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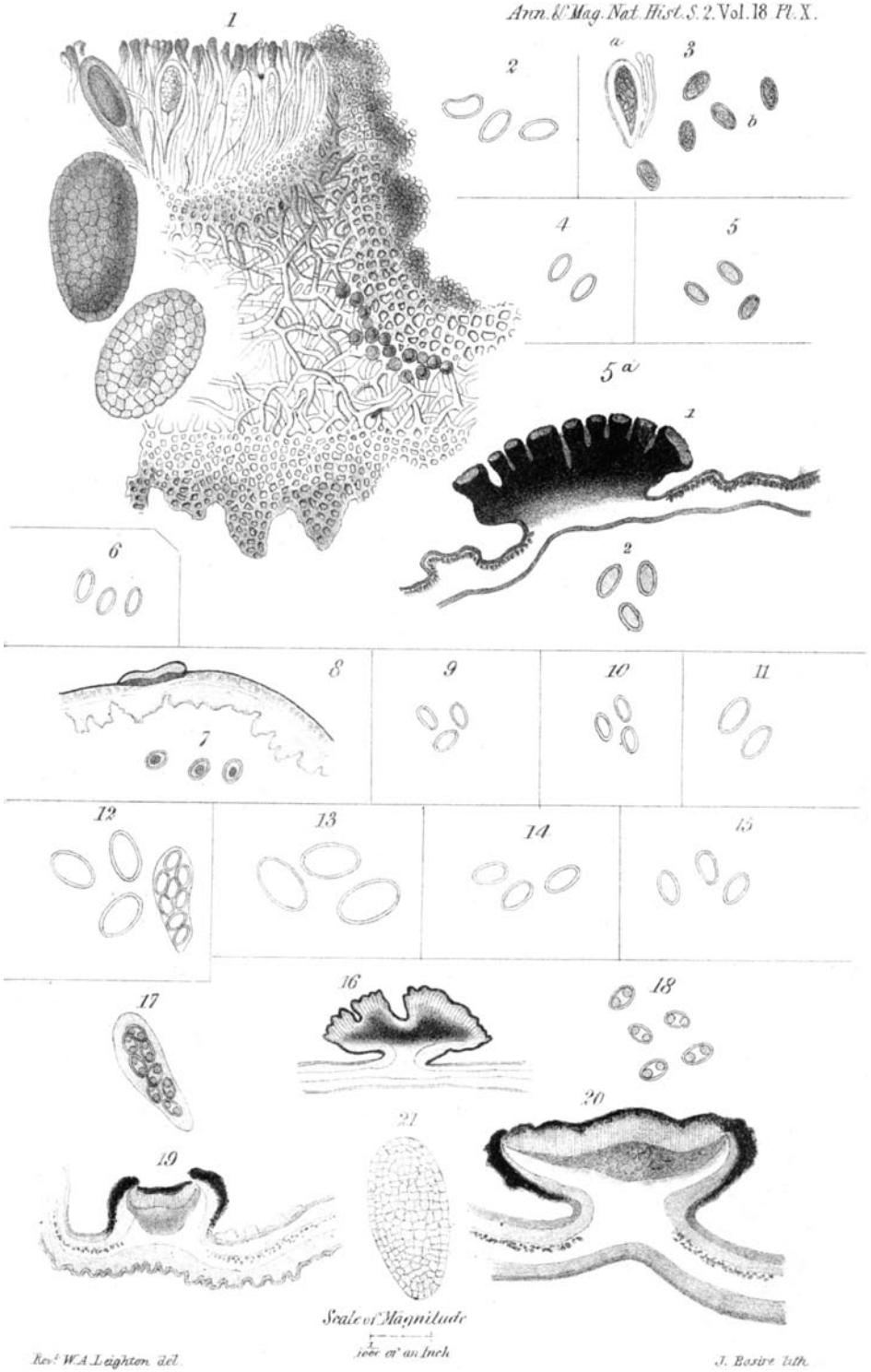
XXV.—*Monograph of the British* Umbilicariæ.

By the Rev. W. A. Leighton, B.A., F.B.S.E.

[With a Plate.]

