm.; outer bract 1.25 mm. long \times 1 mm. broad, segments $\cdot 3$ mm., 1.5 mm. \times 1 mm.; innermost bract 1 mm.

long \times 1 mm. broad; pedicel .15 mm. diam.; capsule .6 mm. \times .5 mm., .75 mm. \times .6 mm.

HAB.—Luggielaw, Co. Wicklow, Ireland, *D. Orr*, 1851, detected by the late Professor Lindberg amongst specimens of *Andreæa* sent him to be named.

Found in alpine situations on the Continent—Tyrol (*Funck*, *Arnold*, *Breidler*), Norway (*Berggren*, *Ryan*, and *Kaurin*, c. fr.).

Obs.—This is peculiarly an alpine species, being only found at a considerable altitude.

I am rather afraid some mistake has been made in the specimens purporting to be from Ireland, the packets having possibly got mixed; however, the specimens of the supposed original plants from Ireland are true *C. revoluta*.

In general appearance like an *Andreæa*.

From all other species distinguished at once by the margin of the whole leaf being evenly revolute.

Some forms of *Marsupella emarginata* (Ehrh.) have their leaves a little reflexed, but never approach to the same regularity as in *C. revoluta*.

In habit this species resembles a true *Marsupella*, with which it also agrees in its sterile pistillidia surrounding the base of the calyptra. On the other hand, it agrees with *Cesia* in having no true perianth, but only a few small bracts with no approach to adherence either to the outer bracts or to each other, and thus well illustrates the position taken by Dr. Spruce that the characters depended upon for the separation of *Cesia* from *Marsupella*, namely, the presence or absence of a perianth and the position of the sterile pistillidia, are not to be relied upon.

I am indebted to Mons. Philibert, "Rev. Bryol." 1890, for the observations on these characters.

DESCRIPTION OF PLATE CLXXIII.—Fig. 1. Plants natural size. 2. Portion of stem \times 16 (Luggielaw, D. Orr). 3–8. Leaves \times 24 (ditto). 9. Portion of leaf \times 290 (ditto). 10. Outer bract \times 24 (Norway, Kaurin & Ryan). 11. Leaf and bracts \times 24 (ditto). 12. Section of outer and inner bract \times 31 (ditto). 13. Innermost bract \times 24 (ditto).

3. *Cesia crassifolia* (Carr.), Lindb.

Gymnomitrium crassifolium, Carr. Trans. Bot. Soc. Edinb. xiii. p. 461 (1879).

Cesia crassifolia (Carr.), Lindb. in Meddel. soc. F. Fl. Fenn. xiv. p. 48 (1888);
Kaalaas, Leverm. Norge, p. 427 (1893).

Dioicous, pulvinate, stoloniferous, small, dark olive-brown to black in colour. Stems simple or branched, branches usually innovant; stout, decumbent at the base, the apex ascending, subterete, fertile ones clavate; radiculose, rootlets abundant, long, tawny. Leaves smaller at the base, of nearly equal size upwards, densely and closely imbricated, erecto-secund, about twice the breadth of the stem, orbiculate or oblong-orbiculate to subquadrate, very concave, emarginate from $\frac{1}{6}$ to $\frac{1}{5}$, sinus acute or obtusate, sometimes lunate, segments subacute, margin entire; texture thick, firm, subopaque, cells small to smallish, roundish or near basal middle roundish-oblong and slightly larger, walls firm, thick, trigones distinct. No stipules. Bracts larger than the leaves, subquadrate, bilobed from $\frac{1}{3}$ to almost the middle, sinus acute, segments acute or obtusate, entire. Innermost bracts free from the outer, about $\frac{1}{3}$ shorter, lobate-dentate, delicate texture. Calyptra campanulate, 8 pistillidia dispersed over it. Capsule spherical, cinnamon-brown, thick-walled, pedicel firm. Spores pale brown, roundish or roundish-oblong, surface irregular; elaters similar in colour, bispiral, narrowly fusiform. Male stems erect, terete, subclavate, apex obtuse; perigonial bracts closely imbricated, erecto-patent, somewhat broader, tumid at the base; antheridia numerous, solitary in the axils of the bracts, roundish-oval, pedicel short, 3, 4 binate cells.

Fruits in early Summer.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, diameter .1 mm., with leaves .5 mm. wide, near clavate apex .75 mm. wide; leaves .4 mm. long \times .35 mm. broad, seg. .1 mm., .375 mm. \times .3 mm., seg. .1 mm., .3 mm. \times .3 mm., seg. .075 mm., upper leaves .6 mm. \times .45 mm., seg. .1 mm.; cells .025 mm. \times .025 mm., .025 mm. \times .02 mm., .015 mm. \times .02 mm., .03 mm. \times .02 mm.; bracts 1 mm. long \times .75 mm. broad, segments .2 mm., 1 mm. \times .9 mm., seg.

·3 mm., ·6 mm. × ·475 mm., seg. ·25 mm.; innermost bracts ·75 mm. long × 1· mm. broad, ·75 mm. × 1·25 mm.; spores ·015 mm., ·0125 mm.; elaters 1· mm. long × ·015 mm. broad; perigonial bracts ·65 mm. × ·5 mm., seg. ·1 mm.; antheridia ·2 mm. × ·15 mm.

HAB.—Growing in broad shallow compact patches in alpine situations. Very rare.

15. Craig Coynach, near Ben Lawers, *Dr. A. O. Black*; Ben Lawers, *C. J. Wild, George Davies*. 16. Ben Nevis, *W. West*.

Found on the Continent, Norway.

Obs.—This is another species which illustrates the slight grounds there are for separating *Cesia* (*Gymnomitrium*) from *Marsupella*. Dr. Spruce has found immature perianths in the specimens he has examined, Dr. Carrington and I have only been able to find fertile stems with the innermost bracts free to the base, from the outer ones, and no perfect tubular perianths; unfortunately only little good material has yet been met with, and a further study of the species, when found in good fruit, may settle the question. Dr. Spruce very wisely says, “The fact is, the character relied on for the separation of *Gymnomitrium* from *Marsupella* is a purely artificial one, like that of *Gymnostomum* among mosses.”

Differs from *C. concinnata*, *C. obtusa* and *C. corallioides* by its smaller size and darker colour, absence of the silvery glaucous tinge, margin of leaves never scarioso.

From *C. crenulata*, G., which it resembles in size, by being less intricately entangled, of a darker colour, almost black, not greenish-brown; margin of leaves entire, not crenulate-dentate.

DESCRIPTION OF PLATE CLXXIV.—Fig. 1. Plants natural size. 2. Stem × 30 (nr. Ben Lawers, Dr. Black). 3. Portion of male stem × 62 (C. & P. n. 76). 4. Leaves × 64 (nr. Ben Lawers, Dr. Black). 5. Leaf × 24 (Ben Lawers, G. Davies). 6. Leaf × 31 (Ben Nevis, W. West). 7. Ditto × 64 (ditto). 8. Portion of leaf, near middle base × 290 (Ben Lawers, G. Davies). 9. Ditto × 200, from near apex of leaf. 10. Bract × 31 (Ben Nevis, W. West). 11. Ditto × 64 (C. & P. n. 76). 12. Innermost bract, calyptra and capsule × 64 (ditto). 13–15.

Innermost bracts $\times 31$ (Ben Lawers, G. Davies). 16. Perigonial bract with antheridium $\times 62$ (C. & P. n. 76). Figures 3 and 16 drawn by Dr. Gottsche, others by Dr. Carrington and W. H. P.

4. *Cesia conferta* (Limpr.).

Sarcoscyplus confertus, Limpricht, Jahrb. Schles. Ges. p. 313 (1880).

Gymnomitrium confertum, Limpr. Flora n. 5 (1881).

Marsupella conferta (Limpr.) Spruce, Rev. Bryol n. 6, 95 (1881); Pears, Journ. of Bot. Sept. (1892).

Monoicous, caespitose or straggling among mosses, pale yellowish-green to reddish-brown in colour. Stems simple or branched, prostrate, flexuose, filiform, terete, denudate at the base; branches short, ascending, about 10 cells in diameter, cortical cells with slightly firmer walls; radiclese, rootlets fasciculate, short, ascending to apex of the stem, few, more frequent below, dull white or reddish-purple. Leaves closely imbricate, bifarious, from a vaginate base, appressed, erect, on fertile stems gradually accrescent, oval, bifid to about $\frac{1}{3}$; sinus and segments acute; texture firm, epidermis smooth, cells very minute to minute, roundish-quadrate or indistinctly 5-6 angled, walls thick, trigones large and distinct. ♀ terminal, on short branches or on main stem; bracts larger than the leaves, oval or oval-rotund, the innermost bracts free or sometimes united into a tube, small, tender, margin irregular. Pistillidia 5-10, dispersed over the calyptra. Pedicel long, thick. Capsule dark brown, almost spherical. Spores yellowish-brown, granulate. Elaters 3-4-spiral, sometimes furcate. Androecia spicate, situated on the main stem or on short branches, perigonial bracts ovate, a little swollen at the base; antheridia solitary, stipitate.

Fruits Summer.

DIMENSIONS.—Stems from $\frac{1}{4}$ to 1 in. long, diam. .2mm., with leaves .5 mm. broad, leaves .65 mm. \times .5 mm., segments .125 mm., .6 mm. \times .45 mm., seg. .125 mm., .5 mm. \times .4 mm., seg. .125 mm., cells .01 mm., .015 mm. \times .01 mm., sub-bracts .45 mm.

× .45 mm., .5 mm. × .45 mm., bracts .75 mm. × .45 mm., segments .1 mm., .65 mm. × .5 mm., seg. .1 mm., .65 mm. × .5 mm., seg. .15 mm., perigonial bract .55 mm. × .425 mm., seg. .1 mm., antheridia .125 mm. × .075 mm.

HAB.—16. Grows in depressed tufts, or straggling among mosses. Ben Nevis, at about 4000 ft., *W. West*, August 12, 1880. The only known British station.

Found on the Continent.

Obs.—The British form differs from any of the Continental specimens I have seen in its larger size, but, as it agrees in its monoicous inflorescence, ♂ and ♀ on the same plant, but on different branches, and in the shape and texture of the leaves, I have little doubt they are one and the same species. Herr Limpricht, the founder of the species, described it at first as a *Sarcoscyphus* (*Marsupella*), with a distinct perianth, but soon afterwards referred it to the genus, or, as Dr. Spruce maintains, subgenus *Cesia*. In carefully examining every stem sent me by Mr. West, I met with two fertile ones which appeared to have true perianths, but the specimens were weathered and too imperfect to rely upon; others, as figured, well represent the genus *Cesia*, where there is no true perianth, and the innermost bracts are free. Distinguished from other species of the same genus and from any of the *Marsupella* by its monoicous inflorescence. Dr. Spruce found in original specimens from Herr Limpricht a fertile involucre which had a tubular perianth reduced to a short multilobate cup, confirming his contention as to the position of the supposed genus *Cesia*.

Cesia conferta has been referred by some authorities to *Cesia varians*, Lindb. (Meddel. soc. F. Fl. Fenn. 13, p. 238 (1886), *Nardia* (*Marsupella*) *varians*, Lindb. Musc. Scand. p. 9 (1879), but I have found no variableness in the inflorescence of *C. conferta*, nor does it agree in other particulars.

When barren it might be overlooked for a small form of *Jung. minuta*, Crantz, but from which it is very distinct.

DESCRIPTION OF PLATE CLXXV.—Fig. 1. Plants natural size. 2. Portion of fertile stem × 24. 3–6. Leaves × 31. 7–9.

Ditto $\times 24$. 10. Leaf $\times 64$. 11. Portion of leaf $\times 290$. 12, 13. Sub-bracts $\times 64$. 14, 15. Bracts with inner perichaetium $\times 64$. 16. Bract $\times 64$. 17. Perigonal bract $\times 64$. 18. Antheridium $\times 85$ (Ben Nevis, W. West).

5. *Cesia brevissima* (Dum.).

Jungermania concinnata B minor, Schleich. Cat. exsicc. (1821).

Acolea brevissima, Dum. Syll. Jung. p. 76 (1831).

Gymnomitrium adustum, Nees, Nat. Eur. Leb. 1, p. 120 (1833); Schiffn. in Engl. & Prantl, Pflanzenf. 91 & 92 Lief. p. 77 (1893).

Cesia adusta (Nees), Lindb. in Meddel. soc. F. Fl. Fenn. 13, p. 238 (1886) et 14, p. 69 (1888); Kaalaas Leverm. Norge, p. 426 (1893).

Paroicous, shallowly caespitose, minute, dark brown colour. Stems intricately entangled, rhizomatous, rhizomes creeping, stems somewhat erect, rigid, ramose; radiculose, rootlets few, somewhat reddish, fertile stems clavate-fusiform. Leaves closely imbricate and accrescent on the fertile stems, more distant on the sterile, erect or erecto-patent, oblong or oval, bifid to $\frac{1}{8}$ or $\frac{1}{6}$, segments acute, somewhat unequal, sinus acute, rarely obtusate; texture firm, cells very small, roundish subquadrate, walls firm, trigones wanting, or small and very indistinct. Bracts larger than the leaves, oval or broadly oval, with one rarely two oval antheridia at their base, innermost bracts 2, of a very delicate texture, pale colour, connate with each other, broadly oval or roundish, quite free from the outer bracts, irregularly dentate, sometimes with a small ovate-acuminate bracteole present. Calyptra oval, sterile pistillidia 8-10, dispersed over its convexity. Capsule dark brown, spores small, pale yellowish or reddish-brown, elaters bispiral, as wide as the spores, dark reddish-brown.

DIMENSIONS.—Stems 2 to 3 mm. long, .1 mm. diam. with leaves .3 mm. wide; leaves .5 mm. long \times .3 mm. broad, segments .075 mm., .4 mm. \times .25 mm., seg. .05 mm., .4 mm. \times .3 mm., seg. .075 mm., .35 mm. \times .2 mm., seg. .075 mm.; cells .02 mm. \times .015 mm., .02 mm. \times .02 mm., .015 mm. \times .015 mm.; bracts .6 mm. long \times .425 mm. broad, segments .1 mm., .5 mm. \times .4 mm., seg. .075 mm., .55 mm. \times .5 mm., seg. .1 mm.; bracteole .175 mm. \times

·1 mm. ; antheridia ·15 mm. × ·1 mm. ; innermost bract ·5 mm. long × ·35 mm. broad ; pistillidia ·1 mm. long × ·035 mm. broad ; spores ·01 mm. diam. ; elaters ·1 mm. long × ·01 mm. broad.

HAB.—Growing on soft sandstone in alpine localities. Extremely rare.

7. Clogwyn du Arddu, Snowdon, Carnarvonshire, August 1881, *H. H. P.* 16. Moidart, West Inverness, *S. M. Macvicar*, 1889.

Found on the Continent (Weiss-wasser, Germany, *G. Limpricht*).

Obs.—I publish this species with some little hesitation, having spent much time and wearied my eyes with taking sections after sections—which is no easy task, as the type is a very small one—and am still somewhat undecided as to its merits as a good species.

It is supposed to be distinguished from *Marsupella olivacea*, Spruce, by its more rigid habit, the more oblong oval leaves, the innermost bracts being quite free from the outer, the absence of a tubular perianth, and the convexity of the calyptra being covered with the sterile pistillidia. All these characters I have found on the Snowdon plants, but they are growing with *Marsupella olivacea*, which has been found having free innermost bracts and not a perfect tubular perianth.

Further investigation may bring more light to bear on these minute species ; meanwhile I give what information I have been able to gather from others and from my own observation.

In 1833 Nees von Esenbeck published in his admirable *Nat. Eur. Leb.* his *Gymnomitrium adustum*, founded on specimens collected by Funck on the Fichtelgebirge. In 1845–6, Dr. Spruce collected on the Pyrenees a small *Sarcoscyphus*, which he identified with the *Gymm. adustum* of Nees, and removed it to the genus *Sarcoscyphus* on account of finding it to have a true perianth. Dr. Gottsche, after examining the specimens collected by Funck in the Neesian Herbarium, confirmed Dr. Spruce's view ; so the matter remained until Gustav Limpricht, of Breslau, having occasion to study this group about the year 1881, examined specimens from Funck in the Nees Herbarium, and found there were really two species which had undoubtedly been confounded

by Nees—*Gymnomitrium adustum vera*, and *Sarcoscyphus adustus*, Spruce; the *Sarcoscyphus* he named after Dr. Spruce (“Jahres-Bericht der Schles. Gesellschaft,” p. 179 (1881).

In 1881 (“Rev. Bryol.”), Dr. Spruce published his Pyrenean plant as *Marsupella ustulata*, and a variety (var. *decipiens*) of *Sarcoscyphus Sprucei*, Limpricht, as *Marsupella oliracea*.

A few years later he observed, in a letter to me, that Hübener has a *Jungfermania ustulata*, which, from the description, is identical with his species, which now stands *Marsupella ustulata* (Hüb.) Sp.

DESCRIPTION OF PLATE CLXXVI.—Fig. 1. Plants nat. size.
 2. Fertile stem × 31. (Weiss-wasser, Germany, G. Limpricht).
 3, 4. Leaves × 64 (ditto). 5, 6. Ditto × 85 (ditto).
 7, 8. Ditto × 85 (Snowdon, W. H. P.). 9. Portion of leaf × 290 (G. & R. 648). 10–12. Bracts × 85 (Snowdon W. H. P).
 13. Bracteole × 85 (Weiss-wasser, Germany, G. Limpricht).
 14. Upper portion of innermost bract × 85 (Snowdon, W. H. P.).
 15. Antheridium × 85 (ditto).

Section 2. *EUCESIA*, Lindb.

Cesia. Sect. B. *Eucesia*, Lindb. Musc. Scand. p. 9 (1879).

Gymnomitrium. Sect. 1. *Typica*, Schiffn. in Engl. & Prantl, Pflanzenf. 91 & 92 Lief., p. 77 (1893).

Type, see description of genus.

6. *Cesia corallioides* (Nees).

Gymnomitrium corallioides, Nees, Nat. Eur. Leb. 1, p. 118 (1833).

Acolea corallioides, Dum. Recueil Jung. p. 25 (1835).

Cesia corallioides, Carruth. in Scem. Journ. Bot. 3, p. 300 (1865); Lindb. Musc. Scand. p. 9 (1879).

Dioicous, densely caespitose, small, pale silvery or brownish-grey to green colour. Stems simple or slightly furcate, cortical cells about 30, these and the next inner layer rather larger than the inner ones, 10 × 15 cells in diameter; frontally compressed, suberect, prostrate below and denudate, flexuose; radiculose,

rootlets few, delicate. Leaves closely imbricate, distichous, erect, broadly ovate, ovate or oval, entire, irregularly lacerate-bifid, erose or bidentate; texture delicate, margin extremely so, membranaceous, diaphanous, quite entire; the walls of the marginal cells hardly visible, except in young leaves, inner cells smallish to small, roundish-quadrate, larger near the middle, walls thick, angles thickened. No stipules. Bracts similar to the upper leaves, innermost bracts small, very delicate. Androecia terminal, perigonial bracts broadly ovate, swollen, bidentate, with a small basal acute segment.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, with leaves .5 mm. wide, .275 mm. \times .2 mm. diam.; leaves .7 mm. \times .6 mm., .9 mm. \times .7 mm., .75 mm. \times .6 mm., .6 mm. \times .55 mm., .7 mm. \times .5 mm.; segments .1 mm.; cells .03 mm. \times .02 mm., .02 mm., .0175 mm.

HAB.—Only found sparingly on high mountains. Extremely rare. 15. Loch-na-gar, *A. Croall*, 1856. Ben Lawers, *W. Young*, 1896; *S. M. Macvicar*, 1900. 16. Ben Nevis, *Dr. Greville*, 1830. 17A. Sutherland Mountains, *Dr. Greville*, 1830.

I. Brandon Mountain, *Dr. D. Moore*, 1840.

Found on the Continent and in North America, Alaska, *Krause*.

OBS.—Hardly to be recognised as an hepatic; the closely appressed leaves give the stem the appearance of a lichen or coral, but when examined under the microscope its character is at once made out.

Mounted in water or glycerine, and examined by transmitted light, the leaves are so transparent that the stem can be seen through them; the extremely delicate hyaline margin, which is quite smooth, and the usually entire or irregularly notched apex distinguish it from *Cesia concinnata* or *Cesia obtusa*.

In recent specimens collected by Mr. Macvicar on Ben Lawers, the young leaves are not weathered, and show the apex to be distinctly but shallowly bidentate, sinus obtuse, segments obtusate or slightly acute.

DESCRIPTION OF PLATE CLXXVII.—Fig. 1. Plants natural size. 2. Portion of stem $\times 24$ (Norway, Boeck). 3–8. Leaves $\times 24$ (G. R. Hep. Eur. n. 513. 9. Leaf $\times 85$ (Husn. Hep. Gall. n. 52). 10–12. Young leaves $\times 24$ (Ben Lawers, S. M. Macvicar). 13. Portion of leaf $\times 290$ (Norway, Boeck). 14, 15. Perigonal bracts $\times 24$ (Ben Lawers, S. M. Macvicar).

7. *Cesia concinnata* (*Lightf.*) G. & B.

Jungermania concinnata, Lightfoot Fl. Scot., 2, p. 786 (1777).

Cesius concinnatus, Gr. & Benn. Nat. Arr. Brit. Pl. 1, p. 705 (1821).

Gymnomitrium concinnatum, Cord. in Sturm Fl. Germ. Gr. 19, 20, p. 23 (1830);

Nees Nat. Eur. Leberm. 1, p. 115 (1833).

Acolea concinnata, Dum. Syll. Jung. p. 76 (1831).

Cesia concinnata, Lindb. Musc. Scand. p. 10 (1879).

Dioicous, closely caespitose, small, of a silvery green colour. Stems suberect, simple or ramose, cylindrical, about 15 cells in diam., filiform below, towards the apices incrassated and compressed, when dry brittle; radiculose, rootlets ascending to apex. Leaves erect, bifarious, loosely imbricate, somewhat secund, concave, ovate, bidentate to about $\frac{1}{5}$, sinus acute, segments acute, margin quite smooth, often hyaline; texture firm, epidermis smoothish, cells smallish, roundish-quadrate or roundish-oblong, walls distinct, trigones small but distinct. No stipules. Bracts bifid or trifid, somewhat similar to the upper leaves, innermost bracts smaller, two or three, free, irregularly lacinate-dentate, very delicate. Calyptra ovate, extremely delicate, cell structure hardly visible, arranged like a spider's web; pistillidia dispersed over it. Capsule small, nearly spherical, of a reddish shining brown colour. Spores spherical, deep fulvous brown colour. Elaters similar in colour, bispiral.

Male stems somewhat clavate; perigonal bracts terminal, broadly ovate, swollen at the base, antheridia about 8, 1 or 2 at the base of each bract, almost spherical, bearers long, of 24 cells in two rows.

Fruits May, June.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .2 mm. diam., with leaves from .4 mm. to .6 mm. wide, at apex of fertile stem 1. mm. wide; leaves 1. mm. long \times .75 mm. broad, segments .2 mm., .9 mm. \times .7 mm., seg. .15 mm., .8 mm. \times .6 mm., seg. .15 mm.; cells .025 mm. \times .025 mm., .025 mm. \times .02 mm., .03 mm. \times .02 mm., .03 mm. \times .03 mm.; trigones .005 mm.; bracts .75 mm. \times .65 mm., .6 mm. \times .5 mm., .55 mm. \times .4 mm.; perigonal bracts .8 mm. long \times .75 mm. broad, .7 mm. \times .7 mm.

HAB.—Grows in cushion-like patches on exposed rocks in subalpine or alpine localities. Not uncommon at these altitudes.

7. Cader Idris, Merionethshire, *J. Ralfs*; *W. H. P.*; Snowdon, *G. E. Hunt*; *J. R. Byrom*; Pass of Llanberis, *E. M. Holmes*; *G. A. Holt*; Glyders, Carnarvonshire, *W. Wilson*. 10. Summit of Ingleborough, *W. J. Hooker*; *Dr. Carrington*; Howgill Fells, *W. West*; Brimham Rocks, *R. Teesdale*, 1798; Cronkley Scar, Teesdale, *J. G. Baker*. 12. Helvellyn, *John Nowell*; Bow Fell, Westmorland, *G. Stabler*. 13. Rocks on Kells Hills, *J. McAndrew*; Hart Fell, Blackhope, *Nichol*. 14. 15. Mael Tarmachan, *C. J. Wild*; Ben Cruachan, *T. Rogers*. 16. Glen Finnan, *Dr. Carrington*; Moidart, West Inverness, *S. M. Macvicar*, not seen below 1400 ft.; frequent from this to the summits. 17. 18.

I have not seen any specimens from Ireland.

Found on the Continent and in North America.

Obs.—Distinguished from *Cesia obtusa*, Lindb. and the rare *Cesia corallioides* (Nees), in addition to other characters by the acute segments of the leaves. It is frequently mistaken for *Anthelia julacea* (Lightf.) by inexperienced collectors, from which it is very different.

The innermost bracts differ considerably in various individuals; some stems having two, some three, and others only one, and are more or less lacinate-dentate, but are always free from each other and the outer bracts.

DESCRIPTION OF PLATE CLXXVIII.—Fig. 1. Plants nat. size

(Sowerby, Eng. Bot. 2229). 2. Ditto. 3. Portion of fertile stem \times 24 (Snowdon, W. H. P.). 4. Portion of barren stem \times 24 (ditto). 5-7. Leaves \times 24 (ditto). 8-10. Ditto (Mael Tarmachan, C. J. Wild). 11. Portion of leaf \times 290 (Snowdon, W. H. P.). 12-14. Bracts \times 64 (ditto). 15. Perigonial bract \times 24 (Mael Tarmachan, C. J. Wild). 16. Ditto (Glen Finnan, Dr. Carrington).

8. *Cesia obtusa*, Lindb.

Cesia obtusa, Lindb. Musc. Scand. p. 9 (1879).

Gymnomitrium concinnatum, var. *crenulatum*, Limpr. in Cohn Krypt. Schles. 1, p. 246 (1877)?

Dioicous, densely caespitose, small, silvery white, where exposed and old it is darker coloured, where shaded it has a greenish tinge. Stems erect when tufts crowded, with few branches assurgent, ascending to the height of the chief stem, when tufts loose, stem prostrate, creeping, fertile stems increasing in size to apex, which is blunt and swollen, barren shoots catenulate, on a transverse section almost round, cortical layer of cells firmer and darker coloured; rootlets few, hyaline, short, arising from the postical side of stem where the two series of leaves join, ascending to about the middle of the stem, the leaves having to be carefully separated from the stem before the origin of the rootlets can be seen. Leaves closely and regularly imbricate, erect, bifarious, ovate, roundish-ovate or obovate, concave, bidentate to $\frac{1}{5}$ or $\frac{1}{4}$, sinus acute or slightly rounded, segments broad, obtuse, finely crenulate on both sides, lower margin of leaf quite entire; texture somewhat fleshy, cells medium size to smallish, roundish-quadrate or roundish-oblong, marginal cells smaller, trigones small but very distinct. No stipules. Bracts larger than the leaves, broadly ovate, bidentate to about $\frac{1}{5}$, segments obtuse, finely crenulate. Innermost bracts free, very delicate, ovate, lacinate-dentate or denticulate; bracteole small, oblong-quadrate, lacinate-dentate or denticulate. Pistillidia few (about 8), oblong, dispersed over the calyptra. Male stems slightly clavate,

antheridia terminal or rarely situated at the middle of the stem ; perigonial bracts little different from the others, slightly swollen at the base and rather broader ; antheridia few, oval, the outer layer persistent ; bearers as long or longer than the antheridia (some 12 cells long).

Fruits May, June.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .2 mm. diam., with leaves .2 mm. to .3 mm. wide ; leaves .9 mm. long \times .7 mm. broad, .85 mm. \times .7 mm., .65 mm. \times .5 mm., segments .25 mm. high \times from .15 mm. to .4 mm. broad at the base ; cells .05 mm. \times .025 mm., .04 mm. \times .03 mm., .04 mm. \times .02 mm., .03 mm. \times .02 mm. ; marginal cells .02 mm. \times .02 mm. ; trigones .0075 mm., bracts .9 mm. long \times .7 mm. broad, segments .2 mm. ; pistillidia .15 mm. long \times .05 mm. broad ; antheridia .25 mm. \times .15 mm.

HAB.—Grows on exposed rocks in subalpine and alpine localities. Not uncommon in North Wales, the Lake District, and Scotland.

7. Cader Idris, Merionethshire, *E. M. Holmes*; *W. H. P.* ; Cwm Bychan, Merionethshire, *G. A. Holt* ; Llanberis and Snowdon, Carnarvonshire, *E. M. Holmes*, *J. R. Byrom*, *James Neild*. 12. Harter Fell, Mardale, *G. Stabler* ; Hill Bell, *J. A. Martindale* & *G. Stabler* ; Long Sleddale ; Langdale, Westmorland, *G. Stabler*. 15. Loch-na-gar, *J. & T. Sim*. 16. Glen Finnan, *Dr. Carrington* ; Moidart, West Inverness, *S. M. Macvicar*, rare on low ground, but descends to sea-level ; common on the hills from 1200 ft. to 2000 ft.

I. Mwellrea Mountains, Co. Mayo, *Dr. D. Moore*, 1874 ; Slieve Donard and other mountains in the North, *Revs. Lett & Waddell*.

Found on the Continent.

Obs.—From *Cesia concinnata* (Lightf.) it may be distinguished by its rounded, obtuse, finely crenulate segments, closely and regularly imbricating leaves, bifariously inserted, never secund (as Lindberg remarks).

Cesia crenulata (Gott.) is a widely different species, with finer

stems, arcuately branched, dark brown or almost black in colour, in shaded situations greenish; in this species the segments are acute, with the hyaline fringe of leaf composed of narrow sharp-pointed, irregularly projecting cells.

Cesia corallioides (Nees) has a more acute leaf, without sinus, or if present, very shallow, or very irregular through being weathered, and always has a very delicate diaphanous hyaline border, so delicate that rarely any cellular structure is to be observed. This character, along with the entire absence of any approach to crenulation of the segments, at once separates it from *C. obtusa*.

Cesia obtusa (Lindb.) was first recognised as British by Mr. George Stabler and published in "Journal of Botany" for 1880.

DESCRIPTION OF PLATE CLXXIX.—Fig. 1. Plants nat. size. 2. Portion of stem $\times 64$ (Cader Idris, E. M. Holmes). 3–7. Leaves $\times 31$ (Glen Finnan, Dr. Carrington). 8, 9. Ditto $\times 31$ (Scotland, Croall). 10. Lobes of leaf $\times 85$ (Norway, Lindberg). 11. Portion of leaf $\times 290$ (Glen Finnan, Dr. Carrington). 12, 13. Bracts $\times 31$ (ditto). 14, 15. Portions of the innermost bracts $\times 64$ (Mardale, G. Stabler). 16. Bracteole $\times 64$ (ditto).

9. *Cesia crenulata* (Gottsche).

Gymnomitrium crenulatum, Gottsche in Carrington's Irish Hepatica, Trans. Bot. Soc. Edinb. vii. (1863).

Acolea crenulata, Dum. Hep. Eur. p. 125 (1874).

Dioicous, densely caespitose, tufts very depressed, small, of a dark reddish or greenish brown or almost black colour. Stems with about 20 cortical cells, reddish colour, 10 cells in diam.; intricately entangled, creeping, prostrate or suberect, arcuately branched, filiform, wiry, catenulate, terete, or somewhat compressed then lanceolate in outline; radiculose, rootlets few. Leaves closely imbricate, erect, scarcely broader than the stem, oval, ovate or broadly ovate, bidentate to about $\frac{1}{5}$, sometimes

sub-entire, segments acute, margin scariose, irregularly crenulate-dentate to the base; texture firm, marginal cells delicate, hyaline, narrow, the next inner row suddenly thickened and coloured, small to smallish, roundish-quadrate; walls thick, angles thickened. No stipules. Fertile stems short; bracts about 3 pairs, larger than the leaves, innermost bracts smaller than the outer, bifid or rarely trifid, fringed with long teeth to the base, free from the outer bracts. Calyptra oval, extremely delicate; pistillidia dispersed over it. Capsule spherical, pale brown. Spores small; elaters somewhat short, brown, bispiral. Andrœcia terminal on short branches; perigonial bracts not so closely imbricate as the leaves, slightly secund, broader than the stem leaves; antheridia oval, stipitate.

Fruits May and June.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{3}{4}$ inch long, diam. .15 mm. with leaves .3 mm. wide; leaves .35 mm. \times .3 mm., seg. .05 mm., .275 mm. \times .25 mm., seg. .05 mm., .3 mm. \times .3 mm., seg. .075 mm., .25 mm. \times .2 mm., seg. .03 mm.; cells .02 mm., .02 mm. \times .025 mm., .025 mm.; marginal cells .04 mm. \times .02 mm., .03 mm. \times .015 mm.; innermost bracts .25 mm. \times .25 mm., seg. .05 mm., .3 mm. \times .275 mm., seg. .075 mm.; pistillidia .15 mm. \times .05 mm.; perigonial bracts .5 mm. \times .45 mm., seg. .1 mm., .35 mm. \times .4 mm., seg. .075 mm.; antheridia .15 mm. \times .1 mm.

HAB.—Growing in intricately entangled round cushions or in patches on exposed rocks or stones in alpine or subalpine localities, and also at a lower elevation than either *Cesia concinnata* or *Cesia obtusa*. Not unfrequent.

1. Dartmoor, Devon, *G. E. Davies*. 7. Cader Idris, Snowdon and other Welsh mountains, *W. Wilson*; *E. M. Holmes*; *W. H. P.* 12. Mardale, Westmorland, *G. Stabler*; Borrowdale, Cumberland, *W. H. P.*; frequent in the Lake District, *G. Stabler*. 13. Frequent on the hills, New Galloway, *J. McAndrew*. 16. Glen Finnan, *Dr. Carrington*; frequent on rocks and boulders on the hills, rarely below 1200 ft.; noted from 700–2500 ft., and in one locality at sea-level, Moidart, West Inverness, *S. M. Macvicar*.

I. Frequent on the higher mountains, and in some few

instances descending to sea-level, *Dr. D. Moore*. On rocks near the tunnel, Cromaglow, *Dr. Carrington*; Dunkerron and Knockavoila, *Dr. Taylor*; Carrantual, *Dr. D. Moore*; Lugnaquilla, Co. Wicklow, and Galtymore, *A. Carroll*; rocks on the Hill of Howth, *Dr. D. Moore*; Golden River, Co. Louth, *Rev. H. W. Lell*.

Found on the Continent (Norway).

Obs.—This is a very distinct species and abundantly different from any other of the genus. *Cesia obtusa*, Lindb., is far removed from it by its larger size, different colour and shape of leaves, the marginal cells of which are rounder and smaller.

Dr. Carrington was the first to distinguish this species, which had been referred by *Dr. Taylor* to *Cesia coralloides* (Nees). He sent specimens as a new species to *Dr. Gottsche*, who gave it the characteristic name of *crenulata*.

Although generally distributed in the mountainous parts of the British Isles, it appears to be very rare on the Continent, and not well understood by some authorities, *Herr Limpricht*, a most acute hepaticologist, and whose devotion to the European mosses has evidently interfered of later years with his study of the Hepaticæ refers *Cesia obtusa* to *C. crenulata*, as a variety of *C. concinnata* (Lightf.), (*Gymnomitrium concinnatum*, var. *crenulatum*), (*Cohn's Krypt. Schles.* 1, p. 246 (1877)).