The *Umbilicariæ* constitute a distinct and well-marked group of Lichens. Their thallus bears a general external resemblance to that of some species of *Endocarpon* (e. g. *End. miniatum*), but the different internal structure shows these genera to have no real connexion. Their apothecia approximate in external form to those both of *Lecidea* and *Opegrapha*. But this resemblance is limited to external character alone, for dissection demonstrates that there is no affinity in structure between the plants. The apothecia of the *Umbilicariæ* are entirely destitute of that black carbonaceous excipulum which is so conspicuous a feature of the *Lecideæ*. Their structure greatly assimilates, and indeed is almost identical with, that of the apothecia of the plant generally known as *Lecidea vesicularis*, Ach. With the *Opegraphæ* the resemblance is altogether external, the gyrations or reduplications to which the apothecia are subject alone constituting the similarity; internal structure being here also entirely different.

The structure of the thallus appears to be alike in all the plants included in the genus, however dissimilar their external aspect may appear. The only differences apparently arise from one portion or layer being more or less developed in growth, probably from local circumstances, than another. This has been admirably investigated, described and figured by M. L. R. Tulasne, in his "Mémoire des Lichens," published in the 'Annales des Sciences Naturelles,' 3 séric, tom. xvii. The thallus of *U. pustulata*, he says, presents a double cortical layer. The



Rev.d W.A. Leighton del.

J. Bosire lith.

superior cortex is formed of small polygonal cells intimately united, and its superficial brown colour is veiled by a sort of furfuraceous powder, whose cellular elements, very irregular, are unequally distributed and variously associated. The cortical layer of the inferior face of the thallus is about double the thickness of the preceding, and forms with it nearly a fourth part of the entire thickness of the lichen. This part of the plant is greyish, of a horny consistence, and very hygrometric. It is constituted, as nearly all the tissues of this sort, by globular utricules, with extremely thick walls, and so united to each other, that the external contours of each of them are indistinct. This horny layer bears on its free face an infinity of minute papillæ of a conical or pyramidal form, and which are continuous with it, that is to say, formed of a tissue entirely similar, but of a very deep brown colour. The fibrous medulla which occupies the middle of the thallus, is, as in most foliaceous lichens, a loose tissue filled with air, above which, the spherical gonidia form a slight continuous layer. The structure of the other species scarcely differs in any material point of view. In our plate (Pl. X. fig. 1) we have copied M. Tulasne's exquisite illustrative section.

The apothecia arise from the medullary layer, and their development appears to take place somewhat in the following manner. In the spot where an apothecium is about to appear, the cortical layer is, by the uplifting of the medullary layer, formed into a small wart or tubercle. This tubercle opens in the middle, the hymenium appears exposed to view, the cortical layer is on either side thrown back or reflected upon itself so as to constitute a kind of excipulum to the hymenium, which is gradually and progressively protruded upwards by the medullary layer, until a fully expanded apothecium is formed, sessile or closely appressed on the surface of the thallus. The apothecia are of a deep black or brown colour, but a vertical section shows this tint to be confined exclusively to the surface of the disk and of the excipulum. The base of the hymenium is not subtended by any carbonaceous mass, as in the *Lecideæ*, the medullary layer becoming in that part of a brown colour more or less deepened in tint. The apothecia are either simple, forming a single patellula, or compound, consisting of numerous gyrations having much the general appearance of the lirellæ in the *Opegraphæ*. The internal structure is the same in both cases; and dissection shows that the compound apothecia result, not from a division of the disk of a single patellula, but from a great number of apothecia springing from the same spot, forced, by excessive compression against each other and growth within a limited circular space, to assume a gyrate direction, and to exhibit the singular appearances for

which the apothecia of the genus are so conspicuous and remarkable.