It generally grows at a lower elevation than any other species of the genus. *Mr. Macvicar* has found it at sea-level in Scotland, and it is one of the commonest species on rocks and walls about Llanberis in North Wales, and Seathwaite in Borrowdale.

DESCRIPTION OF PLATE CLXXX.—Fig. 1. Plants natural size. 2. Branch \times 20 (*Dr. C.*). 3. Fertile branch \times 40 (ditto). 4. Apex of barren branch \times 60 (ditto). 5. Portion of stem \times 24 (*Pass of Llanberis, W. H. P.*). 6. Leaf \times 85 (ditto). 7. Ditto (*Cader Idris, W. H. P.*) 8. Leaves \times (*Dr. C.*). 9. Portion of the apex of a leaf, showing the crenate margin \times 300 (*Dr. C.*). 10. Portion of leaf \times 290 (*Long Stile, G. Stabler*). 11. Marginal cells \times 290 (ditto). 12, 13. Bracts \times 85 (*Pass of Llanberis, W. H. P.*). 14. Bract enclosing the calyptra and capsule \times (*Dr. C.*). 15. Pistillidia surrounded by the innermost bracts \times

(ditto). 16. Pistillidium $\times 85$ (Pass of Llanberis, W. H. P.).
 17. Spores and elaters \times (Dr. C.). 18. Perigonial bract $\times 85$
 (Pass of Llanberis, W. H. P.). 19. Antheridium $\times 85$ (ditto).

Genus 35. **ACROBOLBUS**, *Nees*.

Acrobolbus, Nees in G. L. N. Syn. Hep. p. 5 (1844).

Gymnanthe, Tayl. MSS. G. L. N. Syn. Hep. p. 192 (1844).

Plants small, semi-parasitic. Stems prostrate, radiculose, simple or furcate, rarely with one or two sublateral branches. Leaves succubous, alternate, subquadrate, bifid, upper sometimes trifid, quite entire, or here and there dentate; cells medium size. Stipules absent. Inflorescence dioicous. Bracts ♀ 1-2 pairs, large, plurilobate, undulato-crispate. Pistillidia 10-22. Marsupium terminal, seated at right angles with the stem, short, bulbous, obovato-globose, carnose, mouth without or very rarely with subulate scales. Calyptra adnate up the apex with the marsupium, crowned with the sterile pistillidia. Pedicel calceolate at the base. Capsule oblong. Antheridia terminal.

Acrobolbus Wilsoni (*Tayl.*) *Nees*.

Jungermania Wilsoni, Tayl. in schedis.

Gymnanthe Wilsoni, Tayl. G. L. N. Syn. Hep. p. 192 (1844).

Acrobolbus Wilsoni, Nees, G. L. N. Syn. Hep. p. 5 (1844).

Dioicous, caespitose, tufts scattered, small, pea or dark green in colour. Stems creeping, flexuose, colour olive or olive brown near the base, cells 10×10 , cortical similar to the inner; radiculose, rootlets abundant, clothing the postical side of the stem, dull white, somewhat coarse. Innovations postical or sublateral, slender. Fertile stems suddenly accrescent at the apex and bearing much larger erect leaves. Leaves approximate, semi-vertical, roundish or obovate, divided for one third or even half their length into two acute unequal lobes, the antical somewhat larger, rarely trilobate; sinus acute; margin entire or with an

occasional tooth, insertion oblique, contracted at the base, nearly plane and horizontal at the inferior portion of the stems, but more concave, ascending and connivent near the apex; texture fragile, somewhat thin, but fleshy, cells medium to rather large in size, roundish-hexagonal or roundish-quadrate, walls thick, angles thickened, trigones hardly perceptible, lumen filled with chlorophyllose granules. Stipules wanting or rarely present as minute scales at the apex of innovations. Fructification terminal, but from the growth of innovations sometimes appearing lateral. Bracts 2, larger than the leaves, broadly ovate or cordate, 2 to 3-lobed, the lobes repand-dentate, so as to have a crisped appearance, convolute-concave, base saccate-amplexicaul. Bracteole semi-ovate, acuminate, margin irregularly dentate, connate with one of the bracts, sub-bracts rather smaller, similar in size, but only bilobed, and with margins more or less entire. The bracts are originally free, surrounding the convex apex of the stem, on which 15-20 pistillidia are crowded. But after impregnation the rapid cell-growth of the young germ extends to the 'torus pistillorum,' and the bases of the adjacent leaves, so that the whole are blended together to form an involucre, the lower half of which is ob-conic and entire, projecting below the level of the stem, and forming a kind of bulb, from which numerous rootlets proceed. The mouth of the involucre is surmounted by two connivent bracts and bracteole, which retain their old form.

On longitudinal section the structure will be better understood, the sub-bracts (which approach the terminal ones in size) obscuring it. The capsule is found occupying a cavity composed in part of the metamorphosed apex of the stem and bases of the bracts, and in part of the calyptra, which, with the exception of the dome-like apex, is concrete with the outer walls, bearing around it the remains of the abortive pistillidia, which surround the mouth of the involucre like a fringe. Perianth wanting. Calyptra campanulate, of thin hyaline texture, adnate except at the apex with the fleshy involucre. Capsule oval, dark brown, divided into four valves. Pedicel stout, fleshy, white, bulbous at the base, and inserted into the thickened gibbous portion of

the involucre. Spores reddish-brown, minutely granular. Elaters obscurely bi-spiral. Male inflorescence on slender branches, perigonal bracts 2 or 3 in number, terminal, sub-complicate and saccate at the base, enclosing one or more oval, shortly stipitate antheridia.

Fruits in Autumn and Winter.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ an inch in length, diam. .2 mm. with leaves explanate 2· mm. wide; leaves 1·6 mm. \times 1·5 mm., segments .6 mm., 1·2 mm. \times 1·2 mm., seg. .6 mm., lower leaves 1· mm. \times .75 mm.; cells .05 mm. \times .035 mm., .04 mm. \times .04 mm., .035 mm. \times .035 mm.; sub-bracts 2· mm. \times 2· mm., seg. .5 mm. 2· mm. \times 1·75 mm., seg. .75 mm.; bracts 1·75 mm. \times 2· mm., seg. .75 mm., 1·75 mm. \times 1·75 mm., seg. .75 mm.

HAB.—In scattered tufts, epiphytic on *Radula* or *Frullania*. Extremely rare.

I. Near Bantry, *Miss Hutchins*, 19th Nov. 1812, young fruit. Banks of a ravine near the Hunting Tower, Cromaglow, Killarney, Nov. 1829, fr., *W. Wilson*. Tore Mountain, Killarney, Sept. 1841; Glengariff, Sept. 1839, growing on *Frullania germana*, *Dr. Taylor*.

Obs.—This is a curious and extremely rare species; the absence of a true perianth separates it from *Nardia geosecyphus* (De Not.) and *Jung. capitata*, Hook, which it resembles somewhat in habit, but both are paroicous. This character serves to distinguish them from it, even when their perianths are not fully developed. *Jung. capitata* has also larger and more translucent cells with thinner walls. The above description is almost entirely taken from the late Dr. Carrington's uncompleted "British Hepaticæ."

DESCRIPTION OF PLATE CLXXXI.—Fig. 1. Plants natural size. 2. Portion of stem, antical view, \times 16 (Knock-a-voila, Dr. Taylor). 3. Portion of fertile stem \times (Dr. Carrington del.) 4–7. Leaves \times 16 (Knock-a-voila, Dr. Taylor). 8. Portion of leaf \times 290 (ditto). 9, 10. Sub-bracts \times 16 (ditto). 11, 12. Bracts \times 16 (ditto). 13. Involucre \times (Dr. Carrington, del.)

Genus 36. **SACCOGYNA**, *Dum.*

Saccogyne, Dum. Comm. Bot. (1823).

Dioicous. Plants with the habit of *Chiloscyphus*, procumbent, sparingly radiculose; leaves succubous, horizontal, entire or emarginate; stipules triangular, adnate with the adjacent leaves. Perigynium at first bud-like, postical, proceeding from the axil of a stipule at length oblong, fleshy, saccate, naked, smooth or everywhere pilose, mouth circular; pendulous, affixed laterally by the margin of the apex, sublateral, shortly stipitate, surrounded by the remains of the involueral bracts. Perianth absent. Calyptra connate for most of its length with the outer walls, the dome-like apex alone free. Capsule oblong, 4-valved, valves straight, erect. Elaters bispiral, deciduous. Male spikes minute, postical, arising from the axils of the stipules of separate individuals.

Saccogyne viticulosa (*Linn.*) *Dum.*

Jungermania terrestris viticulis longis, foliis perexiguis, densissimis, ex rotunditate acuminatis, Mich. Nov. gen. p. 8, t. 5, f. 4 (1729).

Jungermania viticulosa, Linn. Sp. pl. 1597 (1753); Hook. Brit. Jung. t. 60 (1816).

Saccogyne viticulosa, Dum. Comm. Bot. p. 113 (1822).

Dioicous, broadly and shallowly cæspitose, medium to largish in size, yellowish green or olive brown in colour. Stems simple or slightly branched, branches postical; radiculose, rootlets few, fasciculate, white, proceeding from the base of the stipules. Leaves succubous, regular, imbricate, sub-opposite, horizontal or patent-divergent, plane or slightly concave, ovate or ovate-triangular, antical margin decurrent; texture firm, cells smallish, 4, 5, and 6-sided, walls thick, trigones absent or indistinct. Stipules connate with the adjoining leaves or leaf, broadly sublimate, acuminate or orbicular-acuminate, irregularly dentate. Perianth produced from the postical side of stem below a stipule, and hanging by a short pedicel proceeding from its upper border,

oval or oblong, cylindrical, clothed with long delicate, white rootlets, mouth and upper portion furnished with oval or subquadrate, dentate, delicate bracts, base solid. Calyptra oblong-obovate, adnate at the lower portion to the perianth; pistillidia 7 to 12, very long and narrow. Capsule oblong, reddish brown. Spores reddish brown. Elaters bispiral. Andrœcia bud-like, ovate, proceeding from the postical side of stem, in the axil of the stipules, composed of 4 or 5 pairs of bracts with bracteoles, bracts crowded, broadly ovate, trifid, ventricose at the base, bracteole broadly subulate, or subulate, bifid, texture much more delicate than either the leaves or stipules, antheridia single, oval, stipes long.

Fruits in Spring and early Summer.

DIMENSIONS.—Stems 1 to 2 inches long, $\cdot 3$ mm. in diam., with leaves $3\cdot 5$ mm. to $4\cdot 5$ mm. wide; leaves $2\cdot 5$ mm. \times $1\cdot 5$ mm., $1\cdot 5$ mm. \times $1\cdot 1$ mm.; cells $\cdot 03$ mm. \times $\cdot 02$ mm., $\cdot 035$ \times $\cdot 03$, $\cdot 025$ mm. \times $\cdot 025$ mm., $\cdot 03$ mm. \times $\cdot 025$ mm.; stipules $\cdot 7$ mm. \times $\cdot 4$ mm., $\cdot 6$ mm. \times $\cdot 5$ mm., $\cdot 45$ mm. \times $\cdot 2$ mm., perianth $2\cdot 5$ mm. \times $\cdot 9$ mm.; scales on the perianth $\cdot 7$ mm. \times $\cdot 5$ mm., $\cdot 6$ mm. \times $\cdot 4$ mm., $\cdot 4$ mm. \times $\cdot 3$ mm., $\cdot 3$ mm. \times $\cdot 2$ mm.; pistillidia, $\cdot 3$ mm. \times $\cdot 04$ mm., perigonial bract, $\cdot 35$ mm. \times $\cdot 3$ mm.; antheridia $\cdot 2$ mm. \times $\cdot 14$ mm.; perigonial bracteoles $\cdot 25$ mm. \times $\cdot 125$ mm., segments $\cdot 15$ mm., $\cdot 3$ mm. \times $\cdot 2$ mm., seg. $\cdot 075$ mm.

HAB.—In various parts of Britain, but more especially in subalpine localities, on damp walls, rocks or stones, often in exposed situations, more rarely in bogs amongst *Sphagna*. Somewhat local in its distribution, but is often very abundant where found draping damp walls, which are its favourite habitat to the exclusion of other species.

1. Common in Cornwall, *W. Carnor*; Linton, North Devon, *T. H. Russell*. 3. Tunbridge Wells, *G. E. Davies*. 5. Banks of Severn by Seckley Wood, Staffordshire, *J. E. Bagnall*. 6. Neath, South Wales, *Dr. Carrington*; Swansea, South Wales, *C. W. Slater & W. H. P.* 7. Near Bangor, Carnarvonshire, *W. Wilson*; Dolgelly, *John Whitehead*; Maentwrog, *W. H. P.*; Cader Idris, *J. Ralfs*; Barmouth, *Dr. Carrington & W. H. P.*; Tyn-y-Groes, Merionethshire, *Dr. Carrington & W. H. P.* 9. Bamford Wood,

Lanes., *C. J. Wild.* 10. Bracken Ghyll, Dent, with marsupia and ♂ plants, *G. Stabler*; Malham Cove, *R. Tresdale*; Halifax, *J. Bolton*, 1775; Dulesgate, Todmorden, *John Nowell*. 10. Rydal, *G. Stabler*; by river Lune, near Orton, *Dr. Carrington*; Black Crag, Staveley, *G. Stabler*, Stock Ghyll; Windermere ♂ and ♀; Langdale; Brown Ghyll, Oxenden, Westmorland, *G. Stabler*; Ulpha, Westmorland, *J. Barnes*; Borrowdale, Cumberland, *Dr. Carrington* & *W. H. P.* 13. Wet rocks, Lochar Moss, *James Craickshank*; Brennan Hill, &c., Kirkeudbright, *J. McAndrew*. 15. Kinnordy, *C. Lyell*. 16. Very common on wet banks, Moidart, West Inverness, *S. M. Macraicar*.

I. Frequent occurrence in many parts of Ireland, but more especially in the south and west; very fine at Lough Bray, Wicklow, and the woods about Killarney. It also extends to the counties of Antrim and Donegal in the north, and Mayo in the west, *Dr. D. Moore*; on a damp bank, Howth demesne, *D. McArdle*; on damp ground, Ballyhaise woods, Co. Cavan, *D. McArdle*.

C. Saint-Ouen, *Aug. Martin*.

Found on the Continent, but very rare.

The male flowers and fruit are extremely rare. *Mr. Wilson* met with fruit near Bangor, March 1835, *C. Lyell* young fruit at Kinnordy, *Prof. Lindberg* fruit at Killarney, July 1872, *Mr. Ralfs* young fruit on Cader Idris, *Mr. John Whitehead* male flowers and fruit at Dolgelly, *Mr. George Stabler* young fruit and flowers near Dent and Windermere, and some years ago I collected it in fruit in great abundance on the left-hand side wall, on the road to Harlech, about a mile beyond Maentwrog, North Wales, where it was again found in 1899 with abundant fruit by *Mr. D. A. Jones*, of Harlech.

OBS.—A very distinct species and only type of the genus, not to be confounded with any other British species.

DESCRIPTION OF PLATE CLXXXII.—Fig. 1. Plants, sterile, ♂ and ♀, natural size. 2. Portion of stem, antical view $\times 11$ (Dolgelly, J. Whitehead). 3. Portion of stem, postical view $\times 24$ (Dolgelly, J. Ralfs). 4. Portion of leaf $\times 290$ (Dolgelly, J.

Whitehead). 5. Stipule $\times 85$ (Dolgelly, J. Ralfs). 6. Perianth $\times 16$ (Dolgelly, J. Whitehead). 7, 8. Scales from near mouth of perianth $\times 24$ (ditto). 9, 10. Ditto from lower down $\times 24$ (ditto). 11. Pistillidia $\times 85$ (ditto). 12. Perigonial bract $\times 85$ (ditto). 13. Antheridium $\times 85$ (ditto). 14, 15. Perigonial bracteoles $\times 85$ (ditto).

Subtribe VII. FOSSOMBRONIEÆ.

Genus 37. **FOSSOMBRONIA**, *Raddi*.

Fossombronia, Raddi in Act. Sc. Soc. Moden. (1820).

Dioicous or monoicous, growing in thin layers, usually densely caespitose, small, pale or yellowish green in colour, inodorous or fetid. Stems short, fragile, simple or furcate, often innovant, no postical branches, antical plane or canaliculate, postical rotundate or narrowly carinate; creeping; densely radiculose, rootlets very long, violet-purple, red or rarely white. Leaves large, succubous, obliquely or sublongitudinally inserted, antical margin decurrent, subquadrate, often longer than broad, usually narrow at the base, undulate, rarely plicate, apex broadly lobulate or sinuate, sometimes subdentate; cells moderately large, in some species two and three layers thick. Stipules absent. Female flowers terminal. Bracts similar to the leaves, but rather larger and more incised. Perianth campanulate, pyriform or turbinate, mouth wide, lobate, often longitudinally plicate, upper part tender and composed of a single layer of cells, lower portion composed of two or three layers. Calyptra free, subglobose or pyriform, much smaller than the perianth, at the base thickened, sometimes with a few sterile pistillidia surrounding it. Pedicel thick, short. Capsule globose, rupturing irregularly into 4 valves, bistratose. Spores large, more or less brownish, tetrahedral, convex face variously armed, lamellate or papillate. Elaters short, obtuse, normally bispiral, sometimes 1 or 3 loosely twisted. Antheridia 2 or 3, aggregated, exposed on the antical face of stem, orange, shortly pedicellate, afterwards mixing with the pistillidia.

Obs.—The genus *Fossombronina* is a very curious one, and naturally comes at the end of the foliose genera; it has characters in common both with the foliose and frondose; for instance, a true stem with leaves, but the latter are usually composed at their base of several layers of cells as with most of the frondose.

An extremely interesting note on the genus is to be found in the “Species Hepaticarum” of Herr Stephani, whose arrangement of the species I have followed.

Six British species have been observed up to now, which are distinguished by their inflorescence, smell, shape of stem and leaves, and more especially by the markings of their spores, full particulars of which are given with each species.

FOSSOMBRONIA.

(A) Spores with lamellæ resembling crests, furcate.

a. Lamellæ laxly disposed.

Fossombronina pusilla (L.), Dum.

b. Crests crowded and numerous.

Fossombronina cristata, Lindb.

(B) Spores with lamellæ regularly reticulated.

c. Margin appearing as if winged.

Fossombronina angulosa (Dicks.), Raddi.

d. Lamellæ prominent at the margin.

Fossombronina Dumortieri (H. et G.), Lindb.

(C) Spores with lamellæ compressed into papillæ.

e. Papillæ truncate.

Fossombronina cæspitiformis, De Not.

f. Papillæ long, hispid.

Fossombronina Mittenii, Tindall.

(A S pores with lamellæ resembling crests, furcate.

a. Lamellæ laxly disposed.

1. **Fossombronia pusilla** (*Dill., L.*), *Dum., Lindb.*

Lichenastrum minimum, capitulis nigris lucidis, Dill. in Ray. Syn. stirp. Brit. iii. ed. p. 110, n. 5 (1724).

Jungermania pusilla, L. Sp. pl. i. ed. ii. p. 1136, n. 27 (1753).

Maurocenia pusilla, Gr. & Benn. Nat. Arr. Brit. Pl. i. p. 687 (1821).

Codonia pusilla, Dum. Comm. Bot. p. 111 (1822).

Fossombronia pusilla, Dum. Recueil, i. p. 11 (1835).

Monoicous, very fetid, cæspitose, small, green in colour. Stems procumbent, about three times broader than thick, simple or furcate, antical side plane, postical rounded; radiculose, rootlets numerous, long, purple-violet. Leaves 3 to 4 pairs, close, obliquely decurrent, horizontal, subquadrate or narrow at the base, undulate, crisp, entire, irregularly emarginate or slightly incised, segments erect, acute or obtuse, those surrounding the perianth (bracts) larger; cells medium size, subquadrate, walls thin, no trigones or thickened angles. Perianth obpyramidal or turbinate; mouth wide, recurved, irregularly dentate or slightly incised. Calyptra pyriform, whitish. Capsule spherical, reddish-brown, walls thin, delicate, bursting irregularly into 4 valves. Spores brown, tetrahedral-globose, with radiating furcate darker coloured lamellæ laxly disposed, margin with 16 to 24 blunt teeth. Elaters pale brown, bi-rarely uni- or tri-spiral. Antheridia situated on the antical side of stem, near the base of the leaves, exposed or enclosed by a bract-like process, spherical, with rather a long pedicel.

Fruit ripens in Autumn.

DIMENSIONS.—Stem about $\frac{1}{4}$ inch long \times 2 mm. wide with leaves; .7 mm. wide, \times .2 mm. thick; leaves 1.5 mm. \times 1.5 mm., 1.25 mm. \times .75 mm., 1.5 mm. \times 1 mm., 1 mm. \times 1 mm., segments .2 mm., .3 mm.; cells .05 mm. \times .04 mm., .04 mm. \times .04 mm., .035 mm. \times .03 mm.; spores .04 mm., .05 mm.; elaters .15 mm. \times .01 mm.

HAB.—On clay or sand, in shady ditches and on damp wood-

land paths, by the margins of dried pools, in fallow fields or ploughed lands. Somewhat rare.

1. Sidmouth, South Devon, *Mrs. Ella M. Tindall*. 2. Hayward's Heath, Sussex, *G. E. Davies*, New Forest, *C. Lyell*. 3. Ditching, Surrey, *G. E. Davies*. Woolwich, Middlesex, *Dillenius*. 10. Barmby Moor, Yorks, *R. Spruce*. 13. New Galloway, *J. McAndrew*.

I. Dingle Bay, *Prof. Lindberg* & *Dr. D. Moore*.

Found on the Continent and in North America.

Var. *ochrospora*, Lindb. Not. pro. F. et Fl. Fenn. p. 387 (1874).

9. Ashley, Cheshire, *G. E. Hunt*. Winwick, Lancashire, *W. Wilson*. Eccles, Lancashire, *Dr. Carrington*. Todmorden, Lancashire, *J. Nowell*. Crumpsall, Lancashire, *C. J. Wild*. 10. Yeadon, Yorkshire, *Dr. Carrington*. 12. Foulshaw, Westmorland, *G. Stabler*. I. Kerry, *Dr. D. Moore*.

OBS.—Under this name all the other British species of the genus, with the exception of *Fossombronia angulosa* (Dicks.), were formerly grouped.

It belongs to that section of the arrangement of Herr Stephani, with the lamellæ of the spore furcate, in which only another British species is included, *F. cristata*, Lindb., and in addition to other characters, is distinguished from it by the fewer number of crests, which are more laxly disposed.

The var. *ochrospora*, so far as I am able to understand it, differs but slightly from the type.

DESCRIPTION OF PLATE CLXXXIII.—Fig. 1. Plants natural size (Hooker). 2. Fertile plant magnified (ditto). 3. Cross-section of stem $\times 24$ (Sidmouth, Tindall). 4–7. Leaves $\times 11$ (Hayward's Heath, G. E. Davies). 8. Leaf $\times 16$ (ditto). 9. Portion of leaf $\times 290$ (ditto). 10. Perianth magnified (Hooker). 11. Spore $\times 290$ (Sussex, Davies). 12. Ditto $\times 400$ (S. O. Lindberg). 13. Ditto (Corbière). 14. Elater magnified (Hooker). 15. Portion of stem showing antheridia, magnified (Hooker). 16. Ditto. 17. Antheridium magnified (ditto).

b. Crests crowded and numerous.

2. *Fossombronia cristata* Lindb.

Fossombronia cristata, Lindb. apud Soc. pro F. et Fl. Fenn. (1873), Not. pro F. et Fl. Fenn. 382 (1874).

Monoicous, inodorous or very slightly fetid, cæspitose or sparsely gregarious, small, green or yellowish-green in colour. Stems procumbent, apex suberect; radiculose, rootlets reddish-purple, numerous. Leaves crisp, subquadrate, obtusely or acutely lobed; texture delicate, cells medium size, quadrate, walls thin, no trigones or thickened angles. Perianth obpyramidal, mouth wide, irregularly dentate or incised. Capsule globose, dark brown. Spores dark brown, tetrahedral-globose, densely cristate, about 10 crests across, sinuous or sub-parallel, 28–36 minute spines projecting around the margin. Elaters pale brown, short, thick, bi- rarely uni- or tri-spiral.

Fruit ripens in Autumn.

DIMENSIONS.—Stems about $\frac{1}{4}$ inch long, .3 mm. thick; leaves 1. mm. \times 1. mm., segments .2 mm., .3 mm., .7 mm. \times .8 mm.; seg. .1 mm., .2 mm.; .75 mm. \times .75 mm. seg. .2 mm., .3 mm.; .9 mm. \times .8 mm., seg. .3 mm., .4 mm.; cells .05 mm. \times .04 mm., .04 mm. \times .03 mm.; bract 1.25 mm. \times 1.25 mm., seg. .4 mm.; calyptra .7 mm. \times .5 mm.; capsule .4 mm.; spores .04 mm., .05 mm.; elaters .13 mm. \times .01 mm.

HAB.—On bare damp soil on footpaths, sides of ditches, margins of ponds, and fallow fields. Rare.

2. Aston and New Forest, Hampshire, *C. Lyell*. Ashdown Forest, *G. E. Davies*, November 1884. 5. Staffordshire, *Rev. H. P. Reader*. 10. Side of pool, near R. Foss, Yorkshire, *W. Ingham*. 16. Moidart, West Inverness, *S. M. Macvicar*.

I. On whitish clay, shore of Loughbrickland, Co. Down, *Rev. H. W. Lett*, October 1890.

Found on the Continent and in North America. Himalaya, *Gamble* vide *Stephani*.

Obs.—Distinguished from *Fossombronia pusilla* (L.) by its

rather smaller size, its only slightly fetid smell, paler colour of stem, which on a cross-section is semicircular, antical surface slightly channelled, postical convex, rootlets not so deep purple in colour, and the dark densely cristate spores, the crests projecting beyond the margin appear like minute spines, and number from 28 to 36 round. (See interesting note in "Journ. of Bot." Oct. 1900, by Mr. Macvicar.)

DESCRIPTION OF PLATE CLXXXIV.—Fig. 1. Plants natural size. 2. Fertile plant $\times 15$ (Schiffner, Engl. und Prantl. Pfl.). 3-6. Cross-sections of stem $\times 24$ (Helsingfors, Lindb.). 7, 8. Leaves $\times 24$ (ditto). 9, 10. Ditto $\times 24$ (Herb. Glasgow). 11. Leaf $\times 31$ (Ashdown, Davies). 12. Portion of leaf $\times 290$ (Herb. Glasgow). 13. Bract $\times 31$ (Ashdown, Davies). 14. Calyptra $\times 31$ (ditto). 15. Spore $\times 290$ (Helsingfors, Lindb.). 16. Ditto $\times ?$ (Corbière). 17. Ditto $\times 204$ (Herb. Glasgow). 18. Ditto $\times 400$ (Lindb.).

- (B.) Spores with lamellæ regularly reticulated.
c. Margin appearing as if winged.

3. *Fossombronia angulosa* (Mich., Dicks.), Radd.

- Jungermania foliis latiusculis, obtusis, undulatis et veluti angulosis*, Mich. Nov. pl. gen. p. 7, n. 1, pp. e loco et excl. planta juvenili (1729).
Jungermania angulosa, Dicks. Fasc. pl. crypt. Brit. i. 7 (1785).
Jungermania pusilla, Sm. Engl. Bot. xxv. n. 1775, pp. (1807).
Fossombronia angulosa, Radd. in Att. soc. sc. Modena, xviii. p. 40, excl. synon. Roth et var. B (1818).

Dioicous, shallowly cæspitose, inodorous, small, of a translucent green colour. Stems procumbent, simple or once furcate, broad, above green, below purple, usually frontally compressed, twice as broad as thick, 12×6 cells, the upper layers composed of somewhat large hyaline cells, the lower smaller and purple; or subterete, plane above and rotund below, more equal; radiculose, rootlets violet-purple, very numerous, close, flat, ribbon-like. Leaves horizontal, decurrent, subquadrate or oblong-quadrate, irregularly and obtusely lobed, lobes undulate; texture delicate, cells rather large, subquadrate, walls thick, angles slightly

thickened. Perianth campanulate, plicate, mouth wide, irregularly obtusely lobate, lobes undulate. Calyptra somewhat fleshy. Capsule globose, brown. Spores dark brown, tetrahedral-globose, alveolate, with 7-9 very large and deep 5- and 6-angled pits, regularly anastomosing, ridges membranaceous, sometimes appearing to surround the spore, giving it a membranaceous border as described by many authorities and figured by Lindberg and Corbière; but as Mrs. Tindall, a most careful observer, remarks, "The membranaceous border surrounding the spore is only the continuation of the intersecting ridges or lamellæ. There is no real border." The projecting ridges around the spore vary from 10 to 12. Elaters abundant, long and narrow, pale brown, 3 to 4 times as narrow as the diameter of the spore, pale brown, bi-rarely tri-spiral, loosely twisted with 20-24 turns. I have not seen the male plant.

DIMENSIONS.—Stems $\frac{1}{4}$ to $\frac{1}{2}$ inch long \times 2 to 4 mm. broad with leaves; .3 mm. to .8 mm. broad \times .3 mm. thick; leaves 2.5 mm. \times 3 mm., 2 mm. \times 1.5 mm.; cells .06 mm. \times .05 mm., .06 mm. \times .04 mm., .045 mm. \times .04 mm.; perianth 2.5 mm. \times 2.5 mm. wide at the mouth; spores .03 mm., .04 mm.; elaters .225 mm. \times .01 mm.

HAB.—In damp sandy situations on the coast, forming wide shallow patches. Rare.

1. Kynall Cliff, Penzance, *W. Curnow*. 7. ?

I. Dingle Bay, *Dr. D. Moore, Prof. Lindberg*; Ross Bay, *Dr. Carrington*.

C. Jersey, *J. Piquet*; La Hauteur, *Mrs. Mackenzie*.

Found on the Continent and in North America.

Obs.—This is the largest and most distinct of our British *Fossombronis*, the few deep pits on the spore along with the membranaceous ridges distinguishing it.

DESCRIPTION OF PLATE CLXXXV.—Fig. 1. Plants natural size. 2-4. Leaves \times 11 (Jersey, Piquet). 5. Portion of leaf \times 290 (ditto). 6-8. Cross-sections of stems \times 24 (ditto). 9. Perianth \times 11 (ditto). 10. Ditto, explanate \times 11 (ditto). 11. Spore \times 400 (Lindberg). 12. Ditto \times 290 (Jersey, Piquet). 13. Ditto \times ? (ditto).

d. Lamellæ prominent at the margin.

4. **Fossombronia Dumortieri** (*Hüb. et Genth.*), *Lindb.*

Codonia Dumortieri, Hüb. et Genth. *Deutschl. Leberm.* n. 80 (1837).

Fossombronia foveolata, Lindb. *Not. pro F. et Fl. Fenn.* p. 382 (1874).

Fossombronia Dumortieri (Hüb. et G.), Lindb., *Not. pro F. et Fl. Fenn.* 13, p. 380 (1874).

Heteroicous, very fetid, cæspitose, small, green in colour. Stems procumbent, simple or sub-ramose, thick, on a cross-section sub-carinate, purple-violet below; radiculose, rootlets purple-violet. Leaves small, slightly imbricate, obliquely obtuse or sub-quadrate, entire or irregularly (once or several times) lobate or dentate, lobes acute or obtuse; texture delicate, unistratose, cells medium size, sub-quadrate, walls thin, no thickened angles. Perianth shortly obpyramidal, mouth wide, shortly and irregularly dentate or incised. Capsule spherical, composed of two layers of cells, inner layer with numerous yellowish-brown, firm, but generally imperfect semi-annular spiral threads. Spores pale brown, tetrahedral-globose, regularly foveolate, pits 12–18, large, pale yellow, 4–6-angled, ridges slightly raised, sub-membranaceous, regularly anastomosing, 20–30 acute teeth projecting beyond the margin. Elaters short and moderately thick, pale brown, bi-rarely tri- or quadri-spiral. Perigonial bracts either below the perianth or on separate plants, 4 to 5 pairs closely imbricate, somewhat roundish, smaller, saccate, margin sub-entire; antheridia roundish-oval.

DIMENSIONS.—Stems about $\frac{1}{4}$ inch long; leaves .8 mm. \times .8 mm., .8 mm. \times 1.1 mm., .6 mm. \times 1. mm., 1. \times .8 mm.; spores .04 mm., .045 mm.; elaters .12 mm. to .135 mm. long; perigonial bract .7 mm. \times 1. mm.; antheridia .2 mm. \times .15 mm.

HAB.—On damp moorlands, or by the margin of ditches. Rare.

10. Barmby Moor, *Dr. Spruce*; Pocklington, *Dr. Spruce*; Allerthorpe Common, East Yorkshire, *J. J. Marshall*; Skipworth Common, near Selby, *William Ingham*.

Found on the Continent and in North America.

Obs.—From the other fetid *Fossombronia*, distinguished by its still stronger disagreeable smell.

The spores are similar to those of *F. angulosa*, only with more numerous and much smaller pits, the ridges are more depressed and the marginal projections number from 20 to 30.

DESCRIPTION OF PLATE CLXXXVI.—Fig. 1. Plants natural size. 2, 3. Plants \times ? (Allerthorpe Common, Marshall). 4–7. Leaves \times 16 (ditto). 8–10. Ditto \times ? (ditto). 11. Portion of leaf \times 290 (Finland, Lindberg). 12–15. Cross-sections of stem \times 24 (ditto). 16. Portion of stem with perianth \times ? (Allerthorpe Common, Marshall). 17. Young capsule \times 24 (Finland, Lindberg). 18. Spore \times 290 (Allerthorpe Common, Marshall). 19. Ditto \times 400 (Lindberg). 20. Ditto \times 400 (Corbière). 21. Perigonial bract \times 24 (Allerthorpe Common, Marshall). 22. Antheridium \times 64 (ditto).

(C.) Spores with lamellæ compressed into papillæ.
e. Papillæ truncate.

5. *Fossombronia cæspitiformis*, De N.

Fossombronia angulosa, var. *B. cæspitiformis*, Radd. in Att. soc. sc. Modena. XVIII., p. 41, excl. synonym. (1818)?

Fossombronia cæspitiformis, De N. in G. R. Hep. eur. dec. 13 et 14, n. 123.

Heteroicous, fetid, cæspitose, small, of a green colour. Stems procumbent or sub-erect, simple or slightly branched, on a cross-section subterete; radiculose, rootlets violet-purple. Leaves crowded, obcuneate, sub-quadrate or oblong-quadrate, lobate, lobes obtuse; texture delicate, cells medium size, sub-quadrate, walls thin, no trigones or thickened angles. Bracts sub-quadrate or roundish-obovate, margin denticulate. Perianth obpyramidal, plicate, mouth wide, irregularly lobate-dentate. Calyptra delicate. Capsule globose, dark brown. Spores dark brown, tetrahedral-globose, densely echinate, spines obtuse, numerous, about 25 projecting around the margin; elaters long, pale brown, bi-rarely tri-spiral.

Andrœcia usually situated below the perianth, exposed or in the axil of the bracts, or more rarely on separate plants.

DIMENSIONS.—Stem $\frac{1}{4}$ inch long \times 1 mm. to 2 mm. wide; leaves 1.75 mm. \times 1 mm., 1.5 mm. \times 1 mm.; bracts 1.75 mm. \times 1.5 mm., 1.5 mm. \times 1.5 mm.; perianth 1.75 mm. \times 1.5 mm. wide at the mouth; calyptra .75 mm. \times .4 mm.; spores .04 mm., .045 mm.; elaters .2 mm. \times .015 mm.

HAB.—On bare damp soil. Very rare.

5. Rugeley, Staffordshire, *Rev. H. P. Reader*. 12. Whitbarrow, Westmorland, *G. Stabler*.

Found on the Continent, Algeria, Madeira, Teneriffe, and Abyssinia.

Obs.—Rather smaller than the other species with a more compact lettuce-like habit, spores with numerous blunt spines; the rootlets are not so deep purple as in the other species.

DESCRIPTION OF PLATE CLXXXVII.—Fig. 1. Plants natural size. 2, 3. Cross-sections of stem \times 24 (Whitbarrow, Stabler). 4, 5. Leaves \times ? (Algiers Herb. Tindall). 6. Leaf \times 16 (Whitbarrow, Stabler). 7. Portion of leaf \times 290 (G. & R. n. 377). 8. Bracts \times 16 (ditto). 9, 10. Bracts \times 16 (Whitbarrow, Stabler). 11. Perianth \times ? (Algeria, Herb. Tindall). 12. Ditto, explanate \times 16 (Whitbarrow, Stabler). 13. Calyptra \times 24 (ditto). 14. Spore \times 400 (Corbière). 15. Ditto (Lindberg). 16. Ditto \times 290 (G. & R. n. 377).

f. Papillæ long, hispid.

6. *Fossombronia Mittenii*, *Tindall*.

Fossombronia Mittenii, Tindall, "Journal of Botany," Feb. 1898.

Monoicous?, cæspitose, small, bright yellowish-green in colour. Stems simple, prostrate, creeping, fragile, radiculose; rootlets numerous, of medium length, bright reddish-purple in colour, giving the stem the appearance of being purple throughout. Leaves overlapping each other by about one-third of their breadth, more crenulate than lobed, much crisped, slightly angled, the

breadth being greater than the length, very pellucid, consisting of only one layer of cells throughout the leaf, rather large in size, the cells at the base being irregularly elongated and much larger than those at the edge of the leaf. Perianth large for the size of the plant, widely open at the crenulate mouth, situated either singly or in pairs at the apex of the frond. Spores large, yellowish-brown, closely covered with dark brown papillæ; papillæ very numerous, averaging about 110 on the face and edge of each spore, finely pointed, projecting like spines from the edge of the spore, so as to give it a spinulose appearance; elaters narrow, of medium length, with two spiral threads, rarely three; spiral threads loosely twisted.

DIMENSIONS.—Stems 4 mm. to 5 mm. long, .5 mm. wide, with leaves, stem .35 mm. × .7 mm., .25 mm. × .7 mm., leaves 1.25 mm. × 1.35 mm., cells .05 mm., .04 mm. × .05 mm., bracts 1.5 mm. × 2.5 mm., calyptra 1 mm. × .85 mm., spores .047 mm., .05 mm., elaters .15 mm. × .0125 mm.

HAB.—Bank on the side of the road between Parracombe and Braunton, North Devon, *W. Mitten*, Aug. 1875.

OBS.—“*Fossombronina Mittenii* belongs to the group of *Fossombroninæ* characterised by the papillose markings on their spores; in this division *F. cæspitifformis*, De Not. and *F. Husnoti*, Corb., are the only hitherto recorded European species. In *F. cæspitifformis* and *F. Husnoti* the papillæ are large, obtuse, comparatively far apart, and number from 20 to 25 on the face and edge of each spore.”—Mrs. Ella M. Tindall. The description and some of the figures are taken from Mrs. Tindall’s paper contributed to the “*Journal of Botany*,” Feb. 1898.

DESCRIPTION OF PLATE CLXXXVIII.—Fig. 1. Plants natural size. 2. Plant ×. 3, 4. Cross-sections of stem × 24. 5, 6. Leaves × 24. 7. Portion of leaf × 290. 8. Bract × 24. 9. Calyptra × 24. 10, 11. Spores ×. 12. Spore × 290. 13. Elater ×. (Original, Herb. Tindall).

Genus 38. **SCALIA**, Gr. & Benn.

Jungermania, Lyell, in Eng. Bot. t. 2555 (1813).

Scalia, Gr. & Benn. Nat. Arr. Brit. Pl. p. 704 (1821).

Mniopsis, Dum. Comm. Bot. p. 114 (1822).

Gymnomitrium, Corda in Opiz Beitr. i. p. 651, n. 1 (1829).

Haplomitrium, Nees, Nat. Eur. Leberm. i. pp. 98, 109 (1833).

Stems firm, suberect, rhizomatous, flexuose, flagelliferous, subsimple, leafy branches few, lateral. Leaves large, subtransverse, tristichous, lateral leaves broadly oblong or obovate, entire or with apices having a few irregular teeth, repand; postical leaf narrower; cells large, subquadrate or hexagonal, leptodermous. Inflorescence dioicous; ♀ terminal polygynous; bracts somewhat distant from the receptacle, slightly broader than the leaves, often incisedentate. Perianth absent. Calyptra large, subcylindrical, much longer than broad, leptodermous or somewhat fleshy below, the base and a little above it surrounded by the sterile pistillidia. Capsule highly exserted, fusiform-cylindrical, composed of one layer of cells, dividing irregularly and incompletely into 4 valves. Elaters slender bi- or uni-spiral, deciduous.

Scalia Hookeri (*Lyell*), Gr. & Benn.

Jungermania Hookeri, Lyell in Engl. Bot. t. 2555 (1813); Hook. Brit. Jung. t. 54 (1816).

Scalia Hookeri, Gr. & Benn. Nat. Arr. Brit. Pl. p. 704 (1821).

Dioicous, loosely caespitose, small, of a dull green colour. Stems erect, slightly flexuose, simple or rarely furcate, often with a young innovation, succulent; radiculose, rootlets horizontal, thick, subcarnose, simple or branched, dull white in colour. Leaves distant or crowded, loosely imbricate, patent or erecto-patent, sometimes a little recurved, tristichous, varying in shape and size, the lower ones smaller and roundish-ovate, upper ovate-oblong or lingulate, obliquely decurrent, repand, margin dentate, irregular or entire; texture somewhat thin and delicate, cells rather large to

large, 4-, 5-, and 6-sided, subquadrate, near the base elongate, walls thin, no trigones or thickened angles. Female bracts imbricate, oblong-ovate, concave. Perianth wanting. Calyptra quite exposed, oblong or linear-oblong, carnose, smooth. Pedicel white, filiform, succulent. Capsule linear-oblong, pale brown, reticulated, delicate, sub-pellucid, 4 sometimes 5 equal linear valves; "it is sometimes cloven on one side only; rarely are all the valves completely separated, but mostly remain cohering at the apex even when free elsewhere. The capsule-wall consists of a single layer of cells, except at the apex, where an inner lining of thin cells is added. Several elaters are attached to this apical cupola, but they are equally long and slender as the others; they are either monospirous throughout, or dispirous below, but with one thread running out at about midway. All the other elaters are dispirous, and a good many of them are entangled in the apical elaters, with which they persist for a time, but soon fall away along with them."—R. Spruce. Spores roundish-angular, reddish-brown, verruculose. Perigonial bracts terminal, larger than the stem leaves, variable in shape, not closely imbricated nor ventricose at the base, apex rather expanded, exposing the antheridia, of which there are several at the base of each bract, spherical in shape, yellow to orange in colour and furnished with a short stipe.

DIMENSIONS.—Stems about $\frac{1}{2}$ inch long, leaves 1·75 mm. \times 1·25 mm., cells, near base of leaf, ·1 mm. \times ·05 mm., ·075 mm. \times ·05 mm., near middle and apex ·045 mm. \times ·035 mm., ·06 mm. \times ·035 mm.; bracts 2·25 mm. \times 1· mm.; bracteole 2· mm. \times ·75 mm.; perianth 4· mm. \times ·75 mm.; pedicel about $\frac{1}{2}$ inch long; capsule 2· mm. \times ·6 mm.; spores ·03 mm.; elaters ·4 mm. \times ·01 mm.; perigonial bracts 2· mm. \times ·6 mm.

HAB.—Heaths and damp places. Very rare.

1. Chyanhal Moor, Penzance, Cornwall, *W. Curnow*, Aug. 1844.
2. Private road from Cadnam to Poultons, New Forest, Hampshire, *C. Lyell*, Dec. 1812.
10. Barmby Moor, near York, *R. Spruce*, Nov. 1842.
15. Kinnordy, Forfar, *C. Lyell*, Aug. 1813.
16. Moidart, West Inverness, *S. M. Macvicar*, 1898. *S. M. Macvicar & W. H. P.*, 1899.

I. Connor Hill, near Dingle, *Professor S. O. Lindberg*, 1873.
Found on the Continent.

Obs.—This, about the rarest of all our British species, was discovered by Mr. C. Lyell, and justly named by him in honour of Sir Wm. Jackson Hooker, whose magnificent “British *Jungermanniæ*” is a monument of the intimate and loving knowledge he had of this group.

It is so distinct a species as to be impossible to be mistaken for any other.

DESCRIPTION OF PLATE CLXXXIX.—Fig. 1. Female plants natural size. 2. Portion of female plant \times (Hooker). 3. Ditto with perianth \times (ditto). 4. Upper portion of leaf \times 290 (Helsingfors, S. O. L.). 5. Ditto lower portion of leaf \times 290 (ditto). 6, 7. Bracts \times 16 (ditto). 8. Bracteole \times 16 (ditto). 9. Perianth and opened capsule \times (Hooker). 10. Spores \times (ditto). 11. Elater \times (ditto). 12. Male plant natural size (ditto). 13. Upper portion of male plant with antheridia \times (ditto). 14. Perigonial bract with antheridia \times (ditto).

Genus 39. **PETALOPHYLLUM**, *Gott.*

Petalophyllum, Gottsche in Lehm. Pug. viii. p. 29 (1844).

Plants frondose, small, tender, cæspitose. Fronds substipitate, subcircular or reniform; costa thick; radiculose; wings lamellate. Inflorescence dioicous. Perianth produced from middle of stem, large, tubular, mouth wide, dentate. Calyptra free, surrounded at base by a few pistillidia. Capsule globose, large, rupturing irregularly. Spores large, reticulate. Elaters deciduous, short, bi-tri-spiral, loosely twisted. Male flowers produced in the lamellæ; antheridia numerous.

Petalophyllum Ralfsii (*Wils.*), *Gott.*

Jungermania hibernica, var. *Wils.* Eng. Bot. t. 2750, f. 15, 16 (1832).

Jungermania Ralfsii, *Wils.* Eng. Bot. Suppl. t. 2874 (1843).

Diplolena Lyellii, var. *lamellata*, *Nees*, Nat. Eur. Leberm. 111, pp. 345, 352 (1838).

Petalophyllum Ralfsii (*Wils.*), *Gott.* in *Lehm.* Pug. pl. nov. et min. cogn. viii. p. 29 (1844), *G. L. N. Syn. Hep.* p. 472 (1846).

Codonia Ralfsii, *Dum.* Hep. Eur. p. 16 (1874).

Petalophyllum lamellatum, *Lindb.* in *Meddel. Soc. F. Fl. Fenn.* 1, p. 91 (1874).

Fossombronina corbuleformis, *Trabut*, Atlas Fl. Alg. p. 7 (1886).

Diocious, cæspitose, closely attached to the ground, small, light green in colour. Fronds procumbent, furcate, broadly obovate or reniform, flattish, beset on the antical side with lamellar processes disposed in radii towards the extremity of the frond, which is somewhat emarginate; texture rather flaccid, cells largish to large, walls thin, with numerous chlorophyl granules attached to their sides, making them to appear somewhat thick, midrib prominent, postically thick, often lengthened out at the base of the frond and denuded so as to resemble a stipe, covered beneath with numerous rootlets. Perianth antical, proceeding from the middle of the frond, tubular, wide at the mouth, which is dentate. Calyptra smaller. Pedicel thick and somewhat persistent. Capsule oblong-spherical, slightly apophysate, coriaceous, splitting to the base into two valves which are usually bidentate. Spores brown, reticulate, walls raised, giving them a bordered appearance not unlike *F. angulosa*, margin hyaline, areolæ 5, 6 across, 20 to 25 cells round. Elaters brown, narrow, bi-tri-spiral. Male fronds broader, antheridia numerous, oval, enclosed in the laminæ, more frequently near the midrib or enclosed in scale-like processes on the mid-rib.

DIMENSIONS.—Fronds about $\frac{1}{4}$ inch long \times $\frac{1}{4}$ inch broad, stems 2 mm. broad \times 1 mm. thick; cells of frond .06 mm.; perianth 4.5 mm. \times 2.25 mm.; capsule 2 mm. \times 1.5 mm.; spores .07 mm.; antheridia .275 mm. \times .175 mm.

HAB.—Damp sandy flats on the coast. Very rare.

1. Near Penzance, *J. Ralfs*. Formerly on the roadside

between Loggan's Mill and Treve, Phillack, and between Hayle Causeway and St. Erth, *W. Curnow*; Gwithian, near Penzance, *W. Curnow*. 7. Aberffraw, Anglesey, *J. Ralfs*, *W. Wilson*, *W. H. P.*, 1900. 9. Southport, Lancashire, *Dr. Carrington*, *C. J. Wild*, *W. H. P.* 10. Coatham Marsh, Yorks, *W. Ingham*, 1901.

I. Malahide, *Dr. D. Moore*.

Algiers, *Trabut*.

OBS.—Mr. W. Curnow, in his "Hepaticæ of West Cornwall," says: "One of the most interesting additions was a new species, *Petalophyllum Ralfsii*, first discovered by Mr. Ralfs in an immature state on the sand-flats of Aberffraw, in Anglesey, and in the spring following I gathered it with perfect fruit at Hayle, growing in company with *Moerckia hibernica*. I regret to say that this locality for it has since been destroyed by drainage, &c. In consequence of this find an animated contest ensued between Dr. Taylor and Mr. Wilson and Mr. Ralfs, each of our opponents considering it a form of one or other of the known species of *Fossombronia*. Mr. Ralfs, however, with his usual clearness of perception, and a praiseworthy pertinacity in maintaining what he believed to be the truth, ultimately won his case, and established the right of the plant to the rank of a new species, whereupon Mr. Wilson courteously appended to it the name of the discoverer."

It is a singular species, easily recognised by the lamellate fronds.

DESCRIPTION OF PLATE CXC.—Fig. 1. Fertile frond, nat. size. 2. Male frond, slightly magnified. 3. Frond with cross-section of perianth (after Wilson, Eng. Bot.). 4–6. Cross-sections of stem $\times 11$ (Southport, C. J. Wild). 7. Portion of frond $\times 290$ (ditto). 8. Perianth $\times 11$ (Aberffraw, Wilson). 9. Spore $\times 290$ (Penzance, J. Ralfs). 10. Antheridium $\times 24$ (Southport, Wild).

Genus 40. **PALLAVICINIA**, *Gr. & Benn.*

Pallavicinia, Gr. & Benn. Nat. Arr. Brit. Pl. (1821).

Dilena, Dum. Comm. Bot. (1822).

Blyttia, Endl. (1840), G. L. N. Syn. Hep. (1846).

Fronds prostrate or suberect, green, radiculose, strongly costate, simple or with a few postical branches, rarely furcate at the apex. Inflorescence dioicous, antical. Bracts ♀, 2-3 series, variously divided, more or less connate. Perianth large, tubular, fleshy, mouth ciliate. Calyptra included, equal or shorter than the perianth, irregularly torn at the apex, somewhat delicate, below the middle only somewhat fleshy and surrounded by the (about 20) sterile pistillidia. Capsule on a long pedicel, cylindrical, composed of one layer of cells, dividing to its base into 4 valves, often incompletely. Elaters slender, bispiral, deciduous. Spores minute. Andrœcia uniseriate, situated on the margin of the midrib, at the base of small incised or dentate perigonial bracts. Antheridia solitary.

1. **Pallavicinia Lyellii** (*Hook.*), *Gr. & Benn.*

Jungermania Lyellii, Hook. Brit. Jung. t. 77 (1816).

Pallavicinia Lyellii, Gr. & Benn. Nat. Arr. Brit. Pl. p. 775 (1821).

Dilena Lyellii, Dum. Comm. Bot. p. 114 (1822).

Blyttia Lyellii, Endl. Gen. Pl. (1840).

Steezia Lyellii, Lehm. Pl. Preiss., II. p. 129 (1846).

Dioicous, in spreading patches, often stratified, medium size, pale to yellowish green in colour. Fronds horizontal, simple or with one or two lateral branches proceeding from the postical side of the frond, oblong, nearly linear or obovate-ligulate, strongly costate, costa plano-convex, postically rotundate, composed of several layers of cells, with a strand of narrow, elongated, darker coloured ligneous cells along the centre, sometimes two strands are observed, apex of frond emarginate, very rarely furcate, gradually or abruptly narrowing at the base, margin undulate, entire or subserrate; radiculose, rootlets few, proceeding chiefly

from the costa, simple, pellucid; texture delicate, cells of the pagina large, oblong-hexagonal, walls thick, no trigones, leptodermous, pellucid. Flowers ♀ antical, often two, proceeding from the costa, about the middle of the frond. Bracts very short, connate, palmatifid-laciniate. Pistillidia 12-20, long and narrow. Perianth erect, linear-cylindrical, fleshy, below 5 cells thick, mouth sub-constricted, lobate-ciliolate. Calyptra a little shorter than the perianth, above delicate, near to the base 2, 3 cells thick, apex irregularly ruptured. Pedicel elongate, delicate, white. Capsule sub-cylindrical, 5 times longer than broad, 4-valved, valves often cohering at the apex, delicate, walls composed of one layer of linear cells. Spores reddish-brown, roundish-angular, finely verruculose. Elaters very long and narrow, pale brown.

Male plant more delicate. Perigonial bracts antical, situated along the middle of the frond, imbricate, scale-like, laciniate-ciliate. Antheridia large, solitary, sub-globose, shortly stipitate.

DIMENSIONS.—Fronds 1 to 2 inches long, 2 mm. wide, costa .85 mm. × .35 mm. thick; cells .08 mm. × .05 mm., .06 mm. × .04 mm., .05 mm., .04 mm.; bracts ♂ 1.5 mm. high; perianth 1.0 mm. × 1.3 mm.; pistillidia .6 mm. long; pedicel 3.5 mm. long; capsule 4 mm. × .8 mm., 3 mm. × .75 mm.; spores .04 mm. diam.; elaters .5 mm. × .02 mm.; antheridia .3 mm. × .25 mm.

HAB.—Boggy spots amongst *Sphagnum*, and on wet dripping rocks. Very rare.

2. New Forest, Hampshire, *C. Lyell*; nr. Tunbridge, Sussex, *Foster*. 7. On wet rocks near Cader Idris, Merionethshire, *J. Ralfs*? 11, 12. Foulshaw Moss, Westmorland, *G. Stabler*. 13. Lochar Moss, Dumfriesshire, *James Cruickshank*.

1. South of Ireland, Bantry, *Miss Hutchins*; Lough Bray, *Dr. Taylor*; Maghanabo Glen, near Fermoy; Castlegregory and by the lakes between Maghanabo Glen and Connor Hill, Co. Kerry, *Dr. D. Moore*.

Found on the Continent and in North and South America and other parts of the world.

Obs.—Distinguished when sterile from any British frondose

species by the presence of a strand of strong, ligneous, narrow, elongated cells running along the centre of the costa; when fertile by the short, lacinate bracts, surrounding the erect linear-cylindrical perianth, which encloses a relatively large calyptra.

DESCRIPTION OF PLATE CXCI.—Fig. 1 and 2. Plants natural size. 3. Portion of fertile plant \times (Hooker). 4. Cross-section of frond \times 24 (Herb. Austin). 5, 6. Ditto \times 16 (ditto). 7. Portion of frond \times 290 (ditto). 8. Female flower (bracts, perianth, and calyptra) \times . 9. Section of female flower, showing bract, perianth, pistillidia, and germen \times . 10. Bract \times . 11. Capsule and portion of pedicel \times . 12. Portion of male stem, showing perigonal bracts and ligneous strand \times . 13. Perigonal bract and antheridium \times . 14. Antheridium \times (Hooker).

2. *Pallavicinia hibernica* (Hook.), Gr. & Benn.

Jungermania hibernica, Hook. Brit. Jung. t. 78, & suppl. t. 4 (1816).

Pallavicinia hibernica, Gr. & Benn. Nat. Arr. Brit. Pl. p. 684 (1821).

Dilæna hibernica, Dum. Comm. bot. p. 114 (1822).

Diplolaena hibernica, Dum. Syll. Jung. p. 83, t. 2, f. 21 (1831).

Diplolaena Lyellii, var. *hibernica*, Nees Nat. Eur. Leberm. 111, p. 343 (1833).

Diplomitrium hibernicum, Corda in Sturm Deutschl. Fl. fasc. 22, p. 87, t. 23 (1835).

Moerckia hibernica, Gottsche in G. & R. Hep. Eur. Exsicc. n. 295 (1866).

Delin. Hook. Brit. Jung. tab. 78 et Suppl. tab. 4; Ekart Syn. Jung. Germ. tab. x. fig. 84, et tab. xiii. fig. 116a; Husn. Hep. Gall. pl. xi. fig. 124.

Dioicous, loosely cæspitose, medium to largish in size, odorous, pale green colour. Fronds procumbent, loosely imbricate, once or twice dichotomously furcate, oblong, margin entire, undulate; texture somewhat delicate, cells medium to rather large in size, quadrate or oblong-quadrate, walls thick, no trigones, midrib thick, broader than thick, 20 cells broad \times 16 cells thick, gradually diminishing in thickness into the lamina, usually with no ligneous strands, lamina on each side of the midrib 8 to 10 cells wide composed of 2 or 3 layers of cells; radiculose, rootlets hyaline, rarely reddish. Female flowers several, produced antically from the mid-rib; bracts two, surrounding base of the

perianth to about one-fourth its height, suborbicular, lacinate-dentate. Perianth large, oblong-ovate, slightly plicate, unistratose near the middle, about 130 cells round, near base two or three cells thick, mouth a little constricted, irregularly and sparsely dentate. Calyptra half the size. Pistillidia long, about 6. Capsule dark reddish brown, oblong-ovate, dividing to the base into 2 or 3 bidentate or entire valves; spores dark reddish brown, with numerous irregular ridges, giving them a minutely verruculose marginal appearance; elaters very narrow, pale brown. Androecia produced in scale-like bracts antically from the mid-rib, perigonal bracts broadly oval, subconcave, apex irregularly dentate; antheridia large, oval spherical.

Fruits about the middle of April.

DIMENSIONS.—Fronds $\frac{1}{2}$ to 2 inches long, 3 to 4 mm. broad, mid-rib .6 mm. broad \times .4 mm. thick; cells .04 mm. \times .05 mm., .03 mm. \times .04 mm., .04 mm. \times .04 mm.; bract 1 mm. high \times .75 mm. broad; pistillidia .3 mm. \times .075 mm.; perianth 4 mm. \times .2 mm.; pedicel .175 mm. diam.; valve of capsule 2 mm. \times 1.25 mm.; spores .035 mm.; elaters .4 mm. \times .01; perigonal bracts .75 mm. \times .6 mm., .65 mm. \times .5 mm.; antheridia .275 mm. \times .2 mm.

HAB.—On elevated marshy situations amongst *Sphagna*. Very rare. 15. Catlaw Hills, Kinnordy, Forfar, *C. Lyell*, 1822.

I. Amongst *Sphagnum cuspidatum* and *Jungermania emarginata* on the shores of Lough Bray, a very elevated situation near Dublin, *Dr. Taylor*. *D. McArdle*, July, 1878.

OBS.—The description is that of the original *Jung. hibernica* published by Hooker in his "British Jung."; two other forms have been grouped with it which probably deserve to rank as distinct species. The type is distinguished from them by its much larger size, long, slender, slightly undulate fronds in addition to other characters.

Distinguished from *Pallavicinia Lyellii* (Hooker) by the absence of a nerve in the midrib, by its strong smell in addition to other characters.

Var. *Wilsoniana*, Gottsche (*Pallavicinia Wilsoniana* (G.),

Pears. MS.). *Jung. hibernica*, Wilson in Eng. Bot. 2, tab. 2750, excl. lower half of plate (1834).

Delin. Eng. Bot. 2, tab. 2750, pp. Husn. Hep. Gall. pl. XI. fig. 124, b, c, d.

Exsicc. G. et R. n. 163; C. and P. n. 143.

Closely cæspitose, small. Fronds more upright, crisp, much folded: mid-rib thicker, bracts more lacinate than in either of the two other forms.

DIMENSIONS.—Capsule 2·5 mm. × 1· mm., spores ·05 mm., ·04 mm., elaters ·35 mm. × ·01 mm., ·2 mm. × ·01 mm.

HAB.—In marshy sandy stations, usually on the coast. Rare.

1. Phillack; Hayle Sands, Cornwall, *W. Curnow*, 1842. 7. Aberffraw, Anglesey, *W. Wilson*, fruit April 1829, September 1830. *W. H. P.*, 1900. 9. Southport, Lanc., *Dr. Carrington*, 1863, 1865; *C. J. Wild*, 1882; *W. H. P.* Coatham Marshes, Yorks., *Wm. Ingham*, 1899. 15. Drumlie Airy, a waterfall on the Noran, Forfar, *C. Lyell*.

Found on the Continent (Finland, Germany, France, Switzerland, and Italy); also in North America.

Var. *leptodesma* (*Pallavicinia leptodesma*, Tansley in litt.).

Fronds $\frac{1}{2}$ to 1 inch long, simple or furcate, margin irregularly lobed, mid-rib with two lateral rudimentary strands, perianth longer and narrower than in type or var. *Wilsoniana*. Spores light to dark brown. Elaters very light brown, very narrow, bi-spiral, 8–10 spiral turns.

HAB.—In marshy, sandy situations on the coast. Very rare.

I. Malahide, *Dr. D. Moore*, *D. McArdle*.

DIMENSIONS.—Perianth 5·5 mm. × 1·5 mm., capsule 2·5 mm. × 1·1 mm., spores ·05 mm., elaters ·275 mm. × ·01 mm., ·2 mm. × ·015 mm.

Obs.—With reference to this variety or species Professor Tansley writes: “We have finished our investigation of the *Pallavicinia-Symphogyna-Hymenophyton* group in reference to the strand of prosenchymatous cells. I was fortunate enough to get living specimens of *Pallavicinia Lyellii* from Professor Howe of New York as you suggested, and find that the strand is water-

conducting, though water passes through it much more slowly than is the case in mosses. In *P. hibernica* from Malahide, which Mr. McArdle sends me, we find two lateral strands of very thin walled but distinctly prosenchymatous cells which may be water conducting, but not having living material I cannot tell for certain. In larger plants from Lough Bray (*Jung. hibernica*, Hook. Brit. Jung. type) we can find no trace of such strands, neither can we in the specimens you sent from Coatham Marshes, Yorkshire, Wm. Ingram (var. *Wilsoniana*). “. . . there is the occurrence in the Malahide plant of two distinct lateral veins in the mid-rib. The walls of the cells of these veins are distinctly lignified though very little if at all thickened, and in other respects, so far as can be seen from dried material, the strands are rudimentary compared with that of *P. Lyellii* and other species of *Pallavicinia*, *Symphogyna*, &c. I shall, of course, be glad to know if you find other characters in the Malahide plant distinguishing it from true *P. hibernica*, but even if not, the marked anatomical characters I find seem to me to justify its separation as a distinct species. In the absence of more conspicuous external characters I would suggest *leptodesma* as a specific name in allusion to the rudimentary character of the strands.” For an account and figures of these strands see Tansley and Chick, “Notes on the Conducting Tissue System in Bryophyta,” *Annals of Botany*, Vol. xv., March, 1901.

DESCRIPTION OF PLATE CXCII.—Fig. 1. Plant natural size (Hooker). 2. Frond \times ? (ditto). 3. Cross-section of midrib \times 24 (Lough Bray, McArdle). 4. Portion of frond \times 290 (var. *Wilsoniana*), (Hayle, Curnow). 5. Portion of bract and perianth \times ? (Hooker). 6. Portion of bract and pistillidia \times 24 (Lough Bray, McArdle). 7. Capsule \times ? (Hooker). 8. Portion of male frond \times ? (Hooker).

DESCRIPTION OF PLATE CXCIII.—Fig. 1. Plants natural size (var. *leptodesma*), (Malahide, McArdle). 2, 3. Ditto (var. *Wilsoniana*), (Aberffraw, Wilson). 4. Plants slightly enlarged (ditto). 5. Fertile plant \times 11 (var. *leptodesma*), (Malahide, McArdle). 6-8. Cross-sections of mid-rib \times 24 (ditto). 9. Perianth \times 11 (var.

Wilsoniana), (Hayle, Curnow). 10. Pistillidium \times 64 (Lough Bray, McArdle). 11. Spore \times 290 (var. *Wilsoniana*), (Hayle, Curnow). 12–14. Perigonial bracts \times 24 (ditto), (Southport, Wild).

3. *Pallavicinia Blyttii* (Moerck), Lindb.

Jaugermania Blyttii, Moerck Fl. Dan. x. 34, t. 2004 (1830).

Gymnomitrium Blyttii, Hüben. Hep. Germ. p. 44 (1834).

Cordea Blyttii, Corda in Sturm Deutschl. Fl. (1835).

Diplomitrium Blyttii, Corda in Sturm Fl. Germ. 11, p. 126 (1835).

Diplolaena Blyttii, Nees Hep. Eur. 111, p. 339 (1838).

Thedenia Blyttii, Hartm. Skand. Fl. (1820–43).

Blyttii Moerckii, G.L.N. Syn. Hep. p. 474 (1844).

Moerckia norvegica, Gottsch. in G. & R. Hep. Eur. n. 295 (1863).

Moerckia Blyttii, Gottsch. Ann. sc. nat. p. 83 (1864).

Dilaena Blyttii, Dum. Hep. Eur. p. 138 (1874).

Dilaena Blyttii, Dum. Hep. Eur. p. 138 (1874).

Pallavicinia Blyttii, Lindb. Musc. Scand. p. 10 (1879); Kaalaas Leverm. Norge, p. 451 (1893).

Calycularia Blyttii (Moerck) St. Sp. Hep. p. 360 (1900).

Dioicous, loosely or closely caespitose, medium size, pale green colour. Fronds oblong, simple or furcate, prostrate, somewhat thick; lobes sub-membranaceous; costate, mid-rib very prominent on the postical side; a cross-section of frond shows 20–30 layers of thin (those below purple-walled) cells, gradually becoming thinner near the margin where it is one layer thick; epidermic cells smaller than the inner, quadrate, large, walls firm, no trigones; margin undulate, sinuate, crispate; radiculose, rootlets numerous, close, reddish-brown. Female flowers antical; bracts surrounding the base of the perianth, undulate, plicate, unequally lacinate. Perianth projecting very much beyond the bracts, oval-campanulate, upper portion plicate, slightly laterally compressed, composed of several layers of cells, mouth unequally lacinate-dentate. Pistillidia 5–8. Calyptra thick. Capsule oval, valves firm, bi-tri-stratose, lanceolate, pedicel very long. Spores dark brown, verruculose. Elaters very narrow, bi-spiral, paler than the spores. Male flowers antical, bracts imbricate, biseriate,

plicate, obovate, simple or bilobed; antheridia large, single, roundish, style short and thick, composed of two rows of cells. Paraphyses few.

DIMENSIONS.—Fronds 2 c. mm. long \times 8 mm. broad; bracts 1 mm. high \times 2 mm. broad; perianth 5 mm. long; pistillidia .5 mm. \times .075 mm.; calyptra 3 mm. \times 2 mm.; valves of capsule 3 mm. \times 1 mm.; spores .035 mm.; elaters .275 mm. \times .01 mm.; male frond 3 mm. broad \times .7 mm. thick near the middle, male bracts .7 mm. \times .65 mm., .7 mm. \times .4 mm.; antheridia .275 mm. \times .25 mm.

HAB.—On small bare vertical peaty banks on grassy slopes, in alpine regions. Extremely rare.

Scotland, *John Sadler*. 15. Loch-na-gar, *George Stabler*, July 1884. Ben Wyvis, *George E. Davies*, July 1888. Ben Lawers, in several localities, 3100 to 3400 ft., *S. M. Macvicar*, June 1901.

Found on the Continent (Germany, Norway).

OBS.—This is an extremely rare British species, being only found in a few alpine situations.

From *Pellia* it is at once distinguished by its oval capsule, no other frondose species with which it is likely to be mistaken for, being found at such altitudes where it is met with.

DESCRIPTION OF PLATE CXCIV.—Fig. 1. Fertile plant natural size. 2. Ditto \times ? 3. Portion of male frond \times ? 4. Bract, explanate \times ? 5. Young perianth \times ? 6. Perianth \times ? 7. Mouth of perianth, explanate \times ? 8. Calyptra \times ? (“*Flora Danica*”).

DESCRIPTION OF PLATE CXCV.—Fig. 1. Cross-section of male stem \times 24 (Norway, Herb. Schimper). 2. Portion of frond \times 290 (Ben Lawers, S. M. Macvicar). 3. Bracts \times 24 (Loch-na-gar, G. Stabler). 4. Mouth of perianth, explanate \times 16 (Norway, Herb. Schimper). 5–8. Male bracts \times 24 (ditto).

Genus 41. **BLASIA**, *Mich.*

Blasia, Mich. Nov. Pl. Gen. p. 14 (1729); Linn. Fl. Suec. ed. 1, p. 933; ed. 2, p. 405 (1745), et Sp. Pl. p. 1605 (1753).
Jungermania, Hook. Brit. Jung. tt. 82-84 (1816).

Plant frondose, nerved. Fructification produced in a rupture of the nerve. Involucre bladder-shaped, adnate to the apex of the frond. Perianth enclosed within the utricular involucre. Calyptra obovate. Peduncle emerging from the apex. Capsule oval-globose, 4-valved, coriaceous. Elaters bi-spiral, deciduous. Antheridia immersed in the thallus, covered with dentate scales. Gemmæ globose, arising by a slender ascending tube from their large flask-like receptacles which are immersed in the thallus.

Blasia pusilla, *L.*

Blasia pusilla, Linn. Sp. pl. 1605 (1753).
Jungermania Blasia, Hook. Brit. Jung. t. 82 & 84 (1816).

Dioicous, in flat imbricating patches, medium size, pale yellowish or bluish-green in colour. Fronds prostrate, horizontal, costate, simple or with a single lateral branch, dichotomously divided, palmate with apices forked or rarely stellate; lobes usually oblong or linear-obovate, apices always broader than the base, often erect, margin pinnatifid or shortly lobate, sinuous, undulate, incurved; throughout the centre of the frond and its divisions runs an evident and broad nerve, most prominent on the postical side; texture fleshy, thinnest at the margin where it is membranaceous; at the middle 8-14 cells thick, gradually becoming thinner to the margins where it is one cell thick; cells somewhat indistinct, at the middle of the frond striate, narrow, elongate, near the margin medium size, oblong-quadrate or quadrate, marginal cells smaller, quadrate, very finely crenulate, walls thick and firm; radiculose, rootlets numerous, proceeding from the postical side of the frond but chiefly along the nerve, long, slender, hyaline. On the postical side of the frond are scattered small, hyaline, oval scales

resembling stipules which are unequally dentate. Involucre antical, oblong-lanceolate, inflated, semi-transparent, vanishing early, imbedded in an oval cavity in the mid-rib of the fronds. Calyptra obovate, free. Capsule oval-globose, on a long pedicel, 4-valved, valves thick, dull reddish brown in colour, inner layer with imperfect spiral threads. Spores sub-spherical, greyish-brown, slightly granulate; elaters very narrow, about $\frac{1}{5}$ the diameter of the spores, hyaline, bi-spiral. Male plant smaller, narrower and rarer; andrœcia imbedded in the antical side of the frond; antheridia elliptical, yellowish in colour, shortly stipitate. Gemmiparous; gemmæ numerous, globose, issuing by a slender ascending tube from their flask-like receptacles, which are immersed in the frond. Fruits March and April, quickly disappearing.