So far as my opportunities of research extend, the first writer who mentions these plants is Tournefort, in his Institutiones Rei Herbariæ, 1710, who describes, in the concise manner usual with earlier writers when treating of Lichens, two species, *U. pustulata* and *grisea*. Vaillant, following his great master, in his Botanicon Parisiense, 1727, describes and figures the same two species, with that characteristic accuracy and fidelity for which his plates are so valuable. Micheli, in his Nova Genera Plantarum, 1729, makes *U. pustulata* the sole type and constituent of his 18th Ordo of Lichens, in which the seeds are disposed "in comosa arbuscula" over the whole surface of the plant. These seeds, which are now ascertained to be pulverulent excrescences of the thallus, he figures with much accuracy, and also the apothecia, of which however he takes no notice in his description, possibly supposing them to be only the incipients of the fructification which would be ultimately developed into the "comosa arbuscula." His tab. 47 represents characteristically a very large specimen in that torn or deeply divided state frequently observable when the plants attain considerable magnitude, and apparently resulting from this excess of growth. He complains that Vaillant's figure is taken from too small a specimen, but identifies it with his own, having received an authentic specimen from Vaillant himself. Dillenius, in his Historia Muscorum, 1741, describes at length and figures *U. proboscidea*, Turn. and Borr., *grisea*, Ach., *erosa*, Hoffm., *arctica*, Ach., *polyphylla*, T. and B., *pellita*, Ach., and *pustulata*, Ach.

Linnæus, in Species Plantarum, 1763, under his section Lichenes Umbilicati includes six species, *velleus*, *pustulatus*, *proboscideus*, *deustus*, *polyphyllus*, and *polyrrhizos*. The same arrangement is followed by Pollich (Flor. Palat. 1777), Lightfoot (Fl. Scot. 1777), Weber (Spicil. Gotting. 1778), Hudson (Fl. Angl. 1778), Hagen (Tent. Pruss. 1782), Humboldt (Fl. Frib. 1793), Retz (Fl. Scand.1795), Withering (Arrang. 1795), Afzelius (Act. Upsal. 1788), Westring (Act. Sc. Stockh. 1793), and Acharius (Act. Sc. Stockh. 1794), varying indeed in the number of species described according to the circumstances of their respective localities. Hoffmann, in his Plantæ Lichenosæ in 1788 (according to the date on his tab. 2) first uses the generic name *Umbilicaria*. He figures with inimitable beauty and accuracy eleven species. This name *Umbilicaria* was immediately adopted by Baumgarten (Flor. Lips. 1790), Schrader (Spicil. 1794), and Acharius (Prodr. 1798). In this latter work it should be mentioned that Acharius refers *murinus* to the genus *Endocarpon*. The generic name *Umbilicaria* is very aptly taken

from the umbilicate thallus; but Acharius, in his Meth. Lich. 1803, changed it to *Gyrophora* from the external appearance of the fructification, because he thought it most probable that future observation would show that *Lecidea Oederi, silacea, privigna,* and other species also, ought to be included in the same genus, because their apothecia became deformed or gyriform like those of *Umbilicaria,* in which case the former name *Umbilicaria* would not be applicable to the genus thus comprehensively considered. Dissection and the microscope have shown that these conjectures of Acharius were groundless, and that there was no real necessity for a change of the generic name. He describes in this work fifteen species, all of which are true *Umbilicariæ,* but refers *pustulatus* to *Lecidea.* Ventenat again changes the generic name to *Capnia.* DeCandolle, in Flor. Franç. 1805, adopts the genus *Umbilicaria* of Hoffmann and Acharius, and enumerates thirteen species, several of which are now considered as varieties or states of the same plants. Acharius retains his name *Gyrophora* in his Lich. Univ. 1810, describing eighteen species, including *murinus* and *pustulatus.* Flörke has some remarks on the genus in the Berlin Magazine for 1810, but which I have not seen. Wahlenberg (Fl. Lapp. 1812) changes the name of the genus to *Gyromium,* but without assigning any reason for so doing, which name he continues in his Flor. Carpath. (1814), Flor. Upsal. (1820), and Flor. Suec. (1824–26). In this latter work he explains the cause of the change to be, from the similarity of the fructification to intestinal convolutions. Turner and Borrer in the Lichenographia Britannica (1813) retain the name *Gyrophora,* as all the generic distinctions in that work had been taken from the fructification. They describe ten species as found in Britain, with an elaborate care and minute fidelity and accuracy which cannot be praised too highly. Another valuable feature of this work was the determination of the plants of Linnæus and Dillenius from their respective herbaria. Acharius (Syn. 1814) extends the number of species to nineteen; one of them, *G. Clementei,* growing on wood, is now referred to *Thelephora quercina,* Pers., all the rest being saxicolar plants. Schærer, in Meisner's Naturw. Anz. 1817, has a paper on the *Gyrophoræ,* and another on the "*Umbilicariæ Helveticæ*" in Seringe's Musée Helvétique d'Hist. Nat. 1821. These he arranges under six species, which he describes at length, adding full synonyms from Vaillant downwards, and illustrates them with five plates filled with beautifully coloured figures of all the species and varieties. In his Spicilegium he refers *U. pustulata* to *Lecidea,* and places all the rest under four species, viz. *U. depressa, U. polymorpha, U. ænea,* and *U. erosa*; whilst in his Enumeratio (1850) he again includes *pustulata,* and