DIMENSIONS.—Fronds $\frac{1}{2}$ to 1 inch long, 4–6 mm. wide; cells $\cdot 03$ mm. \times $\cdot 04$ mm.; spores $\cdot 05$ mm. diam.; elaters $\cdot 2$ mm. long \times $\cdot 01$ mm. broad.

HAB.—On wet clayey banks in woods, or on moist heaths. Moderately rare.

1. Trembath, Chyanhal, Trungle Moor, Cornwall, *W. Curnow*; Madron Valley, near Carfury, and near Gurnard's Head, Cornwall, *E. D. Marquand*. 3. Road leading from Langton Green to Speldhurst Church, *Forster*, "Fl. Tunbr." 5. Banks of Severn, Seckley; Arley Wood; Dimmings Dale, Staffordshire, *W. Bagnall*. 7. Cwm Bychan, Merionethshire, *Rev. T. Salway*. 8, 9. Marple, Cheshire, *G. A. Holt*; Ashley, Cheshire, *W. H. P.*; Daisy Nook, Lanc., *G. A. Holt*, Sailor's Shore, Lanc., *G. A. Holt*, Holden Clough, Lanc., *G. A. Holt*. 10. Near Clapham, *Dr. Carrington*; Clay pool-side, near Sherburn, *Dr. F. A. Lees*; Halifax, *J. Bolton*; Todmorden, *John Nowell*; Pennant Clough, Hebden Bridge, *A. Stansfield*. 12. Low Borrow Bridge; Foulshaw; by river Lune, near Ingmire Hall, Westmorland, *G. Stabler*. 13. Damp roadsides, New Galloway, *J. McAndrew*; near Carronbridge, *Charles Scott*; Cluden Mill, Kirkeudbrightshire, *James Cruickshank*. 15. Den of Garrol, Aberdeenshire, *J. Sim*. 16. Moidart, West Inverness, *S. M. Macvicar*.

I. Castle Kelly Glen, Dublin, *Dr. Taylor*; near Wooden Bridge, Wicklow, *Dr. D. Moore*; at the base of Brandon Mountain, Kerry, *Dr. D. Moore*.

Found on the Continent, Northern Asia, and in North America.

OBS.—A very distinct species, the only one of the genus and easily recognised, even when barren, by the remarkable flask-like receptacles for the gemmæ and the beautiful hyaline serrated bracts on the postical side of the fronds.

DESCRIPTION OF PLATE CXCVI.—Figs. 1 & 2. Plants natural size. 3. Young frond \times . 4. Portion of frond with young receptacles for the gemmæ, the mouth not being yet opened. 5. Fertile plant \times . 6. Portion of frond, postical view showing scales. 7. Cross-section of female frond \times . 8. Capsule opened \times . 9. Antheridium \times . 10. Gemmæ \times (Hooker).

Genus 42. **PELLIA**, *Raddi*.

Jungermania, Linn. Fl. Suec. 1 ed., p. 399 (1745), et. Sp. Pl. 1 ed. 2, 1135, n. 23 (1753); Hook. Brit. Jung. t. 47 (1816).

Pellia, Raddi in Att. Soc. Modena, 18, p. 49 (1818).

Papa, Gr. and Benn. Nat. Arr. Brit. Pl. 1, p. 686, n. 12 (1821).

Scopulina, Dum. Comm. Bot., p. 115 (1823).

Plants frondose. Involucre monophyllous, arising from the antical side of the frond near the apex, cup-shaped, short, mouth lacerate or dentate. Perianth wanting. Calyptra oval, membranaceous, longer or shorter than the involucre. Capsule globose, dividing nearly to the base into 4 valves. Spores angular, oblong. Elaters free, bi-spiral. Elater-bearers attached to the inner face of the valves. Antheridia globose, immersed on the antical surface of the broad indeterminate thickening of the frond.

1. *Pellia epiphylla* (L.), Lindb.

Jungermania epiphylla, L. Sp. pl. ed. 1, 2, p. 1135 (1753).

Pellia epiphylla, A forma *Dillenii*, Gottsch. in Hedwigia, p. 69 (1867).

Pellia epiphylla, Lindb. Hep. in Hib. p. 534 (1874); Limpr. in Cohn Krypt. Schles, 1, p. 328 (1876).

Marsilia epiphylla, Lindb. Musc. Scand. p. 10 (1879).

Monocious, growing in spreading, flat patches, largish, deep green in colour. Fronds imbricating, and matted together by means of their rootlets, simple or irregularly once divided, segments oblong or broadly cuneate, margin entire near the base, near the apex irregularly incised, sinuate or sublobate, broadly nerved, near the middle 14-16 cells thick, gradually becoming thinner towards the margins; texture submembranaceous, cells largish to large, 4-, 5-, and 6-sided, elongate, walls thin, no trigones; radiculose, rootlets brownish white, numerous, close, short. Involucre proceeding from the antical side of the frond, near the apex or more rarely the middle, subcylindrical, plicate, mouth slightly dilated, irregularly inciso-dentate. Calyptra ovate, when older oblong, tuberculate, exserted, carnose, composed of several layers of cells. Pedicel long, hyaline, 18 cells thick. Capsule spherical, pale greyish-brown, dividing into 4 equal, ovate valves, which soon recurve, outer layer composed of hexagonal cells, whose corners are thickened, inner layer with elongated cells containing numerous semi-spiral rings. Elater-bearers for some time persistent at the base of the capsule, 20 to 40, in a dense entangled mass, brownish colour, irregular in length, at the free end conical, obtuse, usually with 1 or 2 brown spiral threads, sometimes 3 or 4, rarely 5 or 6, at their free end, they are more or less uncinat, holding some of the true elaters and spores for a longer or shorter time back. Elaters very long, slender, twisted, usually bi-spiral. Spores oval, greenish-yellow, finely muriculate. Male flowers situated on the antical surface of the frond and always confined to the nerve, in which the antheridia are imbedded irregularly in two rows.

Fruits in Spring.

DIMENSIONS.—Fronds $\frac{1}{2}$ to 2 inches long, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad, cells .09 mm. \times .045 mm., .09 mm. \times .055 mm., .11 mm. \times .05 mm., .09 mm. \times .05 mm.; pedicel 1 to 2 inches long; calyptra 3 mm. high \times 1 mm. broad; valves of capsule 1.75 mm. \times 1.2 mm.; elater-bearers 1 mm long \times .025 mm. broad; elaters .5 mm. long; spores .125 mm. \times .1 mm.

HAB.—Growing in large patches on banks and rocks in damp or wet shady situations, in ditches or springy places.

Common.

1 to 18. I.

Europe, North America.

Obs.—A common species, which fruits plentifully in Spring. It is distinguished when fertile from other frondose species by its long delicate pedicel, which supports a rather large capsule, containing an extraordinary number of spores and elaters; Herr Jack has counted one containing no fewer than 4500 of the former and 5000 of the latter. When sterile, the large, submembranaceous, dark green, broadly nerved frond will distinguish it.

For the characters separating it from *Pellia calycina* (Tayl.), and *Pellia Neesiana* (G.), see notes under those species.

DESCRIPTIIONS OF PLATE CXCVII.—Fig. 1. Fertile plants, natural size (Ekart, after Hooker). 2. Young fertile plant, magnified (ditto). 3. Cross-section of the same, more highly magnified (ditto). 4. Portion of frond \times 290 (Llanfaelog, W. H. P.). 5. Capsule magnified (Ekart, after Hooker). 6. Opened capsule, showing elater-bearers \times 10 (Jack). 7. Elaters and spores \times 75 (ditto). 8. Elater-bearers \times 75 (ditto). 9. Elater \times 316 (ditto).

2. *Pellia Neesiana* (Gottsch.), Limpr.

Pellia epiphylla, B forma *Neesiana*, Gottsche in Hedwigia, p. 69 (1867).

Pellia Neesiana, Limpr. in Cohn Krypt. Fl. Schles. 1, p. 329 (1876); Jack, Flora, p. 81 (1895); Howe Hep. and Antho. of California, p. 76 (1890); Macvicar, Journ. of Bot. July (1900); Stephani Sp. Hep. p. 366 (1900).

Marsilia Neesii, Lindb. Musc. Scand. p. 10 (1879).

Pellia Neesii, Limpr. Kaalaas, Leverm. Norge, p. 456 (1893).

Dioicous, growing in flat creeping layers, especially the fertile plants, medium to largish in size, not so robust as *Pellia epiphylla*, dark green to reddish brown, older plants dark brown in colour. Fronds elongate, cuneate, somewhat sparingly dichotomously branched with oblong or linear segments, margin plane or frequently undulate, middle of frond 10–12 cells thick; radiculose, rootlets numerous, brownish-white. Involucre antical, smooth, perfect, viz., forming a complete ring, cylindrical, longitudinally plicate, mouth truncate, entire or crenulate. Calyptra usually more or less exerted, sometimes included, thick, composed of 5 layers of cells at the base, at apex bistratose. Pedicel hyaline, delicate. Capsule spherical, pale brown, dividing into 4 equal, ovate valves, outer layer of cells nodulose, thickened at the angles, inner layer with numerous semi-spiral rings. Elaters and spores similar to those of *Pellia epiphylla*. Male plants simple or bifid, never repeatedly innovantly furcate; antheridia numerous, imbedded in the frond.

Fruits in Spring and early Summer.

DIMENSIONS.—Fronds $\frac{1}{4}$ to $1\frac{1}{2}$ in. long by $\cdot 7$ c.m. to 1 c.m. broad; involucre 1.2 mm. high; calyptra 1.3 mm. high; pedicel 3.5 c.m. long; capsule 1.5 mm. diameter.

HAB.—In wet grassy ground, Moidart, West Inverness, *S. M. Macvicar*, 1900. Commoner than *P. epiphylla*, above 3000 ft. on Ben Lawers, Perthshire; fruit 3200 ft. *S. M. Macvicar*, 1901.

Middle and North of Europe.

North America.

Obs.—Through the acuteness of Symers M. Macvicar, Esq., I am enabled to add with certainty this distinct species to my list.

In the "Journal of Botany," July 1900, he published it as new to Britain, and gives some interesting notes how to distinguish it from the two other species of the genus, from which I take the following :

"The fronds bear considerable resemblance to those of *P. calycina*, the species being undistinguishable with certainty when barren. The younger fronds are reddish-brown to dark green, frequently wavy at the edges; the older ones are dark brown, narrower, and flat. It also resembles *calycina* in being dioicous, but the male plant is without the hammer-shaped furcate innovations of the latter. The most distinctive character between the two species lies in the structure of the interior layer of the capsule wall, *calycina* being entirely without rings, while the present plant agrees with *epiphylla* in being furnished with them. The involucre forms a complete ring, as in *calycina*, the cylinder varying in length, but never so long as is frequently seen in the latter. The calyptra is more or less exerted, sometimes only slightly beyond the involucre, but more commonly for some distance, and frequently as much as in *epiphylla*. It is usually included in *calycina*.

"*Pellia epiphylla* differs in being monoicous, the antheridia being on the same frond as the female, and it has commonly much broader fronds, which are generally green. The darker coloured narrower forms cannot be distinguished with certainty in the barren state from *Neesiana*. Besides the difference in the inflorescence, *P. epiphylla* also differs from the two other species in that its involucre does not form a complete ring, the antical portion being absent; and the mouth of the involucre looks towards the apex of the frond, while in the others it is vertical. The calyptra is always highly exerted. The interior layer of the capsule wall has more numerous rings than in *Neesiana*."

3. *Pellia calycina* (Tayl.)

Jungermania calycina, Tayl. in Mackay Fl. Hib. 11, 55 (1836).

Jungermania endiviaefolia, Dicks. Pl. crypt. Brit. fasc. iv. p. 19 (1801)?

Jungermania epiphylla, var. *farreigera*, Hook. Brit. Jung. t. 47, f. 18 (1816).

Marsilia endiviaefolia (Dicks.) Lindb. Musc. Scand. p. 10 (1879).

Dioicous, growing in spreading flat patches, medium to largish in size, dark to brownish-green in colour, translucent, shining. Fronds dichotomous, proliferous, broadly linear, palmatifid, margins undulate, sometimes crisped and raised, midrib broad, distinct; texture thin but firm; cells large, hexagonal; radicle, rootlets brownish-white. Involucre proceeding from the middle of the frond near the apex on its antical side, large, erect, cup-shaped, ventricose, subplicate, mouth lacerate, irregularly dentate. Calyptra short, included, smooth. Pedicel delicate. Capsule spherical, light brown, composed of two layers of cells, inner layer destitute of the semi-spiral threads. Elater-bearers often about 100, attached to the base of the capsule, pale yellow, in the form of long threads, somewhat straight and not entangled, loosely and irregularly bi-spiral, sometimes uni- or tri-spiral. Elaters only slightly bent, both ends conical, with 3 or 4 spiral threads. Spores oval, slightly muriculate. Antheridia irregularly immersed in the frond above mid-rib.

Fruits in Spring.

DIMENSIONS.—Fronds 1 to 2 inches long, about $\frac{1}{4}$ inch broad; involucre 4 mm. long \times 2 mm. broad; capsule 1.5 mm. diameter; valves of capsule .08 mm. \times .07 mm.; elater-bearers .6 to .8 mm long \times .005 mm. broad; elaters .175 mm. \times .015 mm.; spores .08 mm. \times .07 mm.

HAB.—Growing in wet places on banks and rocks. Moderately common. 1. Cornwall, not unfrequent, *W. Curzon*. 2, 3. Hungershall Rocks, *Jenner*; Southborough, *Farwell*; near Hadley, *E. M. Holmes*; Bexley, *E. M. Holmes*; near Maidstone, Kent, *E. M. Holmes*. 4, 5. Seckley Wood; near Leek; Dimmings Dale; Weeford, Staffordshire, *J. E. Baguall*. 7. Dolgelly, Merionethshire, *W. H. P.* 8. Stirrup Wood, Derbyshire, *G. A.*

Holt. 9. Hattersley, Marple, Cheshire, *G. A. Holt*; St. Anne's, *J. A. Wheldon*; Hindburn, *A. Wilson*; Longridge, Lancashire, *J. A. Wheldon*. 10. Bracken Ghyll, Dent, *G. Stabler*, and many other stations. 11, 12. Low Borrow Bridge, Westmorland, *G. Stabler*. 13. Damp roadsides, New Galloway, *J. McAndrew*; Whitehill, *J. McAndrew*; Dalveen Hills, *C. Scott*; Beld Craig, *Dr. W. Nichol*. 14, 15, 16. Moidart, West Inverness, common in wet places among rocks, *S. M. Macvicar*. 17.

I. Frequent, Tore Cascade; Cromaglown, Killarney, *Dr. Carrington*; Dunkerron. Co. Kerry, *Dr. Taylor*; Altadore Glen and Lough Bray, Co. Wicklow; Glencar, Co. Sligo; Glenballyemon, Co. Antrim, *Dr. D. Moore*; Hill of Howth, rare, on a small shallow bog by the margin of a brook near Ballykill, *D. McArdle*; on wet rocks, Killarney, *McArdle & Lett*.

Found on the Continent and in North America.

Obs.—Distinguished from *P. epiphylla* by being dioicous, growing in smaller patches, fronds narrower, more divided and crisped, more translucent and shining, calyptra included in involucre, not exerted. smooth, not tuberculate, valves of capsule paler, inner layer of cells destitute of semi-spiral threads, elater-bearers slenderer, more erect and less twisted, elaters only bent not twisted, antheridia fewer and more scattered; according to Herr Jack it is a calcareous plant and more commonly distributed in Europe than *P. epiphylla*, although frequently confounded with it when sterile.

I am indebted for some of my notes to Herr Jack's valuable paper on *Pellia* in "Bot. Zeit.," 1895, 81 Bd. Heft 1.

See notes under *P. Neesiana* to distinguish it from that species.

It is probably the *J. endiviaefolia* of Dickson as Lindberg states, but as Taylor was the first to clearly and fully distinguish the species from *epiphylla*, I retain his characteristic name.

DESCRIPTION OF PLATE CXCVIII.—Fig. 1. Fertile plant, natural size. 2. Sterile plant, natural size (Hooker). 3. Male plant, natural size (Hooker). 4. Ditto magnified (ditto). 5. Portion of same, more highly magnified (ditto). 6. Capsule,

opened $\times 10$ (Jack). 7. Spores and elaters $\times 75$ (ditto).
 8. Elater-bearers $\times 75$ (ditto). 9. Elater $\times 316$ (ditto).

Subtribe VIII. METZGERIEÆ.

Genus 43. **ANEURA** *Dum.*

Riccardia, Gr. & Benn. Nat. Arr. (1821), pro parte.

Aneura, Dum. Comm. (1822).

Aerostolia, Dum. Recueil (1835).

Pseudoneura, Gottsch. Mex. Leverm. (1863).

Plants frondose, broadly depresso-cæspitose, somewhat fleshy, dark green or reddish-brown, rarely light green, when dry, black. Fronds ecostate, prostrate, radiculose, pinnatifid, branches lateral, alternate, or assurgent, bi-tripinnate, pinnae (primary only) opposite, apex (principally when dry) more or less decurved. Stem or primary costa at first almost terete or more or less compressed, near apex the pinnae and pinnules usually thin and broad. Inflorescence dioicous, rarely monoicous. Female flowers on short lateral pinnules; pistillidia 2-8 pairs, sessile, short, subcylindrical, inserted a little within the margin of the costa and partially veiled (involucrate) by the incurved and often deeply laciniate wings of the pinnule; bracts round the fertile pistillidia cup-shaped, very short and lacerate or absent. Perianth wanting. Calyptra ascending, large, more or less clavate, fleshy, smooth or papillose. Pedicel short. Capsule large, oblong-cylindrical, narrow, more than twice as long as broad, coriaceous, dividing to the base into 4 valves, composed of two layers, inner with annular or semi-annular fibres. Elaters loosely unispiral, slender. Elater-bearers short, stout, claviform, persistent at the apex of the valves. Spores minute, scarcely as broad as the elaters, smooth or asperulous. Androecia on short lateral pinnules. Antheridia 2-12 pairs, inserted in two rows, one row on each side of the upper face of the pinnules; in little pits (alveoles) on the very margin, solitary, large, globose, subsessile.

1. *Aneura palmata* (*Hedw.*), *Dum.*

Jungermania palmata, Hedw. Theor. gen., 1 ed. p. 87 (1784).

Aneura palmata, Dum. Comm. Bot. p. 115 (1822).

Riccardia palmata, Carruth. in Seem. Journ. Bot. 3, p. 302, pp. (1865).

Dioicous, cæspitose, small, reddish-brown in colour. Fronds ascending, short, dividing into narrow linear segments, palmatifid, apex subacute, obtuse or emarginate, cross-section bi-convex, 6 to 8 cells thick near the middle, outer layer of cells much smaller, dark, inner hyaline; texture opaque, cells of the antical surface roundish, thick-walled. Female flowers lateral; bracts numerous, minute, lacerate-fimbriate, hyaline. Calyptra clavate, cylindrical, tuberculate. Capsule oblong; valves acute at the apex, strongly reflexed at the margin when dry, inner layer with about 20 fine rows of semi-annular threads. Spores very small, equal in diameter to the thick part of elater, pale brown, smooth. Elaters unispiral, dark reddish-brown, attenuate at each end. Male plant with narrower stems and branches. Androecia lateral, simple or binate, linear, canaliculate, margin incurved; antheridia oval, 6 to 8 imbedded in the frond in two irregular rows.

Fruits Spring or early Summer.

DIMENSIONS.—Plants about $\frac{1}{4}$ inch long, stem and branches .4 to .5 mm. wide, .2 mm. thick; perichaetial bracts .25 mm. long; calyptra 1.75 mm. \times .6 mm.; valves .75 mm. \times .2 mm.; spores .015 mm.; elaters .25 mm. \times .015 mm.; androecia .75 mm. \times .3, cross-section of same .225 mm. high \times .3 mm. wide; antheridia .75 mm. \times .125 mm.

HAB.—On rotting trees. Somewhat rare.

7. Tyn-y-Groes, Merionethshire, *W. H. P.* 9. Marple, Cheshire, *G. A. Holt*; Park Bridge, Lancashire, *R. Roberts*. 10, 12. Mardale, Westmorland, *George Stabler*. 13. Garroch Wood, New Galloway, *J. McAndrew*. 16. Glen Finnan, *Dr. Carrington*; Moidart, West Inverness, *S. M. Macvicar*.

I. Killarney, *Dr. Carrington*, *Dr. D. Moore*; *McArdle & Lett*; Cromaglow, *Stewart & Holt*.

Found on the Continent, in North and South America and Cuba.

Obs.—A distinct species, the growth on rotting trees, the palmatifid fronds, bi-convex stem and branches, dioicous inflorescence characterising it.

DESCRIPTION OF PLATE CXCIX.—Fig. 1. Plants natural size. 2. Plant $\times 24$ (202 G. & R.). 3. Portion of frond $\times 24$ (Cromaglow, Stewart & Holt). 4, 5. Cross-sections of frond $\times 64$ (ditto). 6. Portion of calyx $\times 64$ (ditto). 7. Calyptra $\times 24$ (ditto). 8. Valve $\times 24$ (ditto). 9. Andrœcia $\times 24$ (ditto). 10. Cross-section of same $\times 85$. (Killarney, Dr. C.) 11. Antheridium $\times 64$ (Cromaglow, Stewart & Holt).

2. *Aneura multifida* (L.), Dum.

Jungermania multifida, Linn. Sp. pl. 1602 (1753).

Riccardia multifida, Gr. & Benn. Nat. Arr. Brit. pl. 1, p. 683 (1821).

Aneura multifida, Dum. Comm. Bot. p. 115 (1822).

Monoicous, ♂ usually near the ♀, in small, loose or crowded tufts or among mosses, small, green to yellowish-green in colour, turning brown when old. Fronds prostrate or somewhat erect, irregularly pinnate or bipinnate, cross-section lenticular, at the middle 5 to 8 cells thick, the inner ones larger, gradually becoming thinner towards the margin, where it is 1 cell thick, about 20 cells round; apices obtuse or emarginate; texture fleshy, succulent; epidermis finely punctate. Female inflorescence lateral, usually on the chief stem, sessile; bracts short, lacinate, fimbriate. Calyptra oblong-clavate, fleshy, smooth or very slightly tuberculate. Pistillidia 10-14. Capsule striate, subcylindrical, dark brown. Spores reddish-brown, larger than the thickest part of the elaters, roundish-tetrahedral, indistinctly granulate. Elaters reddish-brown, attenuate, often at one end only, frequently attached to the apices of the valves. Andrœcia generally on main stem, lateral, linear, simple or binate, in which are imbedded 4-6 roundish-oval antheridia. Sometimes gemmiparous, gemmæ at apices of branches, roundish-oval, angular.

Fruits in Spring.

DIMENSIONS.—Stems $\frac{1}{2}$ to 1 inch long, .75 mm. to .1 mm. broad, .2 mm. thick at the middle; calyptra 2.5 mm. long \times .75 mm. thick; spores .02 mm.; elaters .2 mm. long \times .01 mm. thick; andrœcia .75 mm. long \times .2 mm. broad.

HAB.—Damp woods, wet bogs, sides of ditches, or on sandstone rocks.

1. Cornwall, *W. Curnow*. 2. Hampshire. 3, 4, 5. Synnerton, *R. Garner*; Synnerton Old Park; Sherbrook Valley, Staffordshire, *J. E. Bagnall*. 6-8, 9. Stream near Stonyhurst and near Loud Lower Bridge, Lanc., *Wheldon*. 10. Bracken Ghyll, Dent, *G. Stabler*. 11, 12. Mardale; near Ulverston, Westmorland, *G. Stabler*. 13. Bennan Hill, New Galloway, *J. McAndrew*; Colvend; Whitcomb, *Dr. W. Nichol*. 14, 15, 16. Moidart, West Inverness, *S. M. Macvicar*.

I. "Common in Ireland," *Dr. D. Moore*. Hill of Howth, *D. McArdle*; Killakeen, Co. Cavan, *D. McArdle*; Killarney, *McArdle & Lett*.

Found on the Continent and in North America.

OBS.—The only species likely to be confounded with it is *Aneura latifrons* Lindb., which see.

The stations given are those recorded by several authorities and collectors, but they probably include *Aneura latifrons* and *Aneura ambrosioides* (*Aneura multifida*, var. *ambrosioides*), which I consider a distinct species.

DESCRIPTION OF PLATE CC.—Figs. 1-3. Plants natural size. 4. (Ditto) \times 11 (C. and P. n. 62). 5-7. Cross-sections of stem \times 24 (ditto). 8. Fertile branch \times 16 *a* ♂ *b* calyptra, *c* immature ♀ (ditto).

3. *Aneura ambrosioides* (Nees).

Aneura multijida, var. *ambrosioides*, Nees, Nat. Eur. Leb. 111, p. 150 (1838),
G. L. N. Syn. Hep. p. 197 (1844).

Riccardia multijida, var. *ambrosioides* (Nees), Lindb. Acta Soc. Sci. Fenn. 10,
511 (1875).

Monoicous, loosely caespitose or creeping amongst mosses, small, dark green, turning dark brown, when young light green in colour. Stems prostrate, narrow, subpinnate; pinnae ascending, irregular in length, sometimes attenuate; cross-section bi-convex or plano-convex; margin minutely crenulate, composed of a single row of cells; texture rigid; exterior cells small, quadrate, much smaller than the inner, 40 to 60 round, walls dark, firm; inner cells medium to rather large in size, 4-6-sided; 4 to 6 cells thick near the middle. Female flowers lateral on the main stem; bracts small, lacinate. Calyptra relatively very large, cylindrical, smooth. Androecia lateral, long, linear, in which are imbedded about 6 roundish-oval antheridia.

I have never met with perfect fruit.

DIMENSIONS.—Fronds 1 inch long \times 5 to 10 mm. broad, stem .75 mm. broad \times .2 mm. thick; cells interior .03 mm. \times .05 mm., exterior .02 mm.; male catkin 1 mm. long \times .4 mm. broad.

HAB.—Amongst wet mosses or on shaded wet rocks. Somewhat rare.

1. Mousehole Cave, Penzance, Cornwall, *Mitten & Curran*.
7. Tyn-y-Groes, Merionethshire, *W. H. P.*; Ogwen Valley, *Dr. Carrington & W. H. P.* 9. Hayfield, Derbyshire, *G. A. Holt*.
12. Grisedale, *Barus & Stabler*; Broad Gate Bog, Ings, Westmorland, *G. Stabler*. 16. Common on wet rocky banks, especially in ravines, Moidart, West Inverness, *S. M. Maccicar*.

1. Ventry; Connor's Hill; O'Sullivan's Cascade, &c., *Dr. Carrington* and others.

Found on the Continent.

Obs.—This has always been considered by previous writers as a variety of *A. multijida*, but its usually dark brown colour, rigid

habit, narrow outline of frond, with ascending branches, margin of stem and branches usually minutely crenulate, are characters which I consider make it quite worthy of specific rank, and by them it can be easily distinguished from other British species.

DESCRIPTION OF PLATE CCI.—Figs. 1–3. Plants natural size. 4. Frond $\times 11$ (C. & P. n. 63). 5, 6. Cross-section of stem $\times 24$ (Ogwen Valley, W. H. P.). 7, 8. Ditto $\times 24$ (near Penzance, Mitten & Curnow). 9. Male catkin $\times 11$ (C. & P. n. 63).

4. *Aneura latifrons* Lindb.

Jungermania multifida, Schmid. Icon. pl. 111, pp. 213–216, excl. synonym. et pp. (1797), Hook. Brit. Jung. p. 19, n. 75, pp. (1816).

Riccardia multifida, Gr. & Benn. Nat. Arr. Br. Pl. p. 684, n. 1, pp. (1821).

Aneura palmata, a major, Nees, Nat. Eur. Leb. 111, p. 459 (1838), G. L. N. Syn. Hep. p. 498 (1846).

Aneura latifrons, Lindb. Soc. F. Fl. Fenn. (1873).

Riccardia latifrons, Lindb. Hep. Hibern. p. 513 (1875).

Monoicous, broadly and densely cæspitose, depressed, small, pale, bright or brownish-green in colour. Fronds suberect, irregularly subpinnate or sub-bipinnate, transverse section plano-convex, almost the whole breadth 4 or 5 cells thick, the inner ones large, hyaline, exterior smaller and chlorophyllose, one cell thick at the entire margin; branches thin, plane, more or less fastigiata, broadly or oblong-cuneate or sublinear, transverse section linear, 3 cells thick near the middle; radiculose, rootlets few or numerous, hyaline; stoloniferous, stolons proceeding from the main stem and branches, radiculose, subterete and long, sometimes bearing inflorescence; gemmiparous, gemmæ roundish, composed of one or two cells at apex of the branches; texture opaque when dry, somewhat pellucid when living; cells of the antical layer irregular, oblong-rhomboid, slightly or indistinctly thickened. Inflorescence lateral on the stem or branches, very often the ♀ and ♂ together, rarely ♂ alone. Perichætical bracts few but large, broadly oval, irregularly lobate, fimbriate. Pistillidia 3–10, short, conical. Calyptra large, ascending, pyriform, clavate

or cylindrical, truncate, white, slightly verrucose, near the base 7 or 8 cells thick, above 3 or 4. Pedicel hyaline, somewhat thick. Capsule oval or elliptical, brown, dividing to the base into 4 valves, which are elliptical, when dry convolute, reflexed, composed of two layers of cells, inner small. Elaters short, somewhat obtuse, unispiral, spiral threads brown. Spores globose, greenish-brown. Andrœcia narrowly oblong, base narrow and shortly stipitate, base and postical side slightly radiculose; antheridia biseriate, globose, hyaline, very shortly stipitate.

Fruits in Spring.

DIMENSIONS.—Fronds $\frac{1}{4}$ to $\frac{1}{2}$ inch long, branches 4 mm. to 8 mm. long, stem 4 mm. broad \times 2 mm. thick, branches of stem 4 mm. broad \times 1 mm. thick; calyptra 2–3 mm. long \times .75–1 mm. thick; pedicel 4–7 mm. long; capsule .9 mm. \times .4 mm.; valve .9 mm. \times .3 mm.; spores .015–.0175 mm.; elaters .225 mm. \times .0175 mm.

HAB.—On rotting trees, damp turf or in wet places. Rare.

9. Cotteril Clough, Cheshire, *W. Wilson*. 10. Goathland, *M. B. Slater*. 16. Moidart, West Inverness, ascending to 1400 ft., *S. M. Macvicar*.

I. Killarney, *Dr. Carrington* and others.

Found on the Continent and in North America.

OBS.—A species previously confounded either with *A. multifida* or *A. palmata* until the late Prof. Lindberg recognised it as distinct from both. It is abundantly distinct from what was considered a variety of *A. multifida* (*A. ambrosioides*) and from *A. palmata*; from typical *A. multifida* it is distinguished by its relatively thicker and rounder stems, with more irregular and broader branches, and the more tuberculate calyptra.

DESCRIPTION OF PLATE CCII.—Fig. 1. Plant natural size (Hooker). 2. Frond magnified (ditto). 3. Portion of frond magnified (ditto). 4. Frond \times 24 (G. & R. 493). 5. Cross-section of stem \times 85 (ditto). 6. Cross-section of branch \times 85 (ditto). 7. Calyptra \times 16 (Nr. Goathland, *M. B. Slater*). 8. Capsule \times 24 (ditto).

5. *Aneura sinuata* (Dicks.), Dum. p.p.

Lichenastrum chamadryos multifidæ divisura, Dill. Hist. Musc. pp. 511, t. 74, f. 14B (not f. 44A) (1741).

Jungermania sinuata, Dicks. Pl. crypt. Brit. fasc. 2, p. 16 (1790).

Jungermania multifida, var. *sinuata*, Hook. Brit. Jung. t. 45, f. 2 (1816).

Aneura sinuata, Dum. Comm. Bot. p. 115 (1822).

Aneura pinnatifida, N. Carr. Irish Crypt. p. (1863), and of many others.

Riccardia multifida, var. *major*, Lindb. Hep. Hibern. (1875)?

Riccardia latifrons (Lindb.), var. *sinuata* (Dicks.), Lindb. Musc. Scand. p. 5 (1879); Kaalaas Leverm. Norge, p. 213 (1893).

Monoicous, growing in flat spreading patches, medium size, pale green in colour. Fronds prostrate, imbricating, flat, irregularly divided, branches irregularly pinnate or bipinnate; thin, the whole breadth almost equal in thickness; cross-section linear; cells oblong-rhomboid. Female flowers lateral; bracts very short. Calyptra oblong, clavate, smooth. Capsule oblong, dark brown; spores pale brown, same size as the thickest portion of the elaters; elaters unispiral, reddish-brown. Andrœcia lateral, situated near the female flower, oblong-oval; antheridia oval, 8-10 in two rows, imbedded in the male catkin.

Fruits in Spring.

DIMENSIONS.—Stems 1 to $1\frac{1}{2}$ inch long, 2 mm. broad, .2 mm. thick, branches .5 mm.—1.5 mm. broad; calyptra 3 mm. \times .8 mm.; capsule 1 mm. \times .6 mm.; spores .02 mm.; elaters .4 mm. \times .02 mm.; andrœcia .8 mm. \times .4 mm.

HAB.—On wet dripping perpendicular rocks in shady situations. Rare.

7. Arthog, Dolgelly, Tyn-y-Groes, Merionethshire, *Dr. Carrington* & *W. H. P.* 12. Borrowdale, Cumberland, *W. H. P.* Isle of man, *G. A. Holt*.

I. Killarney, Cromaglow, Tore Cascade, *Dr. Carrington* and others.

OBS.—Distinguished from *Aneura multifida* (L.) and *Aneura latifrons* Lindb. by its larger size, thinner fronds and smooth calyptra.

It is a somewhat rare species, and, so far as I know, is only

found on wet dripping perpendicular rocks, frequently growing with *Jubula Hutchinsiae*.

Dr. Schiffner states that *Aneura pinnatifida*, Nees, is quite a different species.

DESCRIPTION OF PLATE CCIII.—Fig. 1. Plants nat. size. 2. Portion of frond magnified. (Isle of Man, Holt). 3, 4. Cross-section of frond $\times 16$ (ditto). 5. Male catkin and young female flower $\times 24$ (Arthog, W. H. P.). 6. Calyptra $\times 16$ (ditto). 7. Capsule $\times 16$ (ditto).

6. *Aneura pinguis* (L.), Dum.

Marsilea media pinguis, pallide virens, floribus nigricantibus, ad foliorum latera egredientibus, Mich. Nov. pl. gen. p. 5, tab. 4, f. 2 (1729).

Lichenastrum capitulis oblongis; juncta foliorum divisuras nascentibus, Dill. Hist. Musc. p. 509, tab. 74, fig. 42 (1741).

Jungermania pinguis, Linn. Sp. pl. p. 1136 (1753); Hook. Brit. Jung. t. 46 (1816).

Aneura pinguis, Dum. Comm. Bot. p. 115 (1822).

Riccardius pinguis, Gray & Benn. Nat. Arr. Brit. Pl. 1, p. 684 (1821).

Dioicous, caespitose or creeping among mosses, of medium size, dark green in colour, turning pale yellowish-green when dry. Fronds decumbent, often imbricate, simple or lobate, oblong sinuate, plane or concave, apex rounded and obtuse, margin somewhat undulate; texture succulent, fleshy, opaque, rigid when dry; 6 to 8 cells thick near the middle, 1 to 2 near the margin, without nerve; cells 4-, 5-sided, interior ones hyaline, walls firm, no trigones; radiculose, rootlets few, minute, short, close, yellowish-white, some fronds rootless. Female flowers proceeding from the postical side near the margin; bracts short, subhemispherical, fimbriate. Calyptra linear-oblong, cylindrical, smooth, nearly the same thickness throughout, straight or slightly waved and curved, mouth a little uneven; pistillidia 7 or 8, small, ovate. Capsule oblong-oval, reddish-brown, striate or furrowed, 4-valved, inner layer of cells with 20 to 30 rows of spiral threads, base of capsule (apex of pedicel) composed of 8×8 large brown cells; spores spherical, brown, muriculate, twice the diameter of the

broadest part of the elaters; elaters pale brown, bispiral, attenuated at both ends. Male plant usually shorter and crisped at the margin, 4 to 16, roundish-oval, slightly pedicellate, antheridia imbedded in the antical side of the roundish, simple or bilobed processes.

Fruits in Spring.

Var. *denticulata*, N.

Fronds smaller than the usual form, simple, linear, margin denticulate.

DIMENSIONS.—Fronds $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, by 5 mm. to 10 mm. broad, .4 mm. to .5 mm. thick near the middle; cells .05 mm. \times .05 mm., .05 mm. \times .06 mm.; calyptra 5 mm. to 7 mm. long \times 1.5 mm. broad; pedicel 1 inch long; valves 1.2 mm. \times .4 mm.; spores .03 mm.; elaters .25 \times .015 mm. near the middle.

HAB.—In damp places, ditches, bogs, or on wet rocks.

Common.

1-3. 5, 6. 7-12. 14-16. I.

Europe, North America, Cuba.

Var. *denticulata*, N. Creeping amongst mosses, frequent in limestone districts.

OBS.—A distinct species, and not likely to be mistaken for any of the other frondose ones; distinguished by its thick, nerveless, fleshy fronds, which are brittle when wet and have a greasy feel, like the leaves of *Pinguicula vulgaris*; its usually larger size and smooth calyptra separate it from the other British species of the genus.

DESCRIPTION OF PLATE CCIV.—Figs. 1-3. Plants, natural size (after Hooker). 4. Frond, postical aspect with involucre slightly magnified (ditto). 5. Cross-section of frond \times 16 (Closter, Austin). 6. Cross-section of involucre magnified (after Hooker). 7. Cross-section of young calyptra, magnified (ditto). 8. Calyptra, magnified (ditto). 9. Capsule, magnified (ditto). 10. Capsule opened, magnified (ditto). 11. Portion of male frond, magnified (ditto). 12. Male receptacle, magnified (ditto).

Genus 44. **METZGERIA** *Raddi*.

Jungermania, L. Sp. pl. ed. 1, p. 324 (1737); Hook. Brit. Jan. g. t. 73, 56 and 55 (1816).

Metzgeria, Raddi in Act. Soc. Sc. Modena, 18, p. 34 (1818).

Plants frondose, soft, pale green or yellow, rarely dark green, prostrate, stratified or creeping laxly amongst mosses. Fronds linear, dichotomously branched, very rarely pinnate; floriferous, branches postical, pilose or ciliate, especially on the costa on the postical side, sometimes on the whole of the postical surface, rarely on the antical. Pili or cilia solitary or 2-5. Costa very distinct, rarely terete, slightly compressed, cross-section oval, 4-11 cells in diameter, cortical cells larger and pellucid, inner narrow, subopaque. Pagina, viz. wings on both sides of the costa, 10-25 cells broad, composed of one layer, texture lax, pellucid, often decurved or undulate. Inflorescence dioicous, very rarely monoicous. Involucre ♀ (bracts) on short postical branches, emarginate or obcordate, sometimes reduced to a mere annulus around the base of the calyptra. Perianth absent. Pistillidia few, 2-5-pairs, short, the sterile surrounding the base of the calyptra. Calyptra exerted, clavate or pyriform, fleshy, the whole or only the upper half pilose or villose. Pedicel short. Capsule oval, dividing to the base into 4 valves, composed of two layers, inner without annular or semi-annular fibres. Elaters long, unispiral, deciduous. Elater-bearers short, claviform, persistent at the apex of the valves. Spores minute, almost smooth. Involucre ♂ similar to the ♀, globose, convolute; antheridia about 4-pairs, globose, very shortly stipitate. Gemmae aggregated on the attenuate apices of the linear fronds, composed of one layer, margin fimbriated.

1. *Metzgeria pubescens* (*Schrank*).

Jungermania pubescens, Schrank, Prim. fl. Germ. 1, p. 231, n. 860, excl. synon. (1792), Hook. Brit. Jung. p. 20, n. 79 (1816).

Metzgeria pubescens, Radd. in Act. Soc. Modena, 18, p. 46 (1818).

Dioicous, in flat patches, medium size, pale glaucous green in colour. Fronds closely imbricate, horizontal, alternately pinnate or sub-decompound, branches short, linear, of uniform width, flat, apices obtuse; margins undulate, uniformly and densely villose on the antical and postical sides; the hairs on the postical side longer, single, or many at the margin double or in threes, irregularly curved, without sucker-like branches at the apex; midrib projecting on the antical and postical side, 8–12 cells thick \times 10–14 cells broad, showing scarcely any cortical cells; texture delicate, cells smallish, 5–6 angled. Perichæatial bracts situated on the postical side of midrib near margin, densely villose, pistillidia 2–10. Androœcia numerous, on the postical side of midrib; antheridia 5–9, subglobose, slightly stipitate.

Only imperfect female flowers have yet been met with.

DIMENSIONS.—Fronds 1–1½ inch long, 2 mm. broad; cells 0225–0285 mm.

HAB.—On rocks and stones, or creeping amongst mosses, rarely on trees, in limestone districts. Moderately common.

5. Rocks about Thor's Cave, *Robert Garner*; Dove Dale, Staffordshire, *J. E. Bagnall*, *W. H. P.* 7, 8, 9. Easegill, near Leck; Over Kellet, *A. Wilson*; Silverdale, Lanc., *J. A. Wheldon*. 10, 11, 12. On an old tree-stump, Barrow Field, near Kendal; Deep Ghyll, Mallerstang; on shady rocks near the bridge, Kirkby Stephen; on Stainmoor, near Barras; in a shady ghyll at the village of Dent, Westmorland, *G. Stabler*. 13. Penton Linns, *Charles Scott*. 15. Ben Lawers, ascending to top, *S. M. Macvicar*. 16. Lismore, Argyll, *S. M. Macvicar*.

I. Mountains near Belfast, *Mr. Templeton*; on limestone rocks between Larne and Glenarm, and at Sillaghbraes, near Larne, *Dr. D. Moore*, *S. A. Stewart*.

Found on the Continent, North America; Simla, Himalayas.

Obs.—The fronds, being densely villose on the antical surface, distinguished the plant at once from the other species of the genus.

DESCRIPTION OF PLATE CCV.—Fig. 1. Plants nat. size (Eng. Bot.). 2. Ditto (Hooker). 3. Portion of frond, antical view \times (ditto). 4. Cross-section of portion of frond \times 60 (Elfving). 5. Portion of frond, bearing antheridia \times (Hooker). 6. Antheridium \times (ditto).

2. *Metzgeria furcata* (L.), Radl.

Lichenastrum saxatile erectum, tenuifolium, furcatum, Dill. Cat. pl. Giss. p. 213 (1718).

Lichenastrum furcatum, Dill. Hist. Musc. p. 513, ut synonym. (1741).

Jungermania furcata, L. Sp. pl. 1, ed. 2, p. 1136, n. 26, excl. synonym. Mich. (1753).

Metzgeria glabra, Rad. in Att. soc. Modena, 18, p. 45 (1818).

Metzgeria furcata, Dum. Recueil, 1, p. 26, min. p. (1835).

Dioicous, caespitose, closely pressed to surface, small, pale to yellowish-green in colour. Fronds imbricating, irregularly branched and furcate, sometimes subsimple or alternately sub-pinnate, linear, here and there narrower, plane or undulate, sometimes slightly convex, antical surface smooth, postical clothed with long white hairs, which are single, most being usually near the midrib and margin; midrib prominent, projecting only on the postical side, a cross-section showing it to be oval, and about 10 cells in circumference; texture thin, membranaceous, one cell thick; cells medium to rather large, regularly 5- and 6-angled, lax and chlorophyllose, walls thickened. Female inflorescence produced from the midrib on the postical side, bracts two, very small, convex, roundish, nerveless, ciliate. Calyptra elongato-pyriform, carnosose, beset with short rigid setae. Pedicel short. Capsule subglobose, brown, when ripe splitting to the base into 4 valves, walls composed of two layers of cells, the inner with semi-annular threads. Spores greenish-yellow, tetrahedral-roundish, finely granulate, broader than the elaters.

Elaters brown, unispiral. Androecia proceeding from the midrib on the postical side of frond; bracts ventricose, beset with numerous short hairs, enclosing 2-4 roundish antheridia, which are very shortly stipitate. Gemmiparous; gemmæ terminal on attenuated branches, discoid, oval or roundish, furnished later with hairs.

Var. *æruginosa*, Hook. Minute, of a blue colour, changing to green. No other good characters are to be observed.

DIMENSIONS.—Fronds $\frac{1}{4}$ to $\frac{1}{2}$ inch long, .5 mm.—1. mm broad; cells .035 mm.—.05 mm.

HAB.—On trunks of trees, stones and rocks, in exposed or shady situations.

Moderately common.

1 to 17. I.

Europe, Africa, North and South America, Australasia.

OBS.—The species belonging to this genus are easily recognised, even in their barren state, by their thin fronds with prominent midrib, which projects on the postical side, and the presence of long white hairs on their surface.

The two good species separated from *M. furcata* by the late Prof. Lindberg are at once identified by the characters given with each species.

DESCRIPTION OF PLATE CCVI.—Fig. 1. Plants nat. size (Eng. Bot. 1632). 2. Plant \times (ditto). 3. Portion of frond, postical view \times (Hooker). 4. Ditto \times (ditto). 5. Portion of frond \times 60 (Elfving). 6. Cross-section of portion of frond \times 60 (ditto). 7. Calyptra \times (Hooker). 8. Spores and elaters \times (ditto).

3. *Metzgeria conjugata*, Lindb.

Jungermania furcata (non L.), Weiss. Pl. crypt. fl. Gott. p. 108 (1770), and others.

Jungermania furcata, var. *elongata*, Hook. Brit. Jung. in textu ad tab. 55 et 56 (pp. ?), (1813-16).

Metzgeria conjugata, Lindb. in Act. Soc. Fl. Fenn. 10, p. 495, n. 27 (1875), Schiffner in Engler & Prantl, Pflanzenfamilien, 91 und 92 Lief. p. 53 (with figures) (1893); McArdle in Proc. Royal Irish Academy, 3rd ser. vol. iv. No. 5 (with plate) (1898).

Monoicous, stratificato-caespitose, medium size, pallid, pale green to green in colour, when dry slightly polished, very pellucid. Fronds dichotomous, or in smaller forms irregularly branched and furcate or sub-bipinnate, branches short, linear, narrower in some parts, convex above, margins revolute, apices obtuse, usually broader, antical surface smooth, postical, with the margins and midribs pilose with rather long, straight, divaricate hairs, the hairs usually double and very frequently with sucker-like branches at their extremities, midrib about 20 cells in circumference, projecting on the postical side; texture firm, cells largish, regularly 5- and 6-angled, lax. Female flowers situated on the midrib on the postical side; bracts pilose, hairs straight and divaricate. Calyptra pyriform, clothed with numerous long divaricate hairs. Androecia very numerous, situated on the midrib, antheridia 3-10, shortly stipitate.

Fruits in Spring and Autumn.

DIMENSIONS.—Fronds 1 to 2 inches long, 1· mm.—2· mm. broad; cells ·04 mm.—·065 mm.

HAB.—On shaded rocks or trunks of living trees. Somewhat rare.

2. Ardingley Rocks, Sussex, *G. E. Davies*. 7. Llanberis, Carnarvonshire, *W. H. P.* 9. Thrang End, Lanc., *J. A. Wheldon*. 10. Dent, *G. Stabler*; Ingleton, *W. West*. 12. Kentmere Plantation; Park Beck; Grisedale; Rossett Ghyll; Rayrigg Wood, Windermere, Westmorland, *G. Stabler*; Isle of Man, *G. A. Holt*. 13. In sub-alpine glens, New Galloway, *J. McAndrew*. 15. Killin,

Perthshire, *G. A. Holt*, *S. M. Maccicar*. 16. Common, Moidart, West Inverness, *S. M. Maccicar*.

I. Killarney, Glena, Tore Cascade, O'Sullivan's Cascade, *Prof. S. O. Lindberg*; Killarney, fertile Sept. 1897, *McArdle & Lett*; Ross Island, fertile May 1899, *McArdle & Lett*; Hill of Howth, *D. McArdle*.

Europe, Asia, North and South America, &c.

OBS.—This large and beautiful species is in addition to other characters, easily distinguished from *M. furcata* and *M. hamata* by its monoicous inflorescence, the male and female flowers being interspersed on the midrib of the same frond.

DESCRIPTION OF PLATE CCVII.—Fig. 1. Plant natural size (Hooker). 2. Portion of fertile frond, postical view $\times 13$ (Schiffner in Engl. und Prantl, Pflanzenf.). 3. Portion of frond $\times 60$ (Elfving). 4. Cross-section of frond $\times 60$ (ditto). 5. Female involucre, seen from above, with a group of pistillidia $\times 37$ (Schiffner in Engl. und Prantl, Pflanzenf.). 6. Portion of midrib with σ flowers $\times 27$, the upper one partly opened, showing the antheridia (ditto).

4. *Metzgeria hamata*, Lindb.

Metzgeria hamata, Lindb. Soc. F. Fl. Fenn. (1874).

Jungermania furcata, var. *B. elongata*, Hook. Brit. Jung. (1813-16).

Metzgeria linearis (non Aust.), Lindb. in Act. Soc. sc. Fenn. 10, p. 494, n. 26, excl. synonym. Sw. (1875).

Dioicous; stratificato-cæspitose; medium to largish size, yellow or pale yellowish-green in colour, pellucid, when dry shining. Fronds prostrate, dichotomous, branches long, linear, of equal breadth, very convex, margins reflexed not undulate, apex obtuse, antical surface smooth, postical surface densely setose-pilose on the midrib, wings without hairs, except at the margin; hairs very long, divaricate, hooked-deflexed; midrib same colour, prominent on the postical side, also slightly so on the antical, about 20 cells in circumference; texture delicate, cells large, regularly 5- and 6-angled. Female flowers produced on the

postical surface of frond from the midrib; bracts densely clothed with very long decurved, divaricate, white hairs. Calyptra elongato-pyriform, densely clothed with long hooked and divaricate hairs. Androecia postical, situated on the midrib, bracts containing 4-8 antheridia. Proliferous; numerous young plants are frequently produced from the margin of the fronds.

DIMENSIONS.—Fronds $1\frac{1}{2}$ to 2 inches long, 2.5 mm. broad; cells .05 mm.—.065 mm.

HAB.—On the ground or rocks in moist situations or on trunks of living trees. Rare.

7. Tyn-y-Groes, Merionethshire, *Wald & Holt*. Festiniog, Merionethshire, *Dr. Carrington & W. H. P.* 12. Brown Ghyll, Great Langdale, Westmorland, *Stabler & Pearson*. 13. New Galloway, *J. McAndrew*. 15. Braemar, *J. Whitehead*. 16. Arrochar, *E. George*. Common on wet rocks in some ravines, forming luxuriant patches of two to three feet across; rare on the hills, but ascending to 1700 ft., Moidart, West Inverness, *S. M. Macvicar*. 17A. Sutherlandshire, *Dr. R. K. Greville*. South of Ireland, Killarney, *Dr. D. Moore, Prof. Lindberg, Canon Lett, D. McArdle*.

Europe, Asia, North and South America, New Zealand, &c.

OBS.—This is a much larger plant than *M. furcata*, of a paler yellow colour, with more elongate less furcate branches, which are remarkably convex, having fewer hairs on the postical surface, a cross-section showing about 2 near the margin and 3 on the midrib, the wings being otherwise smooth, the hairs are also curiously hooked-deflexed.

DESCRIPTION OF PLATE CCVII.—Fig. 7. Plant natural size. 8. Portion of frond $\times 60$ (Elfving). 9. Cross-section of portion of frond $\times 60$ (ditto).

Suborder II. *MARCHANTIACEÆ*.Genus 45. **MARCHANTIA**, *March. fil.*

Marchantia, March. fil. in Mem. Acad. Paris. (1713). Micheli Gen. (1729); Linn. &c.

Fronds fleshy, rarely membranaceous, opaque, often very broad, with a broad diffused midrib, densely radiculose, apex emarginate or dichotomous; no postical branches; antical face reticulate or porose; postical face with scales on each side, 2-5 seriate. Inflorescence dioicous, terminal. Peduncle arising from a sinus in the apex of the expanded forking frond, elongate, bi- (very rarely 3) canaliculate. Capitulum more or less convex, many lobed, radiating, rarely subentire, above smooth, below with narrow scales. Involucre with several (2-5) flowers. Perianth with apex 3-5-fid. Capsule globular, stipitate, exserted, pendulous, dehiscent by 4-8 lacinate segments, often revolute. Elaters long, slender, attenuate at each end, 2-, 3- (very rarely 1-) spiral. Spores medium-minute. Andrœcia pedunculate, peltate, radiate or lobed. Gemmæ lenticular borne in a cup-shaped receptacle.

Marchantia polymorpha, *Linna. Sp. Pl.* 11, 1603 (1753).

Dioicous, cœspitose, medium to large in size, dull green on the antical side, on the postical brownish. Fronds closely imbricate, procumbent, dichotomously branched, flattened, branches short, margin entire, sinuous, midrib broad, thick and very distinct; radiculose, rootlets numerous of two kinds, the stronger but simpler kind are the root hairs which penetrate the substratum and perform the same functions as the true roots of higher plants; the others are more delicate and have internal thickenings arranged spirally; these delicate rhizoids do not penetrate the substratum but lie flat up to the postical surface

of the thallus, covered by the scales; texture between fleshy and membranaceous; on the antical surface there are numerous stomata, each situated in the centre of a diamond-shaped area, the postical side being furnished with numerous brownish scales. Female receptacle produced from the growing points of the thallus, pedunculate, hemispherical, deeply divided to the base into 6 to 12, usually 9, linear decurved rays, covering as many involucre, which are united at the base and mixed with minute chaffy scales. Peduncle 2-channelled. Involucre oblong, open at the end and torn, enclosing an ovate quadrifid perianth. Calyptra obovate, persistent, fissured at the apex. Capsule ovate or globular, exserted, pendulous, pale greenish brown, protruding a little beyond the perianth, opening into about 8 short revolute segments or teeth. Spores smooth; elaters bispiral, slender, attenuate at each end. Male receptacle greenish, pedunculate, produced from the growing point of the thallus, peltate, flat, horizontal, papillose, fleshy, thin at the margin, crenately 8-lobed; antheridia flask-shaped, imbedded in the receptacle opening by an orifice through the papillæ. On the antical surface of the thallus are numerous hemispherical cups with laciniate margins containing numerous roundish, lenticular (contracted near the middle) gemmæ.

DIMENSIONS.—Fronds 1 to 4 inches long, .3 cm.—3.8 cm. wide; peduncle 2.5 cm.—7.5 cm. high, 1.5 mm. \times 1.25 mm. diam.; male peduncle 2.5 cm. high; gemmæ .65 mm. \times .55 mm.; laciniæ of receptacle containing gemmæ .2 mm. long.

HAB.—By the sides of streams or in other damp and wet situations, on earth, walls or stones. Frequent in greenhouses. Very common, except in the Highlands of Scotland.

1-17, 18b. I.

Generally distributed over Europe, Northern Asia, North America, also found in South America, Japan and Java.

Obs.—One of the commonest of our frondose species and easily recognised.

For many of my notes and drawings of this species I am indebted to a valuable paper contributed by my friend Mr. L. W.

Waechter to the Proceedings of the Manchester Microscopical Society, 1891.

DESCRIPTION OF PLATE CCVIII.—Fig. 1. Female plants, natural size (Carrington). 2. Thallus with mature female inflorescence, two-thirds natural size, showing how the midrib of the thallus branches, and how the branches become the stalks of the inflorescence (Waechter). 3. Cross-section of the stalk of a female inflorescence $\times 11$ (W. H. P.). 4. Vertical section of a young female receptacle when grown to about a quarter of an inch above the thallus with rows of pistillidia (Waechter). 5. Vertical section through an older female receptacle: youngest sporogonium (nearest the stalk) on the left; oldest sporogonium very nearly ripe (Waechter). 6. Vertical section of female receptacle $\times ?$ (Bischoff). 7. Involucre, calyptra and capsule $\times ?$ (ditto). 8. Portion of an elater, highly magnified (Waechter). 9. Young thallus with immature male inflorescence; the midrib in this case is not branched (ditto). 10. Vertical section through a male inflorescence, antheridium nearly ripe in the centre of the disc; youngest antheridia near the margin of the disc (ditto). 11. Portion of cup $\times ?$ (ditto). 12. Gemma $\times 11$ (W. H. P.).

Genus 46. **CONOCEPHALUS**, Neck.

Hepatica, Mich. Nov. pl. gen. p. 3 (1729); Lindb. Hep. utv. p. 5 (1877).

Marchantia, L. Sp. pl. ed. p. 1138 (1753).

Conocephalus, Neck. Elem. Bot. 111, p. 344 (1790); Dum. Comm. p. 115 (1822).

Fegatella, Raddi, in Opusc. Scient. di Bologna, 11, p. 356 (1818); Nees, Eur. Leberm. iv. p. 170 (1838).

Fronds large, dichotomous, cartilaginous, reticulate, with a narrow distinct nerve. Female flowers pedicellate, conical or mitriform, membranaceous. Involucres 5–8, tubular, 1-fruited, suspended from the apex of the peduncle, coherent with the interior of the receptacle. Perianth wanting. Calyptra persistent, campanulate, 2–4-lobed at the apex. Capsule oblong-pyriform, dehiscing by 5–9 revolute segments, pedicellate. Spores muricu-

late. Elaters short, thick, bispiral. Male flowers sessile near the apex of the frond, disciform or oval.

Conocephalus conicus (Neck.), Dum.

Hepatica vulgaris, Mich. Nov. pl. gen. p. 3 (1729).

Marchantia conica, L. Sp. pl. ed. 1, p. 1138 (1753).

Conocephalus conicus, Dum. Comm. p. 115 (1822).

Fegatella conica, Corda in Opiz Beitr. 1, p. 649 (1829).

Hepatica conica, Lindb. Hep. utv. p. 5 (1877).

Conocephalum conicum (L.), Necker, Steph. Sp. Hep. p. 141 (1900).

Dioicous, closely caespitose in thick patches, large, pale green antically, often purple postically. Fronds aromatic, prostrate, dichotomous, segments oblong, obtuse or emarginate; midrib distinct, about 20 cells thick near the middle. Epidermic cells large, 6-sided, thin-walled. Furnished on the postical side with numerous reniform or cordate scales of a purple colour and delicate texture. Radiculose, rootlets proceeding from the midrib, long, white, intricately twisted. Spores dark brown to black, muriculate. Elaters short, thick, brown, bi-trispiral. Male receptacle arising from the midrib, antheridia about 20, white-opaque.

Fruits in Spring.

DIMENSIONS.—Fronds 1 to 3 inches long, segments $\frac{1}{2}$ inch broad, .5 mm. thick near the middle, .2 mm. near the margin; cells of postical layer .05 mm. diam.; stomata on antical side .4 mm. \times .3 mm.; postical scales .4 mm. \times .5 mm., pedicel 1 to $1\frac{1}{2}$ inch long; female receptacle 6 mm. \times 4 mm., 5 mm. \times 4 mm.; capsule 1.5 mm. diam.; spores .06 mm. diam.; elaters .5 mm. \times .03 mm.; male receptacle 3 mm. \times 2 mm.; antheridia 1 mm. \times .3 mm.

HAB.—Damp shady banks or on wet rocks. Common.

1-18. I.

Europe, Asia, Japan, North America.

OBS.—Recognised from other frondose hepaticæ by its distinctly reticulated epidermis, and the large whitish stomata which are easily seen by the naked eye.

The plant has also a pleasant aromatic scent.

DESCRIPTION OF PLATE CCIX.—Fig. 1. Sterile frond, natural size. 2, 3. Male fronds, natural size. 4. Portion of cross-section of frond $\times 24$. 5. Portion of frond, postical layer of cells $\times 85$. 6, 7. Scales from postical side of frond $\times 24$. 8, 9. Female receptacles, natural size. 10. Ditto, magnified (Bischoff). 11. More highly magnified (ditto). 12. Cross-section of same, magnified (ditto). 13. Calyptra (*a*) and capsule (*b*) magnified (Bischoff). 14. Capsule, explanate \times . 15. Cross-section of male receptacle $\times 11$. 16. Antheridium $\times 16$.

Genus 47. **REBOULIA**, *Raddi*.

Marchantia, Linn. Sp. pl. 1 ed., 2, p. 1138; Fl. Lapp. (1753).

Asterella, p.p. Beauv. in Encycl. Meth. Suppl. 1, p. 502 (1810).

Reboulia, Raddi in Act. soc. Modena 11, p. 357 (1818), (nom. em. Nees, 1846).

Frondose, fronds rigid, very indistinctly porose, the midrib broad, strong and distinct. Female receptacle pedunculate, conical, hemispherical or plane, 1-6- (usually 4-) lobed, lobes divided to about the middle, peduncle continuous with the frond, barbulate-palaceous beneath. Outer involucre 1-fruited, coherent with the lobes, 2-valved. Perianth wanting. Calyptra oval, minute, lacerate, persistent at the base of the capsule. Capsule hidden by the valves of the involucre, greenish, subglobose, nearly sessile, rupturing at the apex by irregular narrow teeth, or by a fragmentary operculum. Spores tuberculate. Elaters moderately long, mostly bispiral. Inflorescence monoicous. Androecia sessile, lunate-disciform.

Reboulia hemisphærica, *Raddi*.

Marchantia hemispharica, Linn. Sp. pl. p. 1604 (1753).

Asterella hemispharica, p.p. Beauv. in Encycl. Meth. Suppl. 1, p. 502 (1810).

Reboulia hemispharica, Raddi in Act. soc. Modena 11, p. 357 (1818).

Monoicous, cæspitose, medium size, dark green above, purple below and at margin. Fronds rigid, simple, bilobed or dichoto-

mously branched, sinus often deep and narrow; prostrate, flat, costate, midrib broad and prominent, margin crenate, undulate; epidermis smooth; below squamose, scales dark purple, imbricate, quadrate-elongate; radiculose, rootlets copious, slender, white, proceeding from the midrib. Female receptacle pedunculate, subrotund, afterwards hemispherical, deeply 4-5-lobed, proceeding from the antical side of frond, at the base of the sinus; surrounding the base of the female peduncle, also at the apex, there are long, white, silky, hair-like processes, 1 and 2 cells wide. Perianth wanting. Calyptra minute, lacerate, persistent at the base of the capsule. Capsule composed of several layers, the innermost without any spiral threads, globose, rupturing irregularly, teeth not revolute. Spores muriculate, pale yellow with hyaline border when young, brown when old and dry. Elaters very closely twisted, narrow. Antheridia narrow, numerous, immersed in the antical, sessile, crescent-shaped discs.

Fruits in Spring and early Summer.

DIMENSIONS.—Fronds 1 to 2 inches long, 5· to 6· mm. broad; female peduncle 1 to 2 inches long; spores 1 mm. diam.; elaters 35 mm. long.

HAB.—On dryish, exposed cracks of rock filled with earth. Somewhat rare.

1. Extremely rare, Paul Hill, Cornwall, *W. Currow*. 2. Hampshire. 3. Sydenham, *Martyu*; lane leading from Rusthall Common to the High Rocks; Lamberhurst Quarter, *Jenner*; Boro' Green; Ightham; Halstead, Kent, *E. M. Holmes*. 4, 5. Weaver Hill, Staffordshire, *R. Garner*. 7. On rocks, Barmouth, Merionethshire, *Rev. T. Salwey, Dr. Carrington & W. H. P.* 8. Castleton, Derbyshire, *J. Whitehead*. 9. Dalton Crag, Lanc., *J. A. Wheldon*. 10. Ingleboro, *Dr. Carrington*; Dentdale, *G. Stabler*; Thornton Force, *W. West*; Settle, *H. F. Parsons*; Malham Moor, *W. West*; Ingleton, *W. H. P.* 11, 12. Among limestone rocks, Levens Park, Westmorland, *G. Stabler*. 13. Back of Kenmure Castle, New Galloway; rocks near Grennan, Dalry; about Kirkeudbright, *J. McAndrew*. 15, 16. Rather common on exposed rocky banks, Moidart, West Inverness, *S. M. Macvicar*.

I. Dunkerron, *Dr. Taylor*; Dingle Bay, *Dr. Carrington*; limestone rocks near Cork and Fermoy, *I. Carroll*; abundant on the walls of the bridge at Cong, Co. Galway; Sillaghbraes, near Larne, Co. Antrim, *Dr. D. Moore*; on sandy ground at the North Bull, near Dublin, *D. McArdle*; Island of Rathlin, Co. Antrim, *S. A. Stewart*.

Found on the Continent, Asia, North and South America, Java, Japan, Australia, New Zealand.

Obs.—Much rarer than *Preissia commutata*, with which it is frequently confounded. “Easily distinguished by the deeply divided 4-5-fid receptacle, which is barbate beneath and at the base of the peduncle, and by the sessile antheridia, whereas the receptacle of *Preissia commutata* is marked on the top with a cruciate crest and the ♂ pedunculate.”—*Dr. Carrington*.

Another character at once makes the difference certain—viz., the innermost layer of the walls of the capsule of *P. commutata* have in their cells reddish-brown spiral threads, whereas they are absent in this species.

DESCRIPTION OF PLATE CCX.—Figs. 1-4. Fertile plants natural size. 5. Frond, postical view. 6. Plant with young (*a* ♂) and (*b* ♀). 7. Cross-section of pedicel $\times 11$ (W. H. P.). 8-13. Female receptacles. 14. Ditto, showing young capsule. 15, 16, 17. Capsule in different stages $\times ?$. 18. Spores $\times ?$. 19. Spore and elater, more highly magnified. 20. Cross-section of male receptacle $\times ?$ (Bischoff).

Genus 48. PREISSIA, *Corda*.

Preissia, *Corda* in *Opiz Naturalientausch* (1829); *Nees, Eur. Leberm.* (1838).

Frond obcordate, sparsely furcate, margin thin, increasing by joints from the apex, pores conspicuous, bearing the peduncle from a sinus of the terminal lobe. Gemmæ wanting. Female receptacle pedunculate, hemispherical, 4-6-lobed, rays of the lobes shorter, rib-like, only free at the inferior part, fibrous-barbulate underneath. Perianth obconically campanulate, angular,

unequally 4 or 5 parted. Calyptra persistent, rupturing obliquely at the apex. Capsule large, shortly pedicellate, dehiscing by 4 or 8 irregular revolute valves. Spores large, tuberculate. Elaters short, bispiral. Male receptacle pedunculate, peltate, repand, lobate.

Preissia commutata (*Lindenb.*), *Nees*.

Marchantia hemispherica, Linn. Fl. Suec. n. 1052 (1745).

Marchantia quadrata, Scop. Fl. Carn. t. 63, 1356 (1772).

Marchantia commutata, Lindenb. Hep. Eur. p. 101 (1829).

Marchantia androgyna, Tayl. in Trans. Linn. Soc. xvii. p. 380 (1835).

Preissia commutata, Nees, Nat. Eur. Leber. iv. p. 117 (1838).

Preissia hemispherica, Cogn. in Bull. Soc. Bot. Belg. p. 49 (1872); Dum. Hep. Eur. p. 152 (1874).

Chomiocarpon quadratus (Scop.), Lindb. Musc. Scand. (1879).

Dioicous, closely caespitose, medium size, pale green to brownish-green antically, dark purple postically and at the margin. Fronds prostrate, oblong-sinuate, apices bilobed, porose, margin irregularly crenate, on the postical side squamose, scales purplish-black, oblong, acinaciform. Female flowers pedunculate, peltate, angularly hemispherical or subquadrate, sub-entire or lacerate, above obtusely 4-costate, 2-4-lobed, loculi attached to the underside of the lobes, 1-3-fruited, dehiscing irregularly. Perianth obconico-campanulate, 4-5-lobed. Peduncle below red, above pale green, bicanaliculate, channels on both sides with rootlet-threads. Calyptra rotundate, styled, persistent. Capsule globose, shortly pedicellate, reddish-brown or dark purple, dehiscing by revolute segments, cells of the inner wall with reddish-brown ring fibres. Spores brown, submuricate, roundish-tetrahedral. Elaters long, slender, bispiral. Male receptacle pedunculate; peduncle very thick, obtusely angular and irregular in outline, outer walls dark purple, 1 or 2 inner layers purple, others hyaline, trigones large, walls thin, bicanaliculate, with rootlet threads in the channels; smaller than the female, often sessile; peltate, margin scariose, thin, undulate, irregular but undivided;

antheridia immersed, disposed in rays, oblong. At the base of the peduncle are a few very delicate white scales.

DIMENSIONS.—Fronds 1 to 2 inches long, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad, near the margin .5 mm. and at the middle 1 mm. thick; spores .08 mm. diam.; elaters .25 mm. long; female pedicel 1 to 2 inches long; male pedicel $\frac{1}{2}$ to $\frac{3}{4}$ inch long; .75 mm. \times .5 mm. diam.; male receptacle 2 mm. to 3 mm. diam.; antheridia .4 mm. \times .2 mm.

HAB.—On rocks in exposed or shady situations. Frequent in sub-alpine localities.

6, 7. Barmouth, Merionethshire, *Dr. Carrington & W. H. P.*; Llanberis, Carnarvonshire, *J. Cash & W. H. P.* 9. St. Annes, Lanc., *J. A. Wheldon*; Easegill, Lanc., *Wheldon & A. Wilson*; by the Hodder, near Whitewell, Lanc., *J. A. Wheldon*; Millers Dale, Derbyshire, *W. H. P.* 10. Clapham, *Dr. Carrington & W. H. P.* Teesdale, abundant, *Dr. Spruce, M. B. Slater, &c.* 12. Hill Bell; Mardale; Barbon Fell; Grisedale; Little Langdale, Westmorland, *G. Stabler.* 13. Wet rocks, in sub-alpine glens, *Scott*; W. of Cluden; Burnhills, Kirkcudbrightshire, *J. McAndrew.* 15. Ben Lawers, Perthshire, *W. H. P.* 16. Rather common among wet shady rocks; also occurs in stony marshy places, Moidart, West Inverness, *S. M. Macricar.* 17A. Caithness, *Rev. David Lillie.*

I. Ravine below Eagle's Nest, Killarney, *Dr. Carrington*; Dunkerron, *Dr. Taylor*; Kenmare, *W. Wilson*; fissures of damp rocks, and on damp ground in mountainous parts of the country, particularly in limestone districts; occasionally on sandy ground near the sea, as at North Bull, near Dublin; frequent in Co. Galway; rocks above Kylemore Castle, and by the side of the lake at Letterfrack; abundant near Cong; Sillagh-braes, near Larne; Co. Antrim; Co. Kildare; Co. Kerry, about Killarney, &c., &c., *Dr. D. Moore.*

Found in Europe, Asia, North America and Japan.