rearranges the various forms into eight species. British authors, as Purton, Midl. Fl. (1817), Hooker, Fl. Scot. (1821), and Greville, Fl. Edin. (1824), adopt *Gyrophora* as the genus. Fries in all his works resolutely maintains the original name, *Umbilicaria*, of Hoffmann. Eschweiler, Syst. Lich. 1824, places *Gyrophora* in company with *Solorina*, Ach., *Dermatocarpon*, Eschw., *Endocarpon*, Hedw., *Capitularia*, Eschw., and *Peltidea*, Ach., in his Cohors V. *Dermatocarpeæ*. Wallroth, Crypt. Germ. (1831), makes *Umbilicaria* a section of his genus *Graphis*, considering the affinity in structure of the apothecia with those of the *Graphideæ*, hinted at by Bernhardi, Flörke and DeCandolle, to be correct and well founded. Hooker in Brit. Flor. (1833) follows the arrangement of Fée (Cryptog. Ecorces, 1824) into *Gyrophora* and *Umbilicaria*, from the different external aspect of the apothecia. His distribution of the species differs somewhat from that of the 'Lichenographia Britannica.' Dr. Taylor in Flora Hibernica (1836) again unites the two genera. Merat in Flor. env. Paris (1836) puts *U. pustulata* into a new genus called *Lasallia*. Chevallier (Flor. Paris, 1836) and Flotow (Lichenes Flor. Siles., 1850) separate *Umbilicaria* and *Gyrophora*. Tuckerman, Syn. Lich. Amer. (1848), retains the entire genus *Umbilicaria*, Hoffm., with a modified generic character.

Massalongo (Licheni Crostosi, 1852) retains *Umbilicaria*, Hoffm., for the generality of the species, but refers *U. pustulata* to a new genus, *Macrodictya*, his distinctions being taken from the dissimilarity of the sporidia. In his Memorie Lichenog. (1853) he rejects his new genus *Macrodictya* and adopts Merat's *Lasallia*. In his Systema Lichenum Germaniæ (1854) Koerber separates *Umbilicaria* (*pustulata*) from *Gyrophora*. Nylander in his "Nouvelle Classification des Lichens" in Mém. Soc. des Sc. Nat. de Cherbourg (1854 & 1855), retains the original and comprehensive genus of Hoffmann, *Umbilicaria*, as the type of his tribe *Gyrophoreæ*.

From the preceding summary it is seen, that whilst the plants have retained their relative position as members of a closely connected group, considerable difference of opinion has existed as to the name which should be assigned to it, and whether *Umbilicaria pustulata* should be included in the same genus, or form a distinct genus by itself. From the identity of structure both of thallus and apothecium, I incline to think that it ought, with the other plants, to constitute one and the same genus, and that the original name of Hoffmann, *Umbilicaria*, which appears to have been changed from no really substantial scientific reasons, should be restored to it.

The learned authors of the 'Lichenographia Britannica' complain, and with justice, that the genus has been divided into too

many species. In my opinion our British *Umbilicariæ* appear to resolve themselves into two species only, *U. pustulata*, which has peculiar sporidia, and *U. varia*, which may include all the rest, the sporidia being alike in all; and this latter species comprises two series distinguished by the copper or grey colour of the thallus.

1. *Umbilicaria varia.* Thallus coppery or ashy-grey, simple or compound, naked or fringed at the margins; upper surface smooth, efflorescent, granulate, pustulate, areolate, corrugate or reticulated; lower surface smooth, pitted, granulate, papillose, fibrous or reticulated; sporidia in asci, eight, minute, oblong, pale.

* *Thallus dark copper-coloured when dry.*

α. *polyphylla*, Schrad. Thallus thin, unequally lobed, naked and smooth on both sides; upper side greenish copper-colour, under black.

Lichenoides tenue pullum, foliis utrinque glabris, Dill. 225. t. 30. f. 129. A. B. C (1741).
Lichen &c. undique glaber, Linn. Fl. Lapp. no. 452 (excl. syn.).
Lichen polyphyllus, Linn. Sp. Pl. 1618 (ed. 2. 1763); Huds. Fl. Brit. 551; Lightf. Fl. Scot. 2. 863; Robson, Br. Fl. 300; Web. Spicil. 258; Humb. Fl. Frieb. 29; Retz. Scand. 288; With. Arr. 4. 65; Sm. E. Bot. t. 1282.
Lichen glaber, "Ach. in Act. Stockh. xv. 95. t. 2. f. 5" (1794) (fide Ach. et T. & B.); Ach. Prodr. 144.
Umbilicaria polyphylla, Schrad. Spicil. 102 (1794); Hoffm. Fl. Germ. 2. 109; Pl. Lich. 3. 14. t. 59. f. 2; α, Tuckerm. Syn. 71.
Gyrophora glabra, Ach. Meth. 101 (1803); α, Syn. 63. excl. syn. var. *anthracina*; α. & β, Hook. Fl. Scot. 2. 41; Heppe, Fl. Wurzburg. 69; Chev. Fl. Paris, ed. 2. 1. 643.
Umbilicaria glabra α, DC. Fl. Franç. ed. 3. 3. 412 (1805).
Gyrophora heteroidea α. & β, Ach. L. Univ. 218 (1810); Moug. & Nestl. 342!
Gyromium polyphyllum, Wahl. Fl. Lapp. 431 (1812); Fl. Carpath. 394; Fl. Upsal. 423; Fl. Suec. 481.
Gyrophora polyphylla, Turn. & Borr. Lich. Brit. 214 (1813); Hook. Br. Fl. 2. 217; Koerber, Lich. Germ. 95.
Umbilicaria ænea, α. *glabra*, Schær. Spicil. 90. 364 (1826–33); Exs. 149!
Umbilicaria polyphylla, Fries, L. Ref. 352. excl. *b.* & *c.* (1831); S. V. S. 117; Leight. Lich. Brit. Exs. 65!
Umbilicaria polyphylla, α. *glabra*, Schær. Enum. 28 (1850).
Graphis ænea, β. *discolor*, Wallr. Crypt. Germ. 1. 341 (1831).

a. *monophylla.* Thallus of a single peltate leaf.—Turn. & Borr. *l. c.*

Snowdon, *Dillenius.* Cheshire and Cornwall, *Lich. Brit.* Clova! Craig Raynoch! *Mr. W. Gardner in herb. Borrer.* Yorkshire! *Mr. G. Dixon.* Scotland! *Mr. G. Lawson.* Ingleby and

Howden Gill, Cleveland, Yorkshire, *Mr. W. Mudd*! Barmouth, *Rev. T. Salwey*! Wrekin and Arcoll Hills, Shropshire!

"*Thallus* peltate, flattish, consisting of a single leaf, adhering to the stone by a small thickish callous disk, mostly orbicular, but sometimes inclining to elliptical, from half an inch to an inch and a half in diameter; the edges slightly cleft into numerous, irregular, rounded lobes, and minutely, but unequally, crenate: *upper surface* of a greenish copper-colour when moist; when dry, black, or of a very dark brown closely approaching to it, smooth, or rarely very slightly wrinkled, and naked, occasionally marked with minute black dots: *under surface* for the most part perfectly black, whether wet or dry, and usually covered with a fine sooty efflorescence, scarcely perceptible without a microscope, which does not stain the fingers; when this is wanting, the surface is generally most minutely granulated, and in some instances blotched with a colour similar to that of the upper side: *substance* coriaceous, but so thin as to be almost membranous, pliant and soft when moist, rigid and extremely brittle when dry. *Tricæ* very rarely produced, scattered, when present, all over the thallus, sessile, but fixed only by their centre, of an irregularly angular figure; their *margin* thin, notched, enclosing a more or less convex *disk*, the *gyri* of which are not arranged concentrically, but compose, for the most part, several separate groups."—*Turn. & Borr. Lich. Brit.**

Specimens from Upsal, *Fries fil.*, in my herbarium are identical with this form.

b. *congregata*, T. & B. Thalli small, clustered, much curled, edges erect or reflexed.