OBS.—I have adopted the usually accepted name for this species, because it would certainly be unwise to follow Cogniaux and Dumortier in having two species so liable to be confounded

with each other bearing the same specific names. Lindberg revives Scopoli's old name, but Nees and others had doubts about the species being identical. To distinguish the species from *Reboulia hemisphaerica* (L.) with which it is frequently confused, see notes under that species.

DESCRIPTION OF PLATE CCXI.—Fig. 1. Fronds natural size (Taylor). 2–4. Ditto, with female flowers, natural size (ditto). 5. Frond with male flower, natural size (Bischoff). 6. Cross-section of frond $\times 11$. 7. Pore $\times ?$ (Taylor). 8–12. Female receptacles $\times ?$ (Bischoff). 13. Calyptra and capsule $\times ?$ (ditto). 14. Ditto (ditto). 15. Male receptacle $\times ?$ (ditto). 16. Cross-section of portion of male receptacle $\times ?$ (ditto). 17. Cross-section of male pedicel $\times 16$. 18. Antheridium $\times 24$. 19. Spores and elaters $\times ?$ (Bischoff).

Genus 49. **LUNULARIA**, *Mich.*

Lunularia, Mich. Nov. pl. gen. p. 4, tab. 4 (1711).

Marchantia cruciata, Linn. Sp. pl. (1753).

Frond oblong, with rounded lobes, distinctly areolate and porose, squamigerous. Scales imbricate, sublunulate, their apex abruptly contracted into a roundish cochleariform lobe. Gemmae in crescent-shaped discs on the antical side of the frond. Female receptacle cruciately divided into 1–6 (usually 4) horizontal segments or involucres, which are tubular, vertically bilabiate and 1-fruited. Perianth wanting. Calyptra included, persistent, rupturing at the apex. Capsule exerted on a long pedicel. 4–8-valved, the valves spreading, subtortuous. Spores minute, nearly smooth. Elaters short, very slender, bispiral, deciduous or a few remaining attached to the apex of the valves. Peduncle very hairy, involucreate with numerous membranaceous scales at the base. Androecia oblong, sessile in the sinus of the apex of the frond.

Lunularia cruciata (L.), Dum.

Lunularia vulgaris, Mich. Nov. Gen. (1729).

Marchantia cruciata, Linn. Sp. pl. 1137 (1753).

Lunularia cruciata (L.), Dum. Comm. p. 116 (1822).

Dioicous, densely cæspitose, medium size, pale shining green colour. Fronds prostrate, divided into 3 or 4 lobes, furcate, innovant at the apex, margin membranaceous, undulate, antical epidermis distinctly areolate and porose, postical radiculose from the midrib. Female receptacle stalked with four linear lobes; partial involucre at the apex of the peduncle, quaternate, cruciate, spreading horizontally, apex vertically bilabiate, monocarpous. Perianth none. Calyptra included, crowned with a style, splitting above, pedicels the length of the involucre. Capsule exserted, thin, dark brown, obovate, 4-valved; dividing to their base, linear, spreading, somewhat twisted. Spores small, roundish, yellow, smooth. Elaters very long and thin, bispiral.

DIMENSIONS.—Fronds 2·5 c.m. long, 5·–8· mm. broad; peduncle 2·5–3·8 c.m. high.

HAB.—Moderately common. On damp shady paths in gardens, neglected flower beds, crevices in old walls, and often exceedingly abundant in greenhouses. Extremely rare in fruit, Minehead, Somerset, West Cornwall (Hb. Reader), Kew Gardens, Richmond, Surrey.

1 to 5, 7 to 10, 12, 15, 16. I.

In North America, introduced into greenhouses, but always barren. Europe, Africa, South America, Queensland.

OBS.—Distinguished from other frondose species in its barren state by its pale green, somewhat shining frond, dotted on its upper surface with pores, and by the shallow depressions or cavities, half surrounded by a crescent-shaped ridge, from which the generic name *Lunularia* is derived.

I am indebted for some of my notes to an interesting paper on the plant by the Rev. H. P. Reader, M.A. (*Midland Naturalist*, October 1884).

DESCRIPTION OF PLATE CCXII.—Fig. 1. Fertile frond, natural size. 2. Frond, natural size. 3. Ditto, postical view. 4. Portion of frond, cross-section \times ?. 5. Portion of frond, antical view \times ?. 6. Portion of frond, showing receptacle for gemmæ (*a*), and young female flowers (*b*). 7. Female receptacle \times ?. 8. Ditto, showing calyptra (*a*), and capsule (*b*) \times ?. 9. Portion of female receptacle \times ?. 10. Spores and elaters \times ?. 11. Gemma \times ? (Bischoff).

Genus 50. **DUMORTIERA**, Nees.

Dumortiera, Nees in Nov. Act. N. C. vii. (1823).

Hygropylla, Tayl. Linn. Trans. xvii. p. 390, t. 15 (1835).

Fronds large, delicate, soft, with a slight costa, subdichotomous or with apex emarginate, with or without pores, mostly with hair-like rootlets scattered over the entire postical surface. Inflorescence terminal, dioicous or monoicous. Capitulum ♀ pedunculate, peduncle long, bi-canaliculate, apex smooth or setose, orbicular, convex or subplane, divided into 2–8 segments, segments hairy or smooth. Involucre tubular, often setulose, apex shortly bivalved, monocarpous. Perianth absent. Calyptra included, obovate, delicate, rupturing at the apex. Capsule with short pedicel, subglobose, deeply cut into 4–8 segments, segments afterwards more or less revolute. Elaters very long, straight, attenuate at each end, 1–2- or 3-spiral, deciduous. Spores globose, asperulous. Androecia very shortly pedunculate, discoid; antheridia ovate. Gemmæ wanting.

Dumortiera irrigua (Wils.), Nees.

Marchantia irrigua, Wils. in Hook. Brit. Fl. vi. p. 106, n. 5 (1833).

Hygropylla irrigua, Tayl. Linn. Trans. xvii. 390, t. 15 (1835).

Dumortiera irrigua (Wils.), Nees, Nat. Eur. Leber. iv. p. 159 (1838).

Dumortiera hirsuta (Swartz), Steph. Sp. Hep. p. 224 (1900).

Dumortiera hirsuta (Sw.), var. *irrigua* (Tayl.), Spruce Hep. Am. et And. p. 566 (1885); Schiffn. in Eng. & Prantl. Pflanzenf. 91 und 92, Lief. p. 36 (1893).

Dioicous, procumbent, large, bright pleasant green in colour, when older brownish. Fronds bilobed, lobes rotundate, very

slightly undulate, margin of lobes raised, nerveless, without pores, fleshy, membranaceous, semi-pellucid, antical layer of cells clearly defined, 4-, 5- and 6-angled, oblong, walls rather thick, postical layer green, 4-, 5- and 6-angled, clearly defined, about twice the size of the antical layer; postical side of frond clothed with numerous scales; radiculose, rootlets very numerous proceeding chiefly from the midrib, long, fasciculate, simple, white. Scyphi none. Female receptacle convex, pedunculate, at first surrounded by linear scales, all recurved; peduncle long, succulent, thick, semi-pellucid, greenish, flexuose, bi-canaliculate, canals with rhizoids like rootlets. Calyptra ruptured, leaving the remains at the base of the pedicel. Capsule stipitate, globose, slightly verruculose, dividing into 4, 6 or 8 unequal valves. Spores reddish-brown, angular-rotundate, verruculose. Elaters elongate, dark reddish-brown, delicate, spiral fibres closely twisted. Male receptacle raised above the level of the frond; peduncle very short, succulent, thick, greenish below, brownish above, striate, bi-canaliculate, beset with numerous hair-like scales; peltate, depressed in the centre, fleshy; antheridia oval, hyaline.

DIMENSIONS.—Fronds 2 to 5 inches long, $\frac{1}{4}$ to 1 inch wide, near the margin .3 mm. thick, middle .9 mm. thick, scales .2 mm. long, spores .025 mm. diam., elaters .8 mm. long \times .01 mm. broad.

HAB.—On wet dripping rocks in shady places. Very rare, except in the South of Ireland, where in some localities it is abundant.

1. Ilfracombe, Devonshire, *W. Currow*. 2. Fairlight Glen, Hastings, Sussex, *E. M. Holmes*, *Rev. E. N. Bloomfield*.

I. " Sheltered, shady, rocky recesses, where water is constantly trickling over, or otherwise very moist. Blackwater Bridge, near Dunkerron, *Dr. Taylor* (1820). Tore Waterfall, near Killarney. Maghanabo Glen, near Fermoy, Co. Kerry, *W. Wilson, Esq.* (1829), who first published the plant as a native of the British Isles, in *English Flora* (1833). Ballinahassig Glen, near Cork, Fl. Cork. Dunscombe's Wood, *J. Carroll*. Altadore Glen, near Delgany, Co. Wicklow, *The Right Hon. Lord Gough*. We have

also collected it in the same glen, 1872 and 1874; also very sparingly near a small waterfall at Luggielaw, Co. Wicklow. This remarkable plant is very local in Ireland, and only occurs in the warmest and most sheltered spots."—*Dr. D. Moore, Proc. Roy. Irish Acad.* p. 603 (1876). Killarney, *Dr. Carrington*, and others.

Found on the Continent (Pyrenees, *Dr. Spruce, Prof. Schimper*, Italy), and in the Southern States of North America.

Obs.—Our finest frondose species, and which seems to be almost peculiar to the South of Ireland, as only two other stations, where it has been sparingly collected, are known.

When seen not likely to be confounded with any other of our frondose species.

Dr. Spruce and *Prof. Schimper* consider it a variety of the tropical *Dumortiera hirsuta* (Swartz), and *Dr. Stephani* in his *Sp. Hep.* merges it with that species.

DESCRIPTION OF PLATE CCXIII.—Fig. 1. Portion of frond, natural size. 2–4. Female fronds, natural size (Tayl.). 5. Cross-section of frond \times 11 (Killarney, S. O. L.). 6, 7. Cilia \times 64 (ditto). 8. Cross-section of pedicel \times (Tayl.). 9. Calyptra \times (Tayl.). 10. Female receptacle \times (ditto). 11. Ditto, reversed \times (ditto). 12. Spores and elaters \times (ditto). 13. Male frond, natural size (ditto).

Genus 51. TARGIONIA, *Mich.*

Targionia, *Mich. Nov. Pl. Gen.* (1739).

Frond furcate and continuous from the apex, conspicuously porose, squamulose beneath. Distinct female receptacle absent, the involucre sessile springing from the apex of the frond, bivalved, 1-fruited. Pistillidia 3 to 4, of which one is perfected. Perianth absent. Calyptra thin, persistent, investing the capsule, at length vanishing at the apex. Style deciduous. Capsule solitary, shortly pedicellate, globose, rupturing irregularly. Spores globose, tuberculate. Elaters bi-trispiral. Andræcia lateral, disciform, papillose, rising on a separate innovation from the antical costa.

Targionia hypophylla, L.

Targionia hypophylla, Linn. Sp. pl. p. 1604 (1753).

Targionia Michellii, Corda in Opiz Beitr. 1, p. 649 (1829).

Monoicous, growing in spreading patches, small, dark green in colour, with more or less conspicuous whitish pores, margin and postical aspect chocolate-purple. Fronds imbricate, simple, obovate or obcuneate, plane, involute when dry, costate, thick along the middle, margin thinner, a cross-section showing the antical outer layer to be greenish, inner whitish, postical brownish purple; clothed on the postical side with numerous, densely imbricate, broadly lanceolate, chocolate-purple scales; cells elongate, irregularly 4-, 5-, and 6-sided, with several, much smaller, roundish, hyaline ones containing minute, nucleate granules; rootlets very numerous, hyaline. Perianth sessile, protruding postically from the apex of the frond, composed of two semi-roundish, slightly emarginate, dark purple bracts. Calyptra thin, persistent. Style deciduous. Capsule shortly pedicellate, when young pale brown, deep purple when ripe, oval-orbicular, protruding slightly or not at all beyond the perianth, bursting irregularly. Spores globose, dark brown, margin slightly paler, coarsely tuberculate. Elaters 2-4-spiral, pale brown, much narrower than the spores. Andrœcia lateral, disciform, papillose, rising on a separate innovation from the antical costa.

DIMENSIONS.—Fronds 8 mm. to 10 mm. long, by 4 mm. to 5 mm. broad, .75 mm. thick; scales .45 mm. \times .15 mm. broad at the base; cells of scales .08 mm. \times .03 mm., .05 mm. \times .03 mm., .05 mm. \times .04 mm.; small nucleate cells .02 mm.; bracts 1.25 mm. \times 1.5 mm. \times 2 mm.; capsule 1.75 mm. \times 1.4 mm.; spores .05 mm. diam.; elaters .225 mm. \times .015 mm.

HAB.—On exposed warm dry or moist rocky banks. Rare.

1, 2. Hampshire. 5. Moist sunny red sandstone rocks at the entrance to Habberley Valley, Kidderminster, Worcester, *Dr. F. A. Lees*, March 1883; Dove Dale, Staffordshire, *J. E. Bagnall*.

Barmouth, rocks above the town, and by the road to Harlech, *Rev. T. Salway*; Barmouth, on the Dolgelly Road, *Dr. Carrington & W. H. P.* 10.

I. Cave Hill, Belfast, *John Templeton*; on dry limestone rocks, Carrigaline, near Cork, *I. Carroll*; on the warm basaltic rocks at Deerpark, Glenarm, Co. Antrim, *Dr. D. Moore*.

C. Baie de Saint Brelade, *Aug. Martin*.

Found on the Continent, Central Asia, Africa, Australia, Tasmania, New Zealand, North and South America, &c.

Obs.—As only one species of this peculiar genus has been found in Europe there is little difficulty in identifying it. From other genera it is distinguished by the postical sessile perianth, visible at the apex of the frond; in habit it resembles the large *Riccia glaucescens* Carr., but grows in larger patches with the fronds usually spreading in one direction, and when dry remarkably involute, showing the almost black postical scales.

DESCRIPTION OF PLATE CCXIV.—Fig. 1. Plants natural size (Templeton). 2. Ditto, slightly enlarged. 3. Portion of frond, antical view \times (ditto). 4. Ditto, postical view \times (ditto). 5. Frond, postical view $\times 3$ (Schiffner in Engl. & Prantl Pflanzf.). 6. Portion of frond, antical view \times (Templeton). 7. Cross-section of frond $\times 11$ (Alliers, France, du Buysson). 8. Scale \times (Schiffn. in Engl. & P. Pfl.). 9. Ditto $\times 64$ (Alliers, du Buysson). 10. Portion of scale $\times 290$ (ditto). 11. Braets with ripe capsules $\times 3$ (Schiffn. in Engl. & P. Pfl.). 12. Braets and capsule $\times 16$ (Kidderminster, F. A. Lees). 14. Braets, explanate $\times 11$ (ditto). 14. Male branch $\times 5$ (Schiffn. in Engl. & P. Pfl.). 15. Longitudinal section of the same $\times 5$ (ditto).

Genus 52. SPHÆROCARPUS, *Micheli*.

Sphærocarpus, Mich. Nov. Pl. Gen. 4, t. 3 (1729); Dum. Comm. Bot., p. 78 (1822).

Targionia, Dicks. Pl. Crypt. Brit. fasc. 1, p. 8, n. 2 (1785).

Fronds small, orbicular, costate, epidermis indistinct. Perianths produced on the antical surface of the frond, aggregated, sessile,

pyriform or obtusely conical, perforated at the apex, 1-fruited. Calyptra crowned with a deciduous style, closely investing the globose, indehiscent capsule. Spores globose, muriculate, remaining in a coccus. No elaters. Antheridia in folliculose bodies on the surface of separate fronds.

Sphærocarpus terrestris, Mich.

Sphærocarpus terrestris, Mich. Nov. pl. gen. p. 4, t. 3 (1729); Dill. Hist. musc. p. 536, t. 78, f. 17 (1741); Smith, Eng. Bot. t. 297 (1790).

Targionia Sphærocarpus, Dicks. Pl. crypt. Brit. fasc. 1, p. 8 (1785).

Sphærocarpus Michelii, Bell. Act. Taur. v. 258 (1792); Cooke, Brit. Hep. f. 195 (1868).

Sphærocarpus Sphærocarpus (Dicks.), Howe, Hep. & Anthoc. Calif. p. 66 (1899).

Diocious, closely caespitose, small, pale green in colour, somewhat glaucous. Fronds flat, orbicular, midrib 2 to 3 cells thick, indistinct, gradually disappearing towards the thin membranaceous margin, which is slightly and variously lobed, lobes short and rounded, concealed by the aggregated inflated perianths; texture thin, reticulated; radiculose, rootlets long, single, hyaline, papillose within. Perianths aggregated on the frond, sessile, obovate or pyriform, when young longish or elliptical, variable in size, apex obtuse or sub-truncate, when young closed, afterwards opened, mouth small, rounded, texture semi-transparent, regularly 4-6-sided cells. Pistillidia 2-5, oblong. Calyptra very delicate, bistratose at the base, at the apex unistratose, crowned with a deciduous style, closely investing the capsule, and on its maturity disappearing. Capsule globose, included in the perianth, indehiscent, bursting irregularly, composed of a single layer of cells. Spores greenish-black, angular, muriculate. No elaters. Antheridia spherical, shortly pedicellate, situated on the surface of separate fronds which are smaller than the others. Gemmiparous, gemmæ dispersed on the frond, dark coloured, globose, elliptical or oval.

Annual.

DIMENSIONS.—Thallus .6 mm. to 1.3 mm. diam.; perianth 1.5 mm. to 2.5 mm. long.

HAB.—On the ground, especially clover fields. Very rare.

4. Near Yarmouth, *Dawson Turner*; *George Fitt*. 5. Sellach, near Ross, Herefordshire, *Rev. A. Ley*, 1872; *B. M. Watkins*, 1881. 8. On a stone in Collin's Lane, *Coleman*; Stubble field, Twycross, Leicestershire, *Bloxam*. 10.

Found on the Continent, North Africa, and in North America.

Obs.—A very distinct species and the only known British one of the genus.

DESCRIPTION OF PLATE CCXV.—Fig. 1. Plants natural size (W. H. P.). 2. Ditto $\times 2$. 3, 4. Ditto $\times 4$. 5. Perianths in different stages of growth with portion of frond and rootlets \times . 6. Portion of rootlet \times . 7. Portion of frond with section of perianth (*a*) showing pistillidia and (*b*) gemma. 8. Young capsule \times . 9. Half-ripe capsule \times . 10. Half-ripe spores \times . 11. Perfect capsule \times . 12. Portion of calyptra \times . 13. Cross-section of capsule (*a*) and a ripe spore (*b*). 14. Gemmæ \times (Bischoff).

Suborder III. RICCIACEÆ.

Genus 53. **RICCIA**, *Mich.*

Riccia, Mich. Pl. Gen. (1729).

Fronds generally disposed in rosettes, at first radiating from the centre, which often decays, segments bifid or dichotomous; antical plane, depressed or canaliculate; postical usually convex, smooth or squamulose; margin either naked or ciliate; epidermis usually distinct, without pores. Fruit immersed in the interior of the frond, rupturing antically, sessile. Involucre none. Calyptra delicate, coherent with the capsule, style-bearing, style persistent, protruding. Capsule spherical, sessile, indehiscent within the calyptra. Spores tetrahedral, alveolate or muriculate. Rootlets papillose within.

1. *Riccia glauca*, Linn.

Riccia glauca, Linn. Sp. pl. 1605 (1753).

Monoicous, growing in orbicular patches, closely attached to the ground, small, glaucous green in colour, concolorous. Fronds bifid or dichotomous, substellate, lobes linear, obovately-linear or cuneate, 8 to 12 cells thick near the middle, plane or channelled near the apex, punctate, apex emarginate or obtuse, margin thin, membranaceous, crenulate or smooth, postical side green; radiculose, rootlets plentiful; texture fleshy; cells hexagonal or subquadrate, walls thick, no trigones. Capsules subspherical in a single or double row radiating from the centre of the frond and running along near the middle of each lobe, crowned with a style, 4 to 6 cells long, of a dark colour, which alone is protruded, and soon deciduous. Spores dark reddish-brown, almost black when ripe, angular-globose, reticulate, walls of convex side irregularly tuberculate, papillæ narrowly conical, areolæ regular, 5, 6-angled, 8-10 measuring the convex surface, other sides almost smooth; when young with a narrow pellucid border, scarcely visible when ripe.

Var. *minima*. Minute, green on both sides, fronds bifid, lobes linear, thin, 4 to 6 cells thick, plane, slightly channelled near apex.

DIMENSIONS.—Plants $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter; fronds 6 mm. \times 2 mm., 7 mm. thick, 5 mm. \times 1 mm., 5 mm. thick; capsule 6 mm.; spores 09 mm. \times 07 mm.

Var. *minima*, $\frac{1}{4}$ inch in diameter; fronds 1.75 mm. \times .5 mm., .3 mm. thick, 2.25 mm. \times .6 mm., .3 mm. thick, 3.5 mm. \times .7 mm., .3 mm. thick.

HAB.—On moist ground, chiefly clayey fields and gardens.

1-16. I. Common; rarer in Scotland.

Europe, Asia, Japan, North America.

Var. *minima*. Probably generally distributed. 9. Stretford, Lanc., *C. J. Wild*; Cheetham, Lanc., *C. J. Wild*. 12. Fowlshaw Moss, Westmorland, *G. Stabler*.

Obs.—This is the commonest species of the genus, and is easily recognised by its glaucous green colour, the same on both sides. Some hepaticologists consider *Riccia minima* L. to be the same as *R. sorocarpa* Bischoff, but as probably all small forms of *Riccia* would be included under this name, I prefer to follow Bischoff, as he was the first to correctly and fully describe and figure the species, and I retain the small form which cannot be separated as a species from *R. glauca* as var. *minima*. This must not be confounded with the plant described and figured by Lindenberg, which is purple beneath (Lindenb. Mon. Riccia, p. 427, t. xx (1836)).

DESCRIPTION OF PLATE CCXVI.—Figs. 1, 2. Plants natural size (Bischoff). 3, 4. Ditto magnified (ditto). 5. Ditto, var. *major* \times 2 (ditto). 6. Ditto, var. *minima*, natural size (Fowlshaw Moss, G. Stabler). 7. Ditto \times 11 (ditto). 8. Ditto, var. *major* (Baden, Jack). 9, 10. Cross-section of fronds \times (Bischoff). 11–13. Ditto \times 16 (Fowlshaw Moss, G. Stabler). 14. Portion of rootlet \times 200 (Hoffmeister). 15. Antheridium \times 64 (Fowlshaw Moss, G. Stabler). 16. Convex surface of spores, highly magnified (ditto).

2. *Riccia crystallina*, L.

Lichen palustris, Dill. Hist. musc. p. 535, t. 78, f. 12 (1741).

Riccia crystallina, Linn. Sp. pl. 1605 (1753).

Monoicous, forming rosettes, closely attached to the ground, small, pale or yellowish green on both sides, crystalline. Fronds flat, circular or wedge-shaped, segments bilobed or furcate, obcordate, margin slightly crenate, sometimes slightly raised, antical surface pitted, epidermic cells 6-sided; cross-section shows frond to be of equal thickness and full of air-cavities; radiculose, rootlets few, long, hyaline. Capsule embedded in the frond, spherical, brown; style conical, projecting, covered with a hyaline or faintly purple calyptra. Spores roundish-angular, reddish-brown, reticulate, 6–8 lumen across each face, walls raised,

irregular. Antheridia embedded in the frond, cylindrical, hyaline; style projecting, hyaline.

DIMENSIONS.—Fronds about $\frac{1}{2}$ inch long by about $\frac{1}{4}$ inch wide; capsule .65 mm. diam.; spores .08 mm. diam.

HAB.—On very damp earth in fields, on wet banks, or especially by the margin of ponds. Very rare.

3. In a ditch near Deptford, Kent, *Petiver*, now extinct.
 4. Helford, West Norfolk, *Rev. E. N. Bloomfield*, Aug. 1881.
 5. Stoke-on-Trent, *R. Garner*; Pottal Reservoir, Warwickshire, *J. E. Bagnall*. 7. Dolgelly, Merionethshire, *J. Ralfs*, 1863; Aberffraw, Anglesey, *W. Wilson*. 8. Exposed mud banks of reservoirs at Cropstone and Thornton, Leicestershire, *F. T. Mott*, Aug. 1894. 9. Mere Mere, Cheshire, *G. E. Hunt*, 1869.
 13. Brownhall Orchard, Dumfries, *J. Cruickshank*?

Found on the Continent and in North America.

Obs.—This rare and distinct species may be distinguished from *R. glauca* by its larger size, paler and yellower colour, spongy texture and its antical surface being pitted with deep cavities.

It has been conjectured that it might be a terrestrial form of *Ricciocarpus natans*, but, in addition to its other distinguishing characters, the spores are nearly twice as large and are reticulate, not papillose.

DESCRIPTION OF PLATE CCXVII.—Figs. 1–4. Plants natural size. 5. Frond \times . 6. Cross-section of frond \times . 7. Ditto. 8. Portion of frond \times . 9. Rootlets \times . 10. Calyptra \times . 11. Capsule \times . 12. Style \times . 13. Spores \times . 14. Portion of frond, showing styles of antheridia. 15. Styles of antheridia \times (Lindenberg).

3. *Riccia sorocarpa*, *Bischoff*.

Riccia sorocarpa, Bischoff, Hep. Nov. Act. N. Car. xvii. p. 1053, t. 71, f. 11 (1835).

Riccia minima, L. Schiffn. in Engl. und Prantl Pflanzenf. 91 und 92 Lief. p. 15 (1893).

Riccia minima, L. p.p. Howe, Hep. & Antho. Calif. p. 23 (1899).

Monoicous, caespitulose, small, pale green in colour, when dry albescent, concolorous. Fronds subradiate, bifurcate; lobes oblong-linear, on cross-section boat-shaped, sulcate, deeply so when dry, with margins erect; margins thin, smooth, or with few hyaline scales; apex acute or obtuse; texture firm, antical surface finely reticulate. Capsules embedded in the frond, roundish, dark brown. Spores reddish-brown, walls thin, finely tuberculate on the convex sides, projections very minute and numerous.

DIMENSIONS.—Fronds about 4 mm. long; lobes .75 mm. broad \times .75 mm. thick, 1 mm. \times .75 mm., 1 mm. \times .6 mm.; when dry .6 mm. broad \times 1 mm. thick, .75 mm. \times .9 mm., .8 mm. \times .5 mm.; spores .065 mm., .08 mm. \times .055 mm.

HAB.—On thin rocky soil, or more rarely in cultivated fields in limestone districts. Rare.

1. Battery Hedge, near Penzance, Cornwall, *W. Curzon*, Sept. 1879. 5. Gt. Doward Hill, *B. M. Watkins*, Sept. 1879; Cheddar Cliffs, near Ross, Herefordshire, *B. M. Watkins*. 7. Barmouth, Merionethshire, *W. H. P.*, Aug. 1877. 8. Millers Dale, Derbyshire, *W. H. P.*, Jan. 1879. 12. On earth, among rocks, near Levens Church; Whitbarrow; in sandy cultivated fields S.W. of Bridge End, Levens, Westmorland, *G. Stabler*.

1. In fissures and tops of old walls; on an old wall near Dingle, *Lindberg & Moore*, 1873; wall top by the roadside, leading from Dingle to Ventry, the Dingle side of the river near the Union, *Lett & McArdle*, 1898.

Found on the Continent and in North America.

Obs.—From any form of *Riccia glauca* L. distinguished by its deeply sulcate lobes, when dry, being apparently thicker than

broad, and its remarkably firm texture; it is also generally much paler in colour, and is almost peculiar to limestone districts.

DESCRIPTION OF PLATE CCXVIII.—Figs. 1 and 2. Plants natural size. 3, 4. Ditto, slightly magnified. 5. Cross-section of frond with young capsule \times . 6. Ditto with capsule \times (Bischoff). 7–10. Cross-sections of fronds, when dry, \times 31 (Cheddar, Watkins). 11. Epidermis \times . 12. Style \times . 13. Young spores \times . 14. Spores \times (Bischoff).

4. *Riccia bifurca*, Hoffm.

Riccia bifurca, Hoffmann, Deuschl. Fl. p. 95 (1796) (excl. syn. Mich. tab. 57 fig. 4).

Monoicous?, closely cæspitose, small; antical surface glaucous green, margins and postical surface of fronds purplish-black in colour. Fronds crowded and frequently imbricated, firmly attached to the surface, tumid-flabellate or pedate; lobes elliptic, contracted at each end or obovate, rarely oblong, cuspidate, retuse, bifurcate or obovate-emarginate, margin elevated, rounded, antical surface sphacelate; texture solid, homogeneous, upper stratum columnar, intermediate portion darker green, epidermis of the postical surface purplish-brown. Rootlets numerous, either capillary and translucent or papillose within. Sporangia scattered irregularly over the disc of the frond, at length rupturing the epidermis. Spores conspicuous, dark brown, three-angled, subcristate, rounded and reticulate, muricate on the outer surface.

DIMENSIONS.—Fronds 3·75 mm. long \times 2·5 mm. broad, 3 mm. \times 1·25 mm., 5 mm. \times 2·5 mm., from 3 mm. to 5 mm. thick at the middle, near the margin 5 mm. to 7 mm. thick, spores 0·095 mm., 0·1 mm. diam.

HAB.—On ledges of rocks where there is a thin layer of soil and mud-covered walls, chiefly in limestone districts and near the sea. Rare.

1. Penzance, *W. Curnow*. 7. Aberffraw, Anglesey, *W. Wilson*, 1830; Barmouth, Merionethshire, *Dr. Carrington*, 1887, on mud-

covered walls, *W. H. P.* 1876. 12. On damp limestone rocks, Levens Park, Westmorland, *G. Stabler*, 1870. 13. Burnfoot Hill, New Galloway, *J. McAndrew*. 15. Head of Glen Dole, Forfar, *J. Sadler*, 1872.

Found on the Continent and in North America.

OBS.—The only other British species which is without cilia and has a purple margin is *Riccia nigrella* D.C.; this is smaller, with narrow linear lobes, dark green antical surface, the margin and postical surface of which are clothed with regularly imbricating scales.

Riccia glaucescens Carr. is a ciliate species, usually much larger and irregular in shape, but small forms where the cilia are not so evident require careful observation to discriminate from *R. bifurca*. The description and drawings are partly taken from Dr. Carrington's "New British Hepaticæ" contributed to "Grevillea," Dec. 1874.

DESCRIPTION OF PLATE CCXIX.—Figs. 1–3. Fronds natural size. 4–7. Fronds \times ?. 8. Frond \times ?. 9–14. Cross-sections of fronds \times 16. 15. Cross-section of frond near apex \times 16. 16–19. Spores \times 250 (Dr. Carrington & W. H. P.).

5. *Riccia nigrella*, D.C.

Riccia nigrella, De Candolle, Fl. Fr. v., p. 193 (1805); Lindenb. Monog. Ricc. p. 467, t. xxix. f. 1 (1836).

Riccia lamellosa, Ralfs, MSS.; Cooke, Brit. Hep. n. 133 (1868).

Exsicc. Husn. Hep. Gall. n. 96; Carr. & Pears. Hep. Brit. Exsicc. n. 65, et 290.

Dioicous, caespitose, minute, dark green in colour anticlally: clothed with dark purple, almost black, transverse, closely imbricated semi-circular scales postically or on the postical margin. Fronds stellate or sub-stellate, narrow, linear, narrowly canaliculate, margins thickened, involute, strongly so when dry; radiculose, rootlets few, hyaline. Spores angular globose, dark brown, almost black, slightly verruculose.

DIMENSIONS.—Fronds 4 mm. \times 1 mm.; 35 mm. \times 75 mm.,

·3 mm. to ·5 mm. thick; cells of scales ·04 mm., ·05 mm.; spores ·075 mm. × ·05 mm.

HAB.—On banks and mud-covered walls. 7. Barmouth, Merionethshire, *J. Ralfs, Dr. Carrington, W. H. P.*, and others. Very rare.

Found on the Continent and in North America.

OBS.—A very rare and distinct species, the dark purple, almost black, semi-circular scales on the inflexed margins easily distinguishing it.

Herr Stephani considers the British species to be distinct from *Riccia nigrella* D.C., and has published it in his "*Sp. Hep.*" as *Riccia Pearsoni*. It seems very ungracious to question his determination when he does me such honour, but I have not been able to satisfy myself as to our British species being distinct from French specimens upon which De Candoëlle founded his species.

All French specimens I have had the opportunity of examining are dioicous like our British; the specimens in my copy of Husnot's *Hep. Gall. n. 96*, are male plants. Stephani gives the size of the British species as 10· mm. long, but I have examined a great number of specimens, and find them very regular in size, like the French and Italian, 3·5 mm. to 4· mm. long; the apices are all more or less rotundate, the channel varies in being more or less sulcate; cross-sections of British specimens agree exactly with French ones. He also describes the spores as being different in size, but I find those of Italian plants to be similar to the British, ·075 mm. × ·05 mm.

I wrote to Herr Stephani expressing my regret that I could not agree with his observations, and he wrote the following characteristic kindly letter: "You are perfectly at liberty to doubt my publication and to give expression to it. I am not touchy at all. The drawings I here give are copies of my former examinations; you see the form of the Italian plant is altogether different from that of the English one, and *this alone would be sufficient*, all other points being equal. I have examined a great number of plants, which you kindly sent years ago, and I cannot help differing from you."

I give the drawings sent; whatever may be the position of the Italian plant, most of my drawings agree exactly with the French ones.

DESCRIPTION OF PLATE CCXX.—Fig. 1. Plants natural size. 2, 3. Fronds, antical view, magnified. 4, 5. Ditto $\times 16$ (Barmouth, J. Ralfs). 6–8. Cross-sections $\times 24$ (ditto). 9, 10. Ditto (Paimpol, Cotes du Nord, France, Dr. Avice). 11–13. Ditto (Husn. Hep. Gall. n. 96). 14–16. Ditto (C. & P. Hep. Brit. Exsicc. n. 290, Barmouth, W. H. P.). 17, 18. Ditto (Florence, Italy, Dr. Levier). 19, 20, 21. Cross-sections, apex, middle, adult, *Riccia Pearsoni*, after Stephani. 22, 23. Ditto, apex, middle, *Riccia nigrella*, after Stephani.

6. *Riccia tumida*, Lindenb.

Riccia tumida, Lindenb. Syn. Hep. Eur. p. 12 (1829); Lindenb. Monogr. Riccia, p. 459, t. 27 (1836).

Riccia Micheliï, Raddi, var. *ciliaris*, Levier, Bull. Herb. Boiss. vol. ii. No. 4, p. 230 (1894).

Riccia Micheliï, Raddi, Steph. Sp. Hep. p. 11 (1900).

Dioicous?, cæspitose, crowded, minute, bicolorous, light greyish-green antically, margin and portion of postical sides deep purple, almost black, middle yellowish-green. Fronds simple or bifid with segments again slightly divided in some instances, linear or linear-obovate, obtuse at apex, thick, canaliculate, margin thickened, when dry strongly inflexed; texture fleshy; ciliate, cilia marginal, biseriate, subulate, hyaline, often swollen at the base; radiculose, rootlets plentiful, long, of equal length. Capsule embedded in the middle of the fronds, spherical, dark brown. Spores angular-globose, very dark brown, almost black, the plane sides with pale brown border, faintly reticulate, convex side irregularly tuberculate, spines shorter and blunter than in *R. glauca*.

DIMENSIONS.—Fronds from 2 mm. to 4 mm. long \times 5 mm. to 1 mm. broad, 3 mm. to 5 mm. thick; cilia 16 mm. to 25 mm. long \times 05 mm. to 08 mm. broad at the base; rootlets 015 mm. thick capsule 35 mm. \times 4 mm.; spores 1 mm. \times 075 mm.