Maze Beck, Westmorcland! *Mr. W. Robertson in herb. Borrer.* Mynydd-y-Myfyr near Oswestry, Shropshire! *Rev. T. Salwey.* Scotland! *Mr. G. Lawson.* Wrekin and Arcoll Hills, Shropshire! Ingleby, Yorkshire, *Mr. W. Mudd*!

Specimens! from Acharius in herb. Borrer, labelled by himself "*Gyrophora anomæa var. variegata*," are minute specimens of this state of the plant.

The states *monophylla* and *congregata* grow together in some abundance on the Wrekin and adjoining hills, and may be seen passing into each other by every degree of gradation.

c. *sulcata*, T. & B. Thallus marked on the upper side with superficial cracks.

On Ben Ferg, a mountain in Inverness-shire, by the head of Loch Ericht! *Mr. Borrer.* Clova! *Mr. G. Lawson.*

* We have adopted the descriptions from this privately printed work, as little or nothing can be added to their fidelity and accuracy.

"*Thallus* somewhat thicker than in 'a,' simple or more or less compound; *upper surface* marked with a few superficial, undulating, indented lines, the edges of which occasionally separate so as to leave a smooth black interstice; *under surface* as in 'a,' but more commonly blotched with the paler colour of the upper side."—*Lich. Brit.*

This state seems apparently a transition to *hyperborea*.

d. *lacera*. Thallus very deeply divided, divisions lacero-lobate. Craig Raynoch! *Mr. W. Gardner in herb. Borrer*. Scotland! *Mr. G. Lawson*.

The mode of division of the margins of this state is different from that of the preceding ones, and assimilates to that observable in *anthracina*.

A specimen in my herbarium, collected by M. Philippe at Tourmalet, Pyrences, agrees with this state.

Mr. Borrer's herbarium contains specimens! of *G. anthracina* from Acharius and Schærer, with which I have not noticed anything identical among British plants. Their general appearance is different from *polyphylla*, but the sporidia are similar. (See Pl. X. fig. 3.)

PLATE X. fig. 2.

β. flocculosa, Hoffm. Thallus thin, unequally lobed; upper side of a greenish copper-colour, dotted, and rough with sooty granulations; under, black, naked, pitted.

Lichen flocculosus, Wulf. in Jacq. Coll. 3. 99. t. 1. f. 2 (1789), fide Turn. & Borr.
Lichen deustus, Schrank, Fl. Salisb. 234 (1792); Westring in Act. Stockh. 1793 (fide Ach.); Ach. Prodr. 145 (excl. Linn. syn.).
Umbilicaria flocculosa, Hoffm. Fl. Germ. 2. 110 (1795); Pl. Lich. 3. fasc. 4. 3. t. 68. figs. 1–4; Massal. Ricerch. 61 (excl. syn.).
Gyrophora deusta, Ach. Meth. 102 (1803); L. Univ. 255; Syn. 66 (excl. Linn. syn. in all); Sm. E. Bot. t. 2483.
Gyrophora flocculosa, Turn. & Borr. Lich. Brit. 217 (1813); Koerber, L. Germ. 95.
Gyromium deustum, Wahl. Fl. Carpath. 394 (1814); Fl. Upsal. 423; Fl. Suec. 856 (excl. Linn. syn.).
Umbilicaria polyphylla, c. deusta, Fries, L. Reform. 352, excl. Linn. syn. (1831); Nyl. Nouv. Classif. 175.
Graphis ænea, α. concolor, Wallr. Crypt. Germ. 1. 341 (1831).
Gyrophora deusta, Hook. Fl. Scot. 42 (1821); Brit. Fl. 2. 218 (excl. Linn. syn.); Grev. Fl. Edin. 328.
Umbilicaria ænea, γ. flocculosa, Schær. Spicil. 91. 364 (1823–36); Exs. 152!
—— *polyphylla, β. deusta*, Tuckerm. Syn. 71 (1848).
—— *polyphylla, β. flocculosa*, Schær. Enum. 28 (1850).
—— *varia, var. flocculosa*, Leight. Brit. Lich. Exsicc. 219!