HAB.—On mud-covered walls, banks, and rocks. Very rare.

1. On rocks near Penzance, Cornwall, *W. Curnow*, 1870 (Herb. W. H. P.); Trebar-with-Strand, North Cornwall, *E. M. Holmes*, *Mrs. Ella M. Tindall*. 6. Lantyssil, Cardiganshire, *W. Joshua*, May 1877. 7. On mud-covered walls and banks, Barmouth, Merionethshire, *W. H. P.*, April 1876; *T. Rogers*, Sept. 1877.

Found on the Continent and in North America.

OBS.—A minute but very distinct species, recognised by its two colours, green and purple, and the two rows of cilia.

Riccia glaucescens Carr. is a larger species, more irregular in shape, margin somewhat acute, cilia in a single row.

Riccia ciliata Hoffm. is destitute of the purple scales, fronds plane, cilia much more abundant.

The *Riccia tumida*, var. *Pearsoni* Carr. (Lond. Cat. 12 b. 1881) is a form found in damper situations, where the purple scales are not so evident, fronds thinner, and the cilia not so regularly biseriate; it approaches *R. ciliata*, but from close study of the plant *in situ* (Barmouth) I have little doubt but that it is simply *R. tumida* modified by its damper habitat.

Dr. Levier reduces *R. tumida* to a variety (var. *ciliaris*) of *Riccia Michellii* Raddi, and Herr Stephani refers it to that species; all the specimens I have seen from different localities, and all I have seen growing for several years at Barmouth, are so regular in size, shape and in having the double row of cilia, that I follow Lindenberg, who described and figured our British form so accurately.

DESCRIPTION OF PLATE CCXXI.—Fig. 1. Plants natural size. 2. Frond \times ? (Lindenberg). 3–5. Fronds \times 24 (Cardiganshire, Wm. Joshua). 6, 7. Cross-sections of fronds \times ? (Lindenberg). 8, 9. Ditto \times 24 (Cardiganshire, Joshua). 10. Ditto \times ? (ditto). 11–15. Cilia \times 64 (ditto). 16. Cilium \times 290 (ditto).

7. *Riccia glaucescens*, Carrington.

Riccia glaucescens, Carr. in Carr. & Pears. Hep. Brit. Exsicc. fasc. 1, n. 66 (1878).

Riccia Michelii, Raddi, Lindb. Musc. Scand. p. 2 (1879).

Riccia bifurca, Hoffm. Steph. Sp. Hep. p. 30 (1900).

Dioicous, caespitose, small, pale glaucous green antically, border somewhat paler, postical surface covered laterally by a delicate membrane or detached scales of a purple colour, best seen when the plant is dry and the border incurved, mid-line brownish. Fronds flabellate-furcate, sometimes crowded and imbricating each other; segments linear-cuneate or battledore-shaped, concave, not canaliculate on the upper aspect, surrounded by a rather broad border, recurved and convex when moist, but inflexed when dry; texture homogeneous, composed of large cells arranged in regular series, thickened along the mid-line of the lower surface, margins thinner, acute, fringed with small but strong translucent cilia, sometimes these are wanting or irregularly disposed, and the border simply crenulate; radiculose, rootlets hyaline. Capsules few, occupying the hollow central channel near the base of the frond; spores large, brown, muriculate, angular-convex, about 10 areolæ across the convex side.

DIMENSIONS.—Fronds 6· mm. to 12· mm. long, segments 1· mm to 3· mm. broad, ·3 mm. to ·7 mm. thick; cilia ·2 mm. × ·05 mm.; capsule ·75 mm.; spores ·1 mm.

HAB.—On damp banks or mud-covered rocks in exposed situations, usually near the coast. Rare.

1. Penzance, Cornwall, *W. Carnow*. 7. Barmouth, Merionethshire, *Dr. Carrington, W. H. P.*; Aberffraw, Anglesey, *W. Wilson*; Aber, Carnarvonshire, *W. Wilson*. 12. Levens Park, Westmorland, *G. Stabler*. 13. Portpatrick, *J. McAndrew*. 15. Montrose Links, *A. Croall*; Den of Fullarton, Forfar, *A. Croall*.

Obs.—A large and characteristic species discovered by my late friend Dr. Carrington at Barmouth, where it grows in some abundance, remarkable for its glaucous antical surface, hence its name.

The only other bicolourous ciliate species which has been found

in Britain is *Riccia tumida* Lindenb. which is very distinct from it, being a much smaller plant, very neat and regular in its shape, and possessing a double row of cilia; both species grow at Barmouth, and there is no difficulty in distinguishing them with the naked eye.

Riccia Lescuriana Aust., a North American species, approaches the nearest to it, but is thinner, not so purple in colour, with the margins more incurved and with more numerous cilia, which are often 2 and 3 rows deep; it is also monoicous according to Prof. Howe.

Riccia Bischoffi Hüben., a Continental species, is nearly allied to it, but in this the fronds are broader and shorter, generally bilobed, obovate or obcordate, channelled above, but thick and prominent beneath, surrounded with a broad membranaceous margin, fringed with large obtuse cilia.

Herr Stephani in his "*Sp. Hep.*" p. 14, refers *Riccia glaucescens* to *Riccia bifurca* Hoffm., a non-ciliate species.

Lindberg refers it to *Riccia Michellii* Raddi; to the ciliate form of which Dr. Levier refers this species.

The description and some of the observations are taken from Carr. & Pears. *Hep. Brit. Exsicc.* n. 66, contributed by Dr. Carrington.

DESCRIPTION OF PLATE CCXXII.—Fig. 1. Plants natural size. 2. Frond $\times 11$ (Barmouth, W. H. P.). 3. Cross-section of frond $\times 24$ (ditto). 4–8. Ditto $\times 24$ (Barmouth, Dr. Carrington). 9, 10. Ditto $\times 16$ (Aberffraw, W. Wilson). 11, 12. Cilia $\times 25$ (Barmouth, Dr. Carrington). 13. Style $\times 85$ (ditto).

8. *Riccia ciliata*, Hoffm.

Riccia ciliata, Hoffmann, *Deuschl. Fl.* p. 95 (1796).

Monoicous, cæspitulose, small, pale or yellowish-green in colour, concolorous. Fronds sub-orbicular or flabellate, somewhat thin, dichotomously or sub-stellately divided; lobes linear or slightly cuneate, obtuse or sub-emarginate, towards the apex sub-canaliculate, margin slightly thickened and fringed with numerous long,

subulate hyaline cilia, a little swollen at the base; texture somewhat delicate; epidermic cells punctate; radiculose, rootlets numerous, filiform, papillose within. Capsule embedded in the frond, globose, black; spores dark brown, almost black, tuberculate, spines blunt.

DIMENSIONS.—Plants forming circular patches $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter; lobes 3 mm. to 4 mm. long \times 7 mm., 8 mm. and 1 mm. broad; cilia 0.75 mm. to 1.25 mm. long \times 0.1 mm. broad at the base; spores 0.9 mm. diam.

OBS.—Distinguished from any of the other ciliate *Ricciae* by its green colour on the postical as well as antical surface of the fronds, and the numerous long cilia.

HAB.—In damp places by ditch sides or on clayey fields.

Very rare.

1. On mud, Tavistock, Devon, *J. Ralfs* & *W. Curzon*, July 1875.

Found on the Continent and in North America.

DESCRIPTION OF PLATE CCXXIII.—Fig. 1. Plants natural size. 2. Plant \times . 3. Portion of lobe \times . 4. Cross-section of lobe \times . 6. Cilia \times (Lindenberg).

Genus 54. **RICCIELLA**, *Braun*.

Lichenastrum aquaticum, Dill. Hist. musc. p. 514, t. 74, f. 47 (1741).

Riccia, Linn. Sp. pl. 1606 (1753).

Ricciella, Braun, Bot. Zeit. p. 756 (1821).

Plants slender, linear, usually several times dichotomous, scales not present. Fruit globose, exserted, adnate to the postical surface of the frond.

Ricciella fluitans (*L.*), *Braun*.

Lichenastrum aquaticum, Dill. Hist. musc. p. 514, t. 74, f. 47 (1741).

Riccia fluitans, Linn. Sp. pl. 1606 (1753).

Ricciella fluitans, Braun, Bot. Zeit. p. 754 (1821).

Dioicous, caespitose or spreading, not forming rosettes, medium size, yellowish-green in colour. Fronds dichotomously branched, segments narrow, linear, plane or slightly canaliculate, thin, con-

colourous, apex emarginate or obtuse; radiculose when terrestrial only, rootlets hyaline. Female flowers adnate to the postical side of frond. Capsule globose, dark brown, coarsely reticulated, the areolæ 5, 6 across the convex side, walls dark brown, thin, raised in a winged manner.

DIMENSIONS.—Fronds $\frac{1}{2}$ to 2 inches long, 1 mm. wide, .2 mm. thick; capsule .75 mm.; spore .1 mm.

HAB.—Floating on stagnant ponds, or on mud at their margins.

Somewhat rare.

2. Strathfieldsaye, Hampshire, *Hill*, 1855. 3. Kent, *Forster*. 4, 5, 8. Pond near Ashley; pond between Donington and the Trent, Leicestershire, *F. T. Mott*. 9. Ashton Canal, Lanc., *J. E. Sunderland*; Moston, Lanc., *R. Lees*; Reddish Canal, Lanc., *G. A. Holt*; Mere Mere, Cheshire, *G. E. Hunt*. 10. Hirst Courtney and Drax, *H. F. Parsons*; pond near Pollington, *T. Birks, junr.*; near Goole, *H. F. Parsons*. 14.

I. Not unfrequent in ditches near the Shannon, Co. Limerick; by the side of the Bann River, above Drogheda; still ditches near Lough Neagh, where the canal joins the Lough at Lurgan, *Dr. D. Moore*.

Found on the Continent, North America, &c.

OBS.—The fertile terrestrial form of this species is considered by some writers to be a distinct species, but as it is only found on mud at the margins of ponds where the floating form is found, and where the ponds have become lower by dryness, I can only conclude that whatever slight changes it may have undergone are owing to the great difference in habitat to that of floating on water, where it is always barren; the terrestrial form is much smaller, narrower, thicker, and more canaliculate.

DESCRIPTION OF PLATE CCXXIV.—Fig. 1. Plants natural size (Bischoff). 2. Ditto (Lindenberg). 3. Frond \times ? (ditto). 4, 5. Ditto (Bischoff). 6, 7. Cross-sections of fronds \times (Lindenberg). 8, 9. Ditto \times 24 (Mere, Cheshire, Hunt). 10. Capsule \times (Bischoff). 11. Cross-section of frond showing capsule \times (ditto). 12. Spore \times 290 (Barmouth, Dr. Carrington).

Genus 55. **RICCIOCARPUS**, *Corda*.

Ricciocarpus, *Corda* in *Opiz Nat.* (1829).

Riccia, *Linn. Syst.* 956.

Plants obcordate, constantly dividing with growth, air-cavities abundant, postical surface naked or furnished with long dentate scales. Fruit immersed in the frond and not protruding on either surface, at length naked by the splitting of the central groove. Antheridia in a row in the middle of the frond.

Ricciocarpus natans (*Linn.*), *Corda*.

Riccia natans, *Linn. Syst. Nat. ed. v. 12. p. 2* (1753).

Ricciocarpus natans, *Corda* in *Opiz Nat.* p. 651 (1829).

Dioicous, floating on water or when terrestrial forming rosettes, small, pale or dark green above, purple below. Fronds simple, obcordate or obtuneate, broadly emarginate, channelled in the centre, furnished with long linear-lanceolate ribbon-like, flattened, purple, serrated membranaceous processes; epidermis with numerous uniform air-cavities beneath it; texture spongy; radiculose, root-lets few, very long, hyaline, smooth within. Capsules immersed in the frond about the middle in two rows. Spores brownish-black, angular, strongly papillose, papillæ blunt.

DIMENSIONS.—Fronds $\frac{1}{4}$ to $\frac{1}{2}$ inch long, segments 3 mm. broad; capsule .75 mm. diam.; spores .05 mm.

HAB.—Stagnant ponds, floating, or on damp margins of the same. Rare.

2. Hampshire, *Hill*; *Warner*. 4, 5. Near Ross, Herefordshire, *B. M. Watkins*. 7, 8. Thurcaston, Leicestershire, *F. T. Mott*. 10. Hebden Bridge, *S. Gibson*; near Dringhouses, near York, *W. West*.

“Rare in Ireland. Abundant in a large boggy pool, about half-way between Drogheda and Navan, near the Railway, right-hand side going from Navan to Drogheda; ditch by the side of the Shannon, near Portumna, Co. Galway. Ditches near Passy, Co. Limerick, *Dr. W. H. Harvey*.”—*Dr. D. Moore*.

Found on the Continent, North America, &c.

OBS.—When floating the ribbon-like processes are long and abundant, sometimes they are only faintly tinged purple; when growing on land, they frequently disappear, or are only few.

DESCRIPTION OF PLATE CCXXV.—Fig. 1. Plant natural size (Lindenberg). 2, 3. Ditto (Bischoff). 4. Plant, slightly magnified (Bischoff). 5. Cross-section of frond, magnified (Lindenberg). 6. Cross-section of portion of frond, showing immersed capsules, magnified (Bischoff). 7. Ditto, showing antheridia (ditto). 8. Epidermis, magnified (ditto). 9. Hair-like process, magnified (ditto). 10. Capsule, magnified (ditto). 11. Young spores, magnified (ditto). 12. Spores, magnified (ditto).

Suborder IV. *ANTHOCEROTACEÆ*.

Genus 56. **ANTHOCEROS**, *Mich.*

Anthoceros, Mich. Gen. Pl. (1729).

Fronds dark green or blackish, often orbicular; nearly plane or with centre depressed, radiately lobate; lobes variously divided; costa very wide, confluent, confused with the pagina; texture lax, vesicular, with large chlorophyll granules, frequently glandularly thickened at the apex or in streaks along the middle so as to appear nerved. Inflorescence monoicous or dioicous. Involucre tubular. Capsule pedunculate, exserted, linear or cylindrical, very long, oblong, bivalved, furnished with a columella. Elaters in a few species perfectly spiral, in most only undulate or sinuate, simple or branched, often geniculate, more or less heteromorphous, fibres wanting or indistinct. Spores papillose or smooth. Antheridia irregularly disposed on the antical surface of the frond.

1. *Anthoceros lævis*, L.

Anthoceros lævis, Linn. Sp. pl. 1606 (1753).

Dioicous, caespitose, small to medium size, dark green. Fronds flat, smooth, without air-cavities; lobate, lobes undulate, somewhat orbicular, rounded, not laciniate; texture somewhat fleshy, epidermic cells 4 times smaller than the inner, 3 to 4 cells thick near the middle of the frond; radiculose, rootlets numerous, pale dirty brown. Calyptra trumpet-shaped, 1 to 2 cells thick near the middle, 3 to 4 near the base, mouth wide, repand, toothed, rarely scarioso. Capsule brown, dark brown to black when dry; spores yellowish-brown, flattish, angular, almost smooth; elaters rather short, geniculate, somewhat articulated. Androecia irregularly dispersed over the face of the frond, oval; antheridia oval, pale green, slightly stipitate, about 6 in each cavity.

DIMENSIONS.—Fronds $\frac{1}{4}$ to $\frac{1}{2}$ inch long and broad, .2 mm. to .3 mm. thick; calyptra 3 mm. long \times 1 mm. broad, 2 mm. \times 1 mm.; capsule $\frac{3}{4}$ to 1 inch long; spores .05 mm. diam.; androecia .3 mm. \times .2 mm.

HAB.—Wet fields, damp roadsides, by the sides of ditches, &c. Rare.

1. Stable Hobba, near Treceiffe, Newlyn Cliff, Trungle, Paul, *W. Currow*. 3?, 5, 7?, 10, 12. In a cultivated field near Heversham Railway Station; cultivated fields (sand and sandy-peat), Nether Levens and Foulshaw, Westmorland, *G. Stabler*. 17A. Caithness, *Rev. D. Lillie*.

1. On a wet clay bank by the roadside, leading from Dingle to Ventry, left-hand side of the road about a mile and a half from Ventry, *Lindb. & Moore*, 1873. On a pathway in Burnham Wood, Ventry, *Lett & McArdle*, 1898.

Found on the Continent and in North America.

OBS.—Distinguished from *Anthoceros punctatus* by its dioicous inflorescence, the smooth surface of fronds, no air-cavities, lobes rounded not laciniate, paler colour of the spores, which are not echinate.

From *A. Stableri*, see notes under that species.

DESCRIPTION OF PLATE CCXXVI.—Fig. 1. Fertile plant natural size. 2. Ditto \times . 3. Cross-section of frond \times 16. 4, 5. Calyptra \times 11. 6. Cross-section of calyptra \times 11. 7. Ripe capsule opened \times . 8. Male plant natural size. 9. Portion of male plant \times 11.

2. *Anthoceros punctatus*, L.

Anthoceros punctatus, Linn. Sp. pl. 1606 (1753).

Monoicous, cæspitose, small to medium size, bright pale green in colour. Fronds in layers, thin, subimbricate, spreading in a circular manner, centre depressed and concave, lobes suberect, somewhat dichotomous, oblong and obtuse, without any distinct midrib, if present confluent and confused with both sides of the frond, more or less deeply sinuate, pinnatifid or lacinate, crisped; cross-section of frond shows about 2 to 3 layers of cells, rarely 5 to 6; texture delicate, glandular, reticulate; cells lax, epidermic layer 4-, 5-, and 6-angled, chlorophyllose, chlorophyl granules large, angular; walls thin; stomata distinct; small remote scales scattered over the frond; radiculose, rootlets pale dirty brown, arising from base or centre of frond. Calyptra antical, lower half 4 to 6 cells thick, inner layer of cells very minute, others irregular in size with very thin walls, oblong-linear, slightly repand, when young closed at the top, and later ruptured by the protruding capsule, leaving an irregular lacerate opening, parts of which are torn away or remain adhering as scariose rudiments. Capsule pedunculate, exserted, very long, black, pod-like, filiform, arising like blades of grass, tipped with a veil when young, bursting when ripe into 2 valves with a parallel partition. Spores black, strongly echinate, angular, on the convex side beset with blunt prickles, single or 2 and 3 together; on the other two sides irregularly verrucose. Elaters brownish-black, short and broad, flattish, geniculate, variously contorted.

Andrœcia imbedded irregularly in the frond; antheridia pale brown, oval, stipitate, stipes 4 cells long by 2 cells thick, 8-10 in each cavity.

DIMENSIONS.—Fronds $\frac{1}{4}$ to $\frac{1}{2}$ inch long and broad, .2 mm. to .3 mm. thick at the middle; capsule about 1 inch long; spores .05 mm.; elaters .125 mm. \times .015 mm.; antheridia .125 mm. \times .1 mm.

HAB.—In damp fallow fields and on ditch banks, &c. Somewhat rare.

1. West Cornwall, rather common, *W. Curnow*; Sidmouth, South Devon, *Mrs. Ella M. Tindall*; Somerset, *T. Brittain*. 3. Kent, *Dillenius*. 5. Little Fenton, Staffordshire, *R. Garner*. 7. Very finely in Corsygedol Woods, Barmouth, Merionethshire, *Rev. T. Salwey*; Dolgelly, Merionethshire, *C. J. Wild*. 8. Loughborough, Leicestershire, *Pulteney*; Ditch near Twyeros, Leicestershire, *Rev. A. Bloxam*. 10. 13. New Quay, Kirkeudbrightshire, *J. Cruickshank*. 16. Rare; at the side of ditches, Moidart, West Inverness, fruit Oct., *S. M. Maccicar*. 17A. Caithness, *Rev. D. Lillie*.

I. Frequent in the counties of Kerry and Cork, *Dr. D. Moore*. Mount Brandon, *W. Wilson*, 1829; Maghanabo Glen, *D. McArdle*, 1875, *F. W. Moore & D. McArdle*, 1881, 1897; near Brandon Head, *Lett & McArdle*; Glendoon, Co. Antrim; Kelly's Glen, Co. Dublin, *Dr. D. Moore*; Sugar Loaf Mountain, Co. Wicklow, *Dr. E. P. Wright*.

Found on the Continent and in North America.

Obs.—See notes under *Anthoceros laevis* how to distinguish it from that species.

One of the most important contributions to our knowledge of this genus is Prof. Howe's Monograph on the Hepaticæ and Anthocerotæ of California ("Memoirs of the Torrey Botanical Club," vol. vii. 1899).

DESCRIPTION OF PLATE CCXXVII.—Fig. 1. Plant natural size. 2. Plant \times . 3. Ditto. 4. Cross-section of frond \times 16 (Somerset, T. Brittain). 5. Cells \times (Sidmouth, Tindall). 6. Calyptra \times 16 (Somerset, Brittain). 7. Cross-section of

calyptra $\times 16$ (Sidmouth, Tindall). 8. Spores and elater $\times 300$ (Gottsche). 9. Antheridia $\times 64$ (Sidmouth, Tindall).

3. *Anthoceros Stableri*, *Stephani*.

Anthoceros Stableri, *Stephani*. Rev. Bryol. 5, p. 74 (1895).

Monoicous, cæspitose, small, green in colour. Fronds depressed, creeping, flat, longer than broad, from a narrow base broadly obconical, never distinctly furcate, sometimes spreading in a circular manner, 2 to 3 cells thick, margin irregularly laciniate. Calyptra small, cylindrical, 2 to 3 cells thick, which are irregular in size with numerous empty ones, inner layer of cells very minute. Capsule filiform, columella dark brown with hyaline wall; spores black when ripe, when not quite ripe pale yellowish-brown, densely echinate; elaters numerous, dark brown. Androecia large, roundish or oval; antheridia very numerous, about 20 in each cavity.

DIMENSIONS.—Fronds about $\frac{1}{2}$ inch long by $\frac{1}{4}$ inch broad, .2 mm. thick near the middle; cells .05 mm.; calyptra 2 mm. long \times .5 mm. thick; capsule 2 cm. long; spores .042 mm.; elaters .275 mm. \times .02 mm.; androecia .25 mm. \times .2 mm.; antheridia .125 mm. \times .075 mm.

HAB.—Sandy fields, Foulshaw, Westmorland; *George Stabler*, Sept., Oct. 1881. Very rare.

OBS.—“This is the plant Dr. Spruce speaks of in his ‘Hep. Amaz. and And.,’ p. 572, in a footnote. It resembles very much our common *Anth. punctatus* in size, but may easily be distinguished by the frond creeping flat on the soil beneath, while in *A. punctatus* it is almost erect, turbinate, rooting only in the centre, the upper half alone being more expanded. Both have a very thin frond, which appears streaked and reticulate if seen from above, from the sub-epidermous caverns, which in the younger parts of the frond are smaller and more distinctly reticulate. The epidermis of both bears numerous little crests and short scales, always arranged parallel to the axis and never

running across. The frond is—as usual in the genus—repeatedly forking, the forks, however, are not divided and free (as in some exotic species), but connate with each other by means of a thin lamina; a cross-section of the plant shows, therefore, thin and thick parts regularly alternating, the thicker being the costa, which also bears much larger caverns lying over a solid base of unbroken tissue. In both species the frond runs out into numerous laciniae, which in the vicinity of the vegetative apex are smaller and shorter, while older and longer laciniae surround them, giving the margin a very irregular and torn appearance. *Anth. laevis* is a very much stouter plant, very thick and fleshy in living specimens, and the margin is not laciniate, but merely divided into thick rounded lobes. Spores and elaters are very similar to those of *A. punctatus*; but the male organs of *A. Stableri* are very remarkable, each cavity containing up to 20 antheridia on very short stalks.”—Stephani.

The description is taken from Stephani's notes in “Rev. Bryol.” for 1895.

DESCRIPTION OF PLATE CCXXVIII.—Figs. 1–3. Plants natural size. 4. Fertile plant \times . 5. Plant \times 11. 6. Portion of frond \times 290. 7. Cross-section of frond \times 16. 8. Calyptra \times 16. 9. Cross-section of calyptra \times 16. 10. Androecium \times 64. 11. Antheridia \times 85 (Foulshaw, G. Stabler).

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INDEX TO GENERA, SPECIES AND PLATES.

Synonyms are in Italics.

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Acolea</i> ,			<i>Aplozia</i> —(continued)		
<i>brevisima</i> , Dum.	—	399	<i>gracillima</i> , Dum.	—	302
<i>concinmata</i> , Lindb.	—	403	<i>hyalina</i> , Dum.	—	364
<i>coralloides</i> , Dum.	—	401	<i>larida</i> , Dum.	—	298
<i>crenulata</i> , Dum.	—	407	<i>pumila</i> , Dum.	—	292
<i>ACROBOLBUS</i> , Nees	—	410	<i>riparia</i> , Dum.	—	294
<i>Wilsoni</i> (<i>Tayl.</i>), Nees	181	410	<i>spharocarpa</i> , Dum.	—	296
<i>ADELANTHUS</i> , Mitten	—	204	<i>tristis</i> , Dum.	—	294
<i>Carringtoni</i> , Balf.	—	287	<i>Asterella</i> ,		
<i>decipiens</i> (<i>Hook.</i>), Mitt.	79	204	<i>hemisphaerica</i> , Beauv.	—	470
<i>Alicularia</i> ,			<i>BAZZANIA</i> , Gr. & B.	—	126
<i>compressa</i> , G. L. N.	—	368	<i>Pearsoni</i> (<i>Stephani</i>)	50	133
<i>minor</i> , Limpr.	—	372	<i>triangularis</i> (<i>Schleich.</i>),		
<i>scalaris</i> , Corda	—	370	<i>Lindb.</i>	48	130
<i>ANEURA</i> , Dum.	—	449	<i>trienata</i> (<i>Wallenb.</i>)	49	132
<i>ambrosioides</i> (<i>Nees</i>)	201	453	<i>trilobata</i> (<i>L.</i>), Gr. & B.	47	128
<i>latifrons</i> , Lindb.	202	454	<i>BLASIA</i> , Mich.	—	440
<i>multifida</i> (<i>L.</i>), Dum.	200	451	<i>pusilla</i> , L.	196	440
<i>multifida</i> , Nees	—	453	<i>BLEPHAROSTOMA</i> , Dum.	—	111
<i>palmata</i> (<i>Hedw.</i>), Dum.	199	450	<i>connivens</i> , Dum.	—	157
<i>palmata</i> , Nees	—	454	<i>setacea</i> , Dum.	—	124
<i>pinguis</i> (<i>L.</i>), Dum.	204	457	<i>setiformis</i> , Lindb.	—	114
<i>pinatifida</i> , N. Carr.	—	456	<i>trichophyllum</i> (<i>L.</i>), Dum.	11	112
<i>sinuata</i> (<i>Dicks.</i>), Dum.	203	456	<i>BLEPHAROZIA</i> , Dum.	—	104
<i>ANTHELIA</i> , Dum.	—	93	<i>ciliaris</i> (<i>L.</i>), Dum.	38	104
<i>dentata</i> , Dum.	—	187	<i>Hoffmanni</i> , Dum.	—	106
<i>julacea</i> (<i>L.</i>), Dum.	34	94	<i>pulcherrima</i> (<i>Hoffm.</i>), Lindb.	39	106
<i>Juratzkana</i> (<i>Limpr.</i>),			<i>Woodsii</i> , Dum.	—	102
<i>Spruce</i>	35	97	<i>Blyttia</i> ,		
<i>nicalis</i> , Lindb.	—	97	<i>Lyellii</i> , Endl.	—	132
<i>setiformis</i> , Dum.	—	114	<i>Blyttii</i> ,		
<i>Turneri</i> , Dum.	—	190	<i>Moerckii</i> , G. L. N.	—	138
<i>ANTHOCEROS</i> , Mich.	—	498	<i>Calycularia</i> ,		
<i>levis</i> , L.	226	499	<i>Blyttii</i> (<i>Mærck.</i>)	—	438
<i>punctatus</i> , L.	227	500	<i>Calypogeia</i> , Dill.	—	134
<i>Stableri</i> , Steph.	228	502	<i>arguta</i> , Mont. & Nees	—	139
<i>Aplozia</i> ,			<i>Trichomanis</i> , Dum.	—	136
<i>cordifolia</i> , Dum.	—	290	<i>CEPHALOZIA</i> , Dum.	—	111
<i>crenulata</i> , Dum.	—	300	<i>araria</i> , Pearson	69	181
<i>crystalata</i> , Dum.	—	302	<i>albescens</i> , Dum.	—	192

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
Cephalozia—(continued)			Clasmatocolea—(continued)		
<i>alpestris</i> , Cogn.	—	331	<i>cuneifolia</i> (Hook.), Spruce	105	254
<i>bicuspidata</i> (L.), Dum.	57	150	<i>Colonia</i> .		
<i>catenulata</i> (Hüb.)	54	144	<i>Dumortieri</i> , Hüb. &		
<i>connivens</i> (Dicks.)	60	157	<i>Genth.</i>	—	423
<i>curvifolia</i> (Dicks.), Dum.	61	159	<i>pusilla</i> , Dum.	—	418
<i>dentata</i> (Raddi), Lindb.	73	187	<i>Ralfsii</i> , Dum.	—	430
<i>denudata</i> (Nees), Spruce	66	174	<i>Coleochila</i> .		
<i>divaricata</i> (Smith), Dum.	67	177	<i>anomala</i> , Dum.	—	267
<i>elachista</i> (Jack), Lindb.	71	184	<i>cuneifolia</i> , Spruce	—	254
<i>fluitans</i> (Nees), Spruce	63	165	<i>Taylori</i> , Dum.	—	264
<i>Francisci</i> (Hook.), Dum.	62	103	CONOCEPHALUS, Neck.	—	468
<i>Helleri</i> , Lindb.	—	351	<i>conicus</i> (Neck.), Dum.	209	469
<i>heterostipa</i> , Carr. et Spruce	64	168	<i>Cordea</i> .		
<i>hibernica</i> , Spruce MS.	59	155	<i>Blyttii</i> , Cord.	—	438
<i>islandica</i> , Lindb.	—	194	<i>Dilorna</i> .		
<i>Jackii</i> , Limpr. MS.	70	182	<i>Blyttii</i> , Dum.	—	438
<i>lucifolia</i> , Dum.	—	197	<i>hibernica</i> , Gr. & Benn.	—	434
<i>leucantha</i> , Spruce	72	186	<i>Lyllii</i> , Dum.	—	432
<i>lunula-folia</i> , Dum.	56	147	<i>Diplomitrium</i> .		
<i>media</i> , Lindb.	—	147	<i>hibernicum</i> , Cord.	—	434
<i>multiflora</i> , Spruce	—	147	<i>Diplomitrium</i> .		
<i>obtusiloba</i> , Lindb.	—	165	<i>Blyttii</i> , Cord.	—	438
<i>pallida</i> , Spruce	55	146	<i>Diplotena</i> .		
<i>serriflora</i> , Lindb.	—	144	<i>Blyttii</i> , Cord.	—	438
<i>Sphagni</i> (Dicks.), Spruce	65	171	<i>hibernica</i> , Dum.	—	434
<i>stellulifera</i> (Tayl. MS.)	68	179	<i>Lyllii</i> , Nees	—	430 434
<i>Turneri</i> , Lindb.	—	190	DIPLOPHYLLUM, Dum.	—	238
CESIA, Gr. & B.	—	390	<i>albicans</i> (L.), Dum.	97	239
<i>adusta</i> (Nees), Lindb.	—	399	<i>Dicksoni</i> (Hook.), Dum.	100	243
<i>alpina</i> (Gottsche), Lindb.	172	391	<i>Hellerianum</i> , Dum.	—	251
<i>brevissima</i> (Dum.)	176	399	<i>minimum</i> , Dum.	—	353
<i>concinata</i> (Lightf.),			<i>obtusifolium</i> (Hook.),		
<i>G. & B.</i>	178	403	<i>Dum.</i>	99	241
<i>conferta</i> , Limpr.	175	397	<i>saxicolum</i> , Dum.	—	355
<i>corallioides</i> (Nees)	177	401	<i>taxifolium</i> (Wahl.), Dum.	98	240
<i>crassifolia</i> (Carr.), Lindb.	174	395	DUMORTIERA, Nees	—	477
<i>crenulata</i> , Gottsche	179	407	<i>hirsuta</i> (Swartz.), Steph.	—	477
<i>obtusa</i> , Lindb.	179	405	<i>irrigua</i> (Wils.), Nees	213	477
<i>revoluta</i> (Nees), Lindb.	173	393	EREMONOTUS, Lindb.	—	200
CHANDONANTHUS, Mitt.	—	113	<i>myriocarpus</i> (Carr.), Lindb.	78	201
<i>setiformis</i> (Ehrh.), Mitt.	42	114	<i>Eucalyr.</i>		
CHILOSYPHUS, Dum.	—	256	<i>obovata</i> , Lindb.	—	366
<i>polyanthos</i> (L.), Dum.	106	257	<i>Fegatella</i> .		
<i>Chomiocarpon</i> .			<i>conica</i> , Corda	—	469
<i>quadratus</i> (Scop.), Lindb.	—	473	FOSSOMBRONIA, Raddi	—	416
<i>Cincinnulus</i> , Radd.	—	134	<i>angulosa</i> (Mich., Dicks.),		
<i>argutus</i> , Dum.	—	139	<i>Raddi</i>	185	421
<i>Sprengelii</i> , Dum.	—	138	<i>angulosa</i> , Raddi	—	424
<i>Trichomanis</i> , Dum.	—	136	<i>caespitiformis</i> , De V.	187	424
CLASMATOCOLEA, Spruce	—	254			