Highlands of Scotland, *Mr. Dickson*. Corstorphine and Craig-

lockhart Hills, Maughan, *Dr. Greville.* North of England! *Rev. John Harriman in herb. Borrer.* By the lake by the ascent of Ben Nevis! northern ridge of Ben Cruachan! *Mr. Borrer.* Caer Caradoc, Shropshire! states a. b. & c. growing together.

a. *monophylla.* Thallus of a single peltate leaf.

"*Thallus* consisting generally of a single peltate leaf from 1 to 2 inches in diameter, attached to the rock by a central callous disk, orbicular, flattish, but curled and reflexed at the edges, which are irregularly lacerated or divided into a few unequal shallow lobes: the *upper surface* dark greenish-brown when moist; when dry, of a rusty-brown approaching to black, minutely dotted and sprinkled with a coarse sooty efflorescence, very copious in some specimens, but in others rare, sometimes a little wrinkled about the centre, and occasionally bearing numerous small leafy scales: the *under surface* dark brown or black, naked, quite smooth in general, though now and then most minutely granulated and pitted, more copiously in some specimens than in others, with small depressions, which are often so numerous as to give it an absolutely reticulated appearance: *substance* coriaceous, very thin, so as to be almost membranous; flexible when moist, but rigid and brittle when dry. *Tricæ* rare, scattered about the thallus, sessile, but attached only by the centre, orbicular, their *margin* slightly elevated and entire, their *disk* convex; the *gyri* most frequently concentric, sometimes, but rarely, forming irregular groups."—*Lich. Brit.*

Specimens from Upsal, Sweden! *Fries fil.*, and from the Pyrenees! *M. Philippe*, in my own herbarium, agree with our British plants.

b. *polyphylla*, T. & B. Thalli small, clustered, curled.

Whitwick Rocks, Leicestershire! *Rev. A. Bloxam.*

Thallus composed of numerous small remarkably curled leaves arising from a common central disk and growing in an irregularly orbicular group, the diameter of which is not greater than that of the simple leaf of *monophylla*.

c. *squamigera.* Thallus rough with small scale-like leaves.

d. *erosa.* Thallus with ragged and perforated edges.

The tricæ are figured in 'E. Bot.' from foreign specimens received from Dr. Swartz. None of the British specimens in Mr. Borrer's herbarium bore any fructification, nor those in Schærer's Lichenes Exsiccati.

Closely allied to α. *polyphylla*, and apparently approximating to ε. *erosa* by the state d. *erosa*.

PLATE X. fig. 4. Sporidia.

γ. *hyperborea*, Hoffm. Thallus thin, jagged, and somewhat lobed, a little perforated, naked on both sides; upper side greenish-brown, pustulate; under side blackish-brown, nearly smooth, slightly pitted.