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Fossombronina</i> - (continued)					
<i>corbuleformis</i> , Trab.	—	130	<i>HYGROBIELLA</i> , Spruce		196
<i>cristata</i> , Lindb.	181	120	<i>laxifolia</i> (Hook.), Spruce	77	197
<i>Dumortieri</i> (Hüb. & Genth.), Lindb.	186	123	<i>nericensis</i> , Carr.		389
<i>foreolata</i> , Lindb.	—	123	<i>JAMESONIELLA</i> , Spruce		286
<i>Mittenii</i> , Tind.	188	125	<i>Carringtoni</i> (Balf.), Spruce	121	287
<i>pusilla</i> (Dill., L.), Dum. Lindb.	183	118	<i>JUBULA</i> , Dum.	—	35
<i>FRULLANIA</i> , Raddi	—	23	<i>Hutchinsiae</i> (Hook.), Dum.	6	36
<i>dilatata</i> (L.), Dum.	5	33	<i>JUNGERMANIA</i> , L.		288
<i>fragilifolia</i> , Taylor	3	29	<i>acuta</i> , Lindb.	—	316
<i>germana</i> (Taylor)	4	31	<i>acuta</i> , Wils.	—	309
<i>Hutchinsiae</i> , Nees	—	36	<i>adunca</i> , Dicks.	—	99
<i>microphylla</i> (Gottsche), Pears.	2	26	<i>aquiloba</i> , Schwaeg.	—	212
<i>Tamarisci</i> (L.), Dum.	1	21	<i>albescens</i> , Hook.	—	192
<i>Gymnanthe</i>			<i>albicans</i> , Linn.	—	239
<i>decipiens</i> , Mitt.	—	204	<i>albicans</i> , Nees	—	240
<i>Wilsoni</i> , Tayl.	—	110	<i>algeriensis</i> , Gott.	—	309
<i>Gymnocolea</i>			<i>alpestris</i> , Schleich.	112	331
<i>affinis</i> , Dum.	—	309	<i>angulosa</i> , Dicks.	—	121
<i>inflata</i> , Dum.	—	307	<i>anomala</i> , Hook.	—	267
<i>larifolia</i> , Dum.	—	197	<i>aquilegia</i> , Tayl.	—	71
<i>Gymnomitrium</i>			<i>asplenioides</i> , L.	—	271
<i>Blyttii</i> , Hüben.	—	438	<i>attenuata</i> , Lindb.	—	342
<i>Gymnomitrium</i>			<i>autumnalis</i> , De C.	129	303 305
<i>ulustum</i> , Nees	—	399	<i>badensis</i> , Gott.	—	309
<i>concinatum</i> , Cord.	—	403	<i>barbata</i> , Hook.	—	312
<i>confertum</i> , Limpr.	—	397	<i>barbata</i> , Schreb.	118	314
<i>coralloides</i> , Nees	—	401	<i>Bartlingii</i> , Hampe	—	209
<i>crassifolium</i> , Carr.	—	395	<i>Baueri</i> , Mart.	—	159
<i>crenulatum</i> , Gottsche	—	407	<i>bantriensis</i> , Hook.	133 134 135	312 314 316
<i>revolutum</i> , Philip.	—	393	<i>bicornis</i> , Web.	—	353
<i>HARPANTHUS</i> , Nees	—	259	<i>bicrenata</i> , Schmid.	139	321
<i>Flotvianus</i> , Nees	—	261	<i>bicuspidata</i> , G. L. N.	—	111
<i>Flotowii</i> , Nees	108	261	<i>bicuspidata</i> , Linn.	—	150
<i>scutatus</i> , W. & M.	107	259	<i>bicuspidata</i> , Nees	—	153
<i>Hepatica</i>			<i>bidentata</i> , Dum.	—	247
<i>conica</i> , Lindb.	—	469	<i>bidentata</i> , Hook.	—	312
<i>sucutilis</i> , Vaill.	—	221	<i>Blasia</i> , Hook.	—	440
<i>vulgaris</i> , Mich.	—	469	<i>Blyttii</i> , Moerck	—	438
<i>Hepaticoides</i>			<i>byssacea</i> , Roth	—	177
<i>albescens</i> , Vaill.	—	239	<i>calycina</i> , Tayl.	—	447
<i>HERBERTA</i> , Gr. & B.	—	99	<i>calyptrifolia</i> , Hook.	—	64
<i>adunca</i> (Dicks.), Gr. & B.	36	99	<i>capitata</i> , Hook.	138	322
<i>Herpetium</i>			<i>catenulata</i> , Hüben.	—	111
<i>reptans</i> , Nees	—	117	<i>ciliaris</i> , L.	—	104
<i>trilobatum</i> , Nees	—	119	<i>cochleariformis</i> , Weiss.	—	91
<i>Hygropyla</i>			<i>compacta</i> , Roth	—	208
<i>irrigua</i> , Tayl.	—	177			

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Jungermania</i> —(continued)			<i>Jungermania</i> —(continued)		
<i>complanata</i> , Hook.	—	74	<i>furcata</i> (non L.), Weiss.	—	463
<i>complanata</i> , L.	—	78	<i>gelida</i> , Tayl.	143	334
<i>compressa</i> , Hook.	—	368	<i>Gentiana</i> , Hüben.	—	302
<i>concinata</i> , Lightf.	—	403	<i>Goepertiana</i> , Hüben.	—	331
<i>concinata</i> , Schleich.	—	399	<i>Gouldii</i> , Husn.	—	296
<i>conferroides</i> , Raddi	—	177	<i>gracilis</i> , Schleich.	147	342
<i>connivens</i> , Dicks.	—	157	<i>gracillima</i> , Smith	—	302
<i>connivens</i> , Mart.	—	147	<i>hamatifolia</i> , Hook.	—	43
<i>convexa</i> , Scop.	—	236	<i>Hartmanni</i> , Theden.	—	261
<i>convoluta</i> , Hüben.	—	261	<i>Helleriana</i> , Nees	152	351
<i>coreyacea</i> , Nees	—	309	<i>heterophylla</i> , Schrad.	—	250
<i>Cordeana</i> , Hüben.	—	89	<i>hibernica</i> , Hook.	—	434
<i>cordifolia</i> , Hook.	122	290	<i>hibernica</i> , Wils.	—	430
<i>crenulata</i> , Hook. var.	128	302	<i>Hoffmanni</i> , Wallroth	—	106
<i>crenulata</i> , Smith	127	300	<i>Hookeri</i> , Lyell	—	427
<i>culcaris</i> , Wils.	—	312	<i>Hutchinsii</i> , Hook.	—	36
<i>curvifolia</i> , Hook.	—	254	<i>hyalina</i> , Lyell	—	364
<i>cupressina</i> , Swartz.	—	117	<i>hygrophylla</i> , Spruce	—	312
<i>curta</i> , Mart.	—	235	<i>incisa</i> , Schrad.	144	335
<i>curvifolia</i> , Dicks.	—	159	<i>inconspicua</i> , Raddi	—	61
<i>cuspiduligera</i> , Nees	—	209	<i>inflata</i> , Hudn.	131	307
<i>decipiens</i> , Hook.	—	204	<i>inflata</i> , Nees	—	165
<i>deflexa</i> , Mart.	—	130	<i>intermedia</i> , Lindenb.	—	322
<i>dentata</i> , Raddi	—	187	<i>interrupta</i> , Nees	—	269
<i>dennudata</i> , Nees	—	174	<i>irrigua</i> , Nees	—	230
<i>Dicksoni</i> , Hook.	—	243	<i>islandica</i> , Nees	—	194
<i>distans</i> , Schwein.	—	89	<i>Taylori</i> , Hook.	—	264
<i>divaricata</i> , Sm.	—	177	<i>julacea</i> , L.	—	94
<i>Doniana</i> , Hook.	157	361	<i>julacea</i> , Nees	—	97
<i>Douii</i> , Hook.	—	361	<i>juniiperina</i> , Hook.	—	99
<i>Dumortieri</i> , Lib.	—	269	<i>Juratzkna</i> , Limpr.	—	97
<i>eluchista</i> , Jack	—	184	<i>Kunzeana</i> , Hüben.	151	349
<i>elongata</i> , Hook.	—	{463	<i>lorigata</i> , Dum.	—	80
		{464	<i>Lammersiana</i> , Hüben.	—	153
<i>emarginata</i> , Ehrh.	—	375	<i>lanceolata</i> , L.	—	284
<i>endiviatifolia</i> , Dicks.	—	447	<i>lunulifolia</i> , Dum.	—	147
<i>epiphylla</i> , Hook.	—	447	<i>lucifolia</i> , Hook.	—	197
<i>epiphylla</i> , L.	—	443	<i>Leersii</i> , Roth.	—	106
<i>excisa</i> , Dicks.	—	322	<i>lurida</i> , Dum.	—	298
<i>excisa</i> , Funck	—	379	<i>lycopodioides</i> , Walbr.	{149	346
<i>exigua</i> , Tayl.	—	282		{150	348
<i>exsecta</i> , Schmid.	145	337	<i>Lyellii</i> , Hook.	—	432
<i>fissa</i> , Scop.	—	135	<i>Lyoni</i> , Tayl.	146	339
<i>flava</i> , Swartz.	—	49	<i>Mackii</i> , Hook.	—	40
<i>Floerkii</i> , Web.	—	348	<i>macrohiza</i> , Dicks.	—	375
<i>Flotoviana</i> , Nees	—	261	<i>major</i> , Mich.	—	{247
<i>fluitans</i> , Nees	—	165			{257
<i>Francisci</i> , Hook.	—	163	<i>microscopica</i> , Tayl.	—	63
<i>Funckii</i> , Web. et Mohr.	—	379	<i>minima</i> , Mich.	—	327
<i>furcata</i> , L.	—	461	<i>minuta</i> , Crantz	153	353

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Jungermania</i> - (continued)			<i>Jungermania</i> (continued)		
<i>minutissima</i> , Hook.	—	54	<i>Schraderi</i> , Mart.	—	305
<i>minutissima</i> , Sm.	—	61	<i>Schraderi</i> , Nees	—	305
<i>montana</i> , Mart.	—	212	<i>scutatus</i> , W. & M.	—	259
<i>Muelleri</i> , Nees	—	314	<i>Schweyeri</i> , Hüb.	—	165
<i>multifida</i> , Hook.	—	456	<i>serpyllifolia</i> , Dicks.	—	45
<i>multifida</i> , Linn.	—	451	<i>serpyllifolia</i> , Hook.	—	42
<i>multifida</i> , Schmidt	—	154	<i>setacea</i> , Web.	—	124
<i>naua</i> , Nees	—	298	<i>setiformis</i> , Ehrh.	—	114
<i>nemorosa</i> , Hook.	—	225	<i>silivretta</i> , Gott.	—	372
	—	235	<i>sinuata</i> , Dicks.	—	56
<i>nemorosa</i> , L.	—	222	<i>socia</i> , Nees	137	320
<i>nemorosa</i> , Mich.	—	222	<i>sphacelata</i> , Gies.	—	377
<i>nericensis</i> , Carr.	—	389		125	296
<i>nivalis</i> , Sw.	—	97	<i>sphaerocarpa</i> , Hook.	126	298
<i>obovata</i> , Nees	—	366	<i>Sphagni</i> , Dicks.	—	171
<i>obtusa</i> , Lindb.	136	318	<i>Sphagni</i> , Hook.	—	174
<i>obtusifolia</i> , Hook.	—	211	<i>spinulosa</i> , Dicks.	—	276
<i>oreadensis</i> , Hook.	155	357	<i>spinulosa</i> , Hook.	—	280
<i>ornithopolioides</i> , With.	—	219	<i>Sprengelii</i> , Mart.	—	138
<i>orata</i> , Dicks.	—	243	<i>Starkii</i> , Herb. Funck.	—	177
<i>palnata</i> , Hedw.	—	450	<i>Starkii</i> , Nees	—	179
<i>pubustris</i> , Mich.	—	284	<i>stellulifera</i> , Tayl. MS.	—	179
<i>Pearsoni</i> , Spruce	156	359	<i>stipulacea</i> , Hook.	—	259
<i>pinguis</i> , Linn.	—	457	<i>subalpina</i> , Nees	—	211
<i>planifolia</i> , Hook.	—	219	<i>subapicalis</i> , Nees	—	303
<i>platyphylla</i> , L.	—	84	<i>subcompressa</i> , Lämpr.	—	312
<i>polycanthos</i> , Linn.	—	257	<i>sudetica</i> , Nees	—	331
<i>Porella</i> , Dicks.	—	89	<i>Tamarisci</i> , L.	—	24
<i>porphyroleuca</i> , Nees	—	327	<i>tuvifolia</i> , Wahl.	—	240
<i>pubescens</i> , Schrank	—	460	<i>Taylori</i> , Hook.	—	264
<i>pulcherrima</i> , Hoffm.	—	106	<i>terrestris</i> , Mich.	—	135
<i>pumila</i> , Wither.	123	292	<i>terrestris</i> , Mich.	—	413
<i>purpurea</i> , Scop.	—	91	<i>tersa</i> , Nees	—	290
	—	418	<i>Thuja</i> , Dicks.	—	82
<i>pusilla</i> , Linn.	—	421	<i>tomentella</i> , Ehrh.	—	108
	—	339	<i>triangularis</i> , Schleicher	—	130
<i>quinquedentata</i> , Web.	—	430	<i>Trichomanis</i> , Dicks.	—	135
<i>Ralfsii</i> , Wils.	—	114	<i>trichophylla</i> , L.	—	112
<i>reclusa</i> , Tayl.	—	294	<i>trirenata</i> , Wahlenb.	—	132
<i>riparia</i> , Tayl.	124	239	<i>trilobata</i> , L.	—	128
<i>repens</i> , Mich.	—	119	<i>tristis</i> , Nees	—	294
<i>reptans</i> , Dum.	—	117	<i>turbinata</i> , Raddi	132	309
<i>reptans</i> , Hook.	—	217	<i>Turneri</i> , Hook.	—	190
<i>resupinata</i> , Linn.	—	208	<i>tyrolensis</i> , Nees	—	212
<i>resupinata</i> , Web. et Mohr.	—	233	<i>ulicina</i> , Tayl.	—	51
<i>rosacea</i> , Corda	—	209	<i>uliginosa</i> , Nees	—	153
<i>rupestris</i> , Schleich.	—	154	<i>uliginosa</i> , Sw.	—	231
<i>saxicola</i> , Schrad.	154	355	<i>umbrosa</i> , Schrad.	—	236
<i>scularis</i> , Mart.	—	174	<i>undulata</i> , Linn.	—	224
<i>scularis</i> , Schrad.	—	370	<i>ustulata</i> , Hüb.	—	382
<i>Schraderi</i> , Ekart	130	303			

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Jungermania</i> —(continued)			<i>Lichenastrum</i> —(continued)		
<i>ventricosa</i> , Dicks.	(140)	327	<i>aquaticum</i> , Dill.	—	495
<i>verruculosa</i> , Lindb.	(141)	351	<i>asplenii facie</i> , Dill.	—	274
<i>viticulosa</i> , Linn.	—	413	<i>arboris vitæ facie</i> , Dill.	—	82
<i>Wallrothiana</i> , Nees	—	309	<i>auriculatum</i> , Dill.	—	84
<i>Weberi</i> , Mart.	—	353	<i>auriculatum</i> , Dill.	—	217
<i>Wilsoni</i> , Tayl.	—	410	<i>auriculatum</i> , Dill.	—	219
<i>Wilsoniana</i> , Nees	—	309	<i>auriculatum</i> , Dill.	—	222
<i>Woodsi</i> , Hook.	—	102	<i>auriculatum</i> , Dill.	—	239
KANTIA, Gr. & B.	—	134	<i>capitulis oblongis</i> , Dill.	—	457
<i>arguta</i> (Mont. & Nees), <i>Lindb.</i>	53	139	<i>chamaedryos</i> , Dill.	—	456
<i>Sprengelii</i> (Mart.)	52	138	<i>filicinum</i> , Dill.	—	108
<i>Trichomanis</i> (L.), Gr. & B.	51	135	<i>furcatum</i> , Dill.	—	461
LEJEUNE, Libert	—	39	<i>imbricatum</i> , Dill.	—	24
<i>calcareæ</i> , Lib.	16	58	<i>— minus</i> , Dill.	—	33
<i>calyptrifolia</i> (Hook.), Dum.	20	64	<i>minimum</i> , Dill.	—	327
<i>diversiloba</i> Spruce	15	56	<i>multifidum</i> , Dill.	—	418
<i>echinata</i> , Tayl.	—	58	<i>multifidum</i> , Dill.	—	119
<i>flava</i> (Swartz.) Nees	12	49	<i>pinnatis</i> , Dill.	—	128
<i>Holtii</i> Spruce	13	51	<i>pinnatis</i> , Dill.	—	224
<i>hamatifolia</i> (Hook.), Dum.	9	43	<i>pinnatis</i> , Dill.	—	247
<i>Mackaii</i> (Hook.), Spreng.	7	40	<i>pinnatis</i> , Dill.	—	250
<i>microscopica</i> , Tayl.	19	63	<i>scorpioides</i> , Dill.	—	104
<i>minutissima</i> (Sm.)	18	61	<i>trichoides</i> , Dill.	—	112
<i>minutissima</i> , Spruce	—	54	<i>Trichomanis</i> , Dill.	—	257
<i>Molleri</i> , Steph.	—	42	LICHLENA, Nees	—	284
<i>Moorei</i> , Lindb.	—	49	<i>lanceolata</i> (L.), Nees	120	284
<i>ovata</i> , Tayl.	8	42	LOPHOCOLEA, Dum.	—	245
<i>patens</i> , Lindb.	11	47	<i>bidentata</i> (L.), Dum.	101	247
<i>Rossettiana</i> , Massal.	17	60	<i>bidentata</i> , Nees	—	249
<i>serpyllifolia</i> (Dicks.), Lib.	10	45	<i>cuspidata</i> , Limpr.	102	249
<i>Taylori</i> , Spruce	—	61	<i>heterophylla</i> (Schröd.)	103	250
<i>ulicina</i> , Tayl.	14	54	<i>Hookeriana</i> , Nees	—	247
LEPIDOZIA, Dum.	—	116	<i>spicata</i> , Tayl.	104	252
<i>cupressina</i> (Sw.)	43	117	<i>Lophozia</i>	—	316
<i>Pearsoni</i> , Spruce	45	121	<i>acuta</i> , Dum.	—	314
<i>pinnata</i> , Dum.	—	117	<i>barbata</i> , Dum.	—	314
<i>reptans</i> (L.), Dum.	44	119	<i>bicrenata</i> , Dum.	—	324
<i>setacea</i> (Web.), Mitt.	46	124	<i>exsecta</i> , Dum.	—	337
<i>tumidula</i> , Tayl.	—	117	<i>incisa</i> , Dum.	—	335
<i>Wulfsbergii</i> , Lindb.	—	121	<i>lycopodioides</i> , Cogn.	—	346
<i>Leptoscyphus</i>	—	—	<i>Muelleri</i> , Dum.	—	314
<i>cuneifolia</i> , Mitt.	—	254	<i>scutata</i> , Dum.	—	259
<i>interruptus</i> , Mitt.	—	269	<i>ventricosa</i> , Dum.	—	327
<i>Taylori</i> , Mitt.	—	264	LUNULARIA, Mich.	—	475
<i>Lichen palustris</i> , Dill.	—	485	<i>cruciata</i> (L.), Dum.	212	476
<i>Lichenastrum</i>	—	—	<i>vulgaris</i> , Mich.	—	476
<i>alpinum</i> , Dill.	—	91	<i>Madotheca</i>	—	—
		94	<i>Thuja</i> (Dicks.)	—	82
			<i>platyphylla</i> , Dum.	—	84
			<i>Porella</i> , Nees	—	89

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Madotheca</i> (continued)			<i>METZGERIA. Raddi</i>	—	459
<i>ricularis</i> , Nees	—	87	<i>conjugata</i> , Lindb.	207	463
<i>Madotheca</i> , Dum.	—	79	<i>furcata</i> (L.), <i>Raddi</i>	206	461
<i>lorigata</i> , Lindb.	—	80	<i>glabra</i> , Dum.	—	461
MARCHANTIA, <i>March. fil</i>	—	166	<i>hamata</i> , Lindb.	207	464
<i>androgyna</i> , Tayl.	—	173	<i>linearis</i> , Lindb.	—	464
<i>commutata</i> , Lindb.	—	173	<i>pubescens</i> (<i>Schrank</i>)	205	460
<i>conica</i> , L.	—	469	<i>Muina</i> .		
<i>cruciata</i> , L.	—	476	<i>fissum</i> , L.	—	135
<i>hemisphaerica</i> , L.	—	470	<i>jungermania</i> , L.	—	91
<i>irrigua</i> , Wils.	—	473	<i>Trichomanis</i> (<i>Dill.</i>), L.	—	135
<i>polymorpha</i> , L.	208	466	<i>Moerckia</i> .		
<i>Marsilia</i> .			<i>Blyttii</i> , Gotts.	—	438
<i>endivivifolia</i> , (<i>Dicks.</i>), Lindb.	—	447	<i>hibernica</i> , Gotts.	—	434
<i>epiphylla</i> , Lindb.	—	443	<i>norvegica</i> , Gotts.	—	438
<i>Neesii</i> , Lindb.	—	445	<i>Muscoides</i> .		
<i>pinguis</i> , Mich.	—	457	<i>terrestre</i> , Mich.	—	119
MARSUPELLA, <i>Dum.</i>	—	375	<i>terrestris</i> , Mich.	—	128
<i>conferta</i> (<i>Limpr.</i>), <i>Spruce</i>	—	397	MYLIA, <i>Gr. & B.</i>	—	263
<i>emarginata</i> (<i>Ehrh.</i>), <i>Dum.</i>	(163) (164)	375	<i>anomala</i> (<i>Hook.</i>), <i>Gr. & B.</i>	110	267
<i>Funckii</i> (<i>Web. et Mohr.</i>), <i>Dum.</i>	—	166	<i>Taylori</i> (<i>Hook.</i>), <i>Gr. & B.</i>	109	264
<i>latifolia</i> , Lindb.	—	389	<i>cuneifolia</i> , <i>Gr. & B.</i>	—	254
<i>nevicensis</i> (<i>Carr.</i>), <i>Kaul.</i>	171	389	NARDIA, <i>Gr. & Ben.</i>	—	363
<i>olivacea</i> , <i>Spruce</i>	167	380	<i>Carringtoni</i> , <i>Balf.</i>	—	287
<i>revoluta</i> , Lindb.	—	393	<i>compressa</i> , Lindb.	—	287
<i>silvretta</i> , <i>Dum.</i>	—	372	<i>compressa</i> (<i>Hook.</i>), <i>Gr. & B.</i>	160	368
<i>sparsifolia</i> (<i>Lindb.</i>), <i>Dum.</i>	169	384	<i>geoscypha</i> , <i>Mass.</i>	—	372
<i>sphacelata</i> (<i>Gies.</i>), <i>Dum.</i>	165	377	<i>harmatosticta</i> , Lindb.	—	372
<i>Stableri</i> , <i>Spruce</i>	170	386	<i>hyalina</i> (<i>Lyell</i>), <i>Carr.</i>	158	364
<i>ustulata</i> (<i>Hüb.</i>), <i>Spruce</i>	168	382	<i>latifolia</i> , Lindb.	—	389
<i>Martinellia</i> .			<i>obovata</i> (<i>Nees</i>), <i>Carr.</i>	159	366
<i>aquiloba</i> , Lindb.	—	212	<i>revoluta</i> , Lindb.	—	393
<i>convexa</i> , Lindb.	—	236	<i>scalaris</i> (<i>Schrad.</i>), <i>Gr. & B.</i>	161	370
<i>gracilis</i> , Lindb.	—	217	<i>Benn.</i>	—	372
<i>nemorosa</i> , <i>Gr. & B.</i>	—	222	<i>silvretta</i> , <i>Gotts.</i>	162	372
<i>undulata</i> , <i>Gr. & B.</i>	—	224	<i>sparsifolia</i> , Lindb.	—	384
<i>Mastigobryum</i> .			<i>sphacelata</i> (<i>Gies.</i>), <i>Carr.</i>	—	377
<i>Pearsoni</i> , <i>Stephani</i>	—	133	<i>Novellia</i> , <i>Mitt.</i>	—	141
<i>trilobatum</i> , <i>Nees</i>	—	128	<i>curcifolia</i> , <i>Mitt.</i>	—	159
MASTIGOPHORA, <i>Nees</i>	—	102	<i>Odontochisma</i> , <i>Dum.</i>	—	111
<i>reptans</i> , <i>Nees</i>	—	119	<i>decipiens</i> , Lindb.	—	204
<i>Woodsi</i> (<i>Hook.</i>), <i>Nees</i>	37	102	<i>denudatum</i> , <i>Dum.</i>	—	174
<i>Mavrocenia</i> .			<i>Sphagni</i> , <i>Dum.</i>	—	171
<i>pusilla</i> , <i>Gr. & Ben.</i>	—	418	PALLAVICINIA, <i>Gr. & Benn.</i>	—	432
<i>Mesophylla</i> .			<i>Blyttii</i> (<i>Moerck</i>), <i>Lindb.</i>	(191) (195)	438
<i>orcadensis</i> , <i>Dum.</i>	—	357	<i>hibernica</i> (<i>Hook.</i>), <i>Gr. & B.</i>	(192) (193)	434
<i>compressa</i> , <i>Dum.</i>	—	368	<i>Benn.</i>	—	432
<i>scalaris</i> , <i>Dum.</i>	—	370	<i>Lyellii</i> (<i>Hook.</i>), <i>Gr. & Benn.</i>	191	432

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
PEDINOPHYLLUM, <i>Lindb.</i>	—	269	PORELLA (<i>Dill.</i>)	—	79
<i>interruptum</i> (<i>Nees</i>), <i>Lindb.</i>	111	269	<i>revigata</i> (<i>Schrad.</i>), <i>Lindb.</i>	28	80
<i>pyrenaicum</i> , <i>Lindb.</i>	—	269	<i>pinnata</i> (<i>Dill.</i>), <i>Lindb.</i>	32	89
PELLIA, <i>Raddi</i>	—	442	<i>platyphylla</i> (<i>L.</i>), <i>Lindb.</i>	30	84
<i>calycina</i> (<i>Tayl.</i>)	198	447	<i>rivularis</i> (<i>Nees</i>), <i>Lindb.</i>	31	87
<i>epiphylla</i> (<i>L.</i>), <i>Lindb.</i>	197	443	<i>Thuja</i> (<i>Dicks.</i>), <i>Moore</i>	29	82
<i>Neesiana</i> (<i>Gotts.</i>), <i>Limpr.</i>	—	445	PREISSIA, <i>CORDA</i>	—	472
<i>Neesii</i> , <i>Limpr.</i>	—	445	<i>commutata</i> (<i>Lindb.</i>), <i>Nees</i>	211	473
PETALOPHYLLUM, <i>Gott.</i>	—	429	<i>hemisphærica</i> , <i>Cogn.</i>	—	473
<i>lamellatum</i> , <i>Lindb.</i>	—	430	PRIONOLOBUS, <i>Spruce</i>	—	189
<i>Ralfsii</i> (<i>Wils.</i>), <i>Gott.</i>	190	430	<i>Turneri</i> (<i>Hook.</i>), <i>Spruce</i>	74	190
<i>Physotolum</i> , <i>Nees</i>	—	90	<i>Ptilidium</i>	—	—
<i>cochleariforme</i> , <i>Nees</i>	—	91	<i>ciliare</i> , <i>Hamp.</i>	—	104
PLAGIOCHILA, <i>G. L. N.</i>	—	274	RADULA, <i>Dum.</i>	—	66
<i>ambagiosa</i> , <i>Mitt.</i>	115	275	<i>aquitoba</i> , <i>Dum.</i>	—	212
<i>asplenioides</i> (<i>L.</i>), <i>Dum.</i>	(113) (114)	274	<i>aquilegia</i> , <i>Tayl.</i>	25	74
<i>Bartlingii</i> , <i>M. et N.</i>	—	209	<i>aquilegia</i> , <i>Tayl.</i>	—	76
<i>compacta</i> , <i>M. et N.</i>	—	208	<i>asplenioides</i> , <i>Dum.</i>	—	274
<i>corniculata</i> , <i>Dum.</i>	—	280	<i>Carringtonii</i> , <i>Jack</i>	26	76
<i>curta</i> , <i>M. et N.</i>	—	235	<i>complanata</i> (<i>L.</i>)	—	68
<i>decipiens</i> , <i>Dum.</i>	—	204	<i>complanata</i> (<i>L.</i>)	—	70
<i>exigua</i> , <i>Tayl.</i>	119	282	<i>complanata</i> (<i>L.</i>), <i>Dum.</i>	27	78
<i>interrupta</i> , <i>Dum.</i>	—	269	<i>commutata</i> , <i>Gottsche</i>	—	68
<i>pyrenaica</i> , <i>Lindb.</i>	—	269	<i>corniculata</i> , <i>Dum.</i>	—	280
<i>punctata</i> , <i>Tayl.</i>	117	278	<i>curta</i> , <i>Dum.</i>	—	235
<i>rosacea</i> , <i>M. et N.</i>	—	233	<i>decipiens</i> , <i>Dum.</i>	—	201
<i>spinulosa</i> (<i>Dicks.</i>)	—	—	<i>dentata</i> , <i>Dum.</i>	—	217
<i>Dum.</i>	116	276	<i>germana</i> , <i>Jack</i>	23	70
<i>Stableri</i> , <i>Pearson</i>	112	273	<i>Holtii</i> , <i>Spruce</i>	24	72
<i>tridenticulata</i> , <i>Tayl.</i>	118	280	<i>Lindenbergiana</i> , <i>Gottsche</i>	—	68
<i>tyrolensis</i> , <i>M. et N.</i>	—	212	<i>Lindbergii</i> , <i>Gottsche</i>	22	68
<i>uliginosa</i> , <i>M. et N.</i>	—	231	<i>nemorosa</i> , <i>Dum.</i>	—	222
<i>umbrosa</i> , <i>Mont.</i>	—	236	<i>resupinata</i> , <i>Dum.</i>	—	208
<i>Pleuranthe</i>	—	—	<i>uliginosa</i> , <i>Dum.</i>	—	231
<i>olivacea</i> , <i>Tayl.</i>	—	261	<i>umbrosa</i> , <i>Dum.</i>	—	236
<i>Pleuroschisma</i> , <i>Dum.</i>	—	141	<i>undulata</i> , <i>Dum.</i>	—	224
<i>denudatum</i> , <i>Dum.</i>	—	174	<i>voluta</i> , <i>Tayl.</i>	21	67
<i>Donniana</i> , <i>Dum.</i>	—	361	REBOULIA, <i>Raddi</i>	—	470
<i>reptans</i> , <i>Dum.</i>	—	119	<i>hemisphærica</i> , <i>Rad.</i>	210	470
<i>Sphagni</i> , <i>Dum.</i>	—	171	<i>Riccardia</i>	—	—
<i>trilobatum</i> , <i>Dum.</i>	—	128	<i>latifrons</i> , <i>Lindb.</i>	—	{ 454
PLEUROCLADA, <i>Spruce</i>	—	192	<i>multifida</i> , <i>Gr. & Benn.</i>	—	{ 456
<i>albescens</i> (<i>Hook.</i>), <i>Spruce</i>	75	192	<i>multifida</i> , <i>Gr. & Benn.</i>	—	{ 454
<i>albescens</i> , <i>Spruce</i>	—	194	<i>multifida</i> (<i>Nees</i>), <i>Lindb.</i>	—	453
<i>islandica</i> (<i>Nees</i>)	76	194	<i>multifida</i> , <i>Lindb.</i>	—	456
PLEUROZIA, <i>Dum.</i>	—	90	<i>palmata</i> , <i>Carruth.</i>	—	450
<i>cochleariformis</i> (<i>Weiss</i>), <i>Dum.</i>	33	91	<i>Riccardius</i>	—	—
<i>purpurea</i> , <i>Lindb.</i>	—	91	<i>pinguis</i> , <i>Gr. & Benn.</i>	—	457
			RICCIA, <i>Mich.</i>	—	483
			<i>bifurca</i> , <i>Hoffm.</i>	219	488

	PLATE VOL. 2	PAGE VOL. 1		PLATE VOL. 2	PAGE VOL. 1
<i>Riccia</i> —(continued)			<i>Scapania</i> —(continued)		
<i>bifurca</i> , Hoffm.		193	<i>nemorosa</i> (L.), Dum.	88	222
<i>ciliata</i> , Hoffm.	223	194	<i>nemorosa</i> , Husnot		227
<i>crystallina</i> , L.	217	183	<i>nimbosa</i> , Tayl.	87	220
<i>fluitans</i> , L.		195	<i>ornithopodioides</i> (Dill. et		
<i>glauca</i> , L.	216	184	<i>With.</i>) Pears.	86	219
<i>glaucescens</i> , Carr.	222	193	<i>planifolia</i> (Hook.), Dum.		219
<i>lamellosa</i> , Ralfs.		189	<i>purpurascens</i> (Hook.), Tayl.		
<i>Michelii</i> , Raddi		191	<i>M.S.</i>	90	225
<i>minima</i> , L. Schiff.		187	<i>resupinata</i> (L.), Dum.	85	217
<i>natans</i> , L.		197	<i>rosacea</i> (Corda), Dum.	91	233
<i>nigrella</i> , D.C.	220	189	<i>subalpina</i> (Nees), Dum.	82	211
<i>sorocarpa</i> , Bisch.	218	187	<i>tyrolensis</i> , G.L.N.		212
<i>tumida</i> , Lindenb.	221	191	<i>umbrosa</i> (Schrud.), Dum.	96	236
<i>RICCIELLA</i> , Braun.		195	<i>uliginosa</i> (Swartz.), Dum.	93	231
<i>fluitans</i> (L.), Braun.	224	195	<i>undulata</i> (L.), Dum.	89	224
<i>RICCIOCARPUS</i> , Corda		197	<i>Schisma</i> , Dum.		99
<i>natans</i> (L.), Corda	225	197	<i>atunca</i> , Dum.		99
<i>SACCOGYNA</i> , Dum.		113	<i>Senttnera</i> , Nees		99
<i>viticulosa</i> (Linn.), Dum.	182	113	<i>atunca</i> , Carr.		99
<i>Sarcoscyphus</i> .			<i>juniperina</i> , Nees		99
<i>alpinus</i> , Gottsch.		391	<i>Woodsii</i> , G.L.N.		102
<i>anomalus</i> , Jack		372	<i>Southbya</i> .		
<i>capillaris</i> , Limpr.		389	<i>obovata</i> , Dum.		366
<i>confertus</i> , Limpr.		397	<i>SPHEROCARPUS</i> , Mich.		481
<i>Ehrharti</i> , Corda		375	<i>Michelii</i> , Bell.		182
<i>Fuueckii</i> , Nees		379	<i>terrestris</i> , Mich.	215	182
<i>revolutus</i> , Nees		393	<i>Sphagnoecetis</i> , Nees		141
<i>sparsifolius</i> , Lindb.		384	<i>communis</i> , Nees		170
<i>sphacelatus</i> , Nees		377	<i>Hübneriana</i> , Rabenh.		174
<i>SCALIA</i> , Gr. & Benn.		127	<i>Sphagni</i> , Nees		171
<i>Hookeri</i> (Lyell), Gr. & Benn.	189	127	<i>Stetziu</i> .		
<i>SCAPAXIA</i> , Dum.		207	<i>Lyellii</i> , Lehm.		432
<i>aequiloba</i> (Schwarg.), Dum.	83	212	<i>TARGIONIA</i> , Mich.		179
<i>aspera</i> , Bern.		84	<i>hypophylla</i> (L.)	214	180
<i>Bartlingii</i> (Hampe), Nees	81	209	<i>Michelii</i> , Corda		180
<i>Carestia</i> , De. Not.		209	<i>sphaerocarpus</i> , Dicks.		482
<i>compacta</i> (Roth.), Dum.	80	208	<i>Thedenia</i> .		
<i>convexa</i> , Scop.		236	<i>Blyttii</i> , Hartm.		438
<i>curta</i> , Carr.		233	<i>TRICHOOLEA</i> (Dum.), Nees		108
<i>curta</i> (Mart.), Dum.	95	235	<i>tomentella</i> (Ehrh.), Dum.	10	108
<i>dentata</i> , Dum.		217	<i>Tricholea</i> .		
<i>intermedia</i> , Husnot	91	227	<i>tomentella</i> , Dum.		108
<i>irrigua</i> (Nees), Dum.	92	230			

ERRATA.

- P. 11, col. 2, line 16, *for pistillidia read antheridia.*
 P. 11, col. 2, line 30, *for male read female.*
 P. 24, line 22, *for Monoicous read Dioicous.*
 P. 45, line 29, *for Dioicous read Monoicous.*
 P. 102, bottom line, *for smaller read larger.*
 P. 157, line 18, *for flagelliferous read eflagelliferous.*
 P. 214, line 24, *delete Müller.*
 P. 221, line 18, *for smooth read minutely papillose.*
 P. 339, above *Jungermania Lyoni insert*—

Section 2. **BARBATAE**, *Schiffn.*

Plants usually large. Leaves 3–5-fid. Stipules present, bifid, ciliate.
 Perianth oval, plicate almost to the base.

- P. 351, above *Jungermania Helleriana insert*—

Section 3.

- P. 384, line 11, *for sparsifolia read sparsifolius.*
 P. 413, line 2 from the bottom, p. 414, lines 17 and 18, p. 416, lines 1 and 3,
for perianth read perigynium.
 Plate cxviii. *for trideniculata read tridenticulata.*