"*Lichen superficie subtus lacunata*, Linn. Fl. Lapp. n. 453" (fide Wahl.).
—— *pullus*, "Wulf. in Jacq. Misc. 2. 83. t. 9. f. 3" (1781) (fide Dicks.); Dicks. Crypt. 2. 23 (secund. specim. in herb. Borrer!).
—— *erosus*, Westr. in Act. Stockh. 1793 (fide Ach.).
—— *hyperboreus*, Ach. in Act. Stockh. xv. 89. t. 2. f. 2 (1794); Prodr. 146.
Umbilicaria hyperborea, Hoffm. Fl. Germ. 2. 110 (1795); Pl. Lich. 3. fasc. 4. t. 71; Stenh. in Sched. Crit. fasc. 5 & 6. no. 126; Fries, L. Ref. 353; S. V. S. 117; L. S. 126 (fide Nyl.); Tuckerm. Syn. 73; Massal. Ricerch. 63. fig. 117; Nyl. N. Class. 175!
Lichen Jacquini, With. Arr. 4. 62? (1796).
Umbilicaria papillosa, DC. Fl. Franç. 3rd ed. 3. 411 (1805).
Gyrophora hyperborea, Ach. Meth. 104 (1803); L. Univ. 225; Syn. 66; Turn. & Borr. Lich. Brit. 227; Heppe, Fl. Wurzb. 70; Moug. & Nest. Stirp. Crypt. Vosges. 1047!; Koerber, Lich. Germ. 95.
Gyromium hyperboreum, Wahl. Fl. Lapp. 482 (1812); Fl. Ups. 424; Fl. Suec. 856.
Umbilicaria ænea, β. *hyperborea*, Schær. Spicil. 91. 364 (1823–36); Exs. 150! 151!
Graphis ænea, γ. *papulosa*, Wallr. Crypt. Germ. 341 (1831).
Umbilicaria polyphylla, γ. *hyperborea*, Schær. Enum. 29 (1850).

By the Truim, near Dalwhinnie, Inverness-shire? *James Brodie of Brodie, Esq.*

"*Thallus* peltate, composed of a single leaf, attached to the stone by a thick, callous, central base, irregularly orbicular, 2 inches or more in diameter, flattish, folded in a most uncertain manner, crose and laciniated at the edges, so as to be torn into many shapeless lobes of variable size, and perforated here and there with equal irregularity: *upper surface* dusky greenish-brown when moist, much darker and losing the tinge of green, or sometimes almost black, when dry; always naked, and all over rugged, with irregular pustular elevations of the cuticle, which has the appearance of having burst, leaving smooth black interstices, varying much in width and figure between the elevations: *under surface* deep blackish-brown, smooth and naked, irregularly pitted all over, and thence appearing obsoletely reticulated; sometimes, in very old specimens, slightly granulated, and pierced here and there with perforations of the inferior coat of the thallus: *substance* coriaceous, thin, flexible when moist, and somewhat so, though brittle, even when dry. *Tricæ* sessile, attached by the centre, irregularly orbicular, elliptical, or variously distorted and angular, flat, or more generally more or less convex; their *margin* nearly entire; *gyri* of the *disk* often parallel and straight, but most frequently variously twisted and disposed in several groups, and in this case the common margin

of the tricæ is often wanting. In old specimens the *thallus* is sometimes found partially separated into two coats, but much less frequently and remarkably, as in ϵ. *crosa*. The edges of the blisters of the cuticle become also now and then detached, and somewhat elevated, so as to give the *thallus* the appearance of being covered with leafy scales."—*Lich. Brit.*

Mr. Borrer states that he has sought for the plant in vain in the particular station specified by Mr. Brodie.

In my own herbarium is a specimen received from Mr. George Dixon, of Great Ayton, Yorkshire, given to him by a friend who collected it somewhere in Scotland; but I could not ascertain the exact locality by subsequent correspondence. Specimens from Upsal, Sweden, from Fries fil. and Dr. Nylander are identical.

PLATE X. fig. 5 & fig. 5 *a*. (1. Section of thallus and apothecia. 2. Sporidia.)

δ. *arctica*, Ach. Thallus thickish, crenate, slightly lobed, naked on both sides; upper side greenish-brown, rugged with pustules; under, blackish-brown, nearly smooth.

Lichenoides atrum corii Persici instar exasperatum, Dill. 110. t. 30. f. 119, fide herb. Dilleniani cl. Borrero teste (1741).

Gyrophora arctica, Ach. Meth. 106. t. 2. f. 6 (1803); L. Univ. 221; Sm. E. Bot. t. 2485; Turn. & Borr. Lich. Brit. 225; Sommerf. Suppl. Fl. Lapp. 177.

Gyromium proboscideum, β. *arcticum*, Wahl. Fl. Lapp. 483 (1812), fide speciminis a Wahlenbergio seipso recepti teste cl. Smithio in E. Bot. t. 2485.

Gyrophora proboscidea, β. *arctica*, Ach. Syn. 65 (1814); Hook. Br. Fl. 2. 217.

Umbilicaria polymorpha, γ. *arctica*, Schær. Spicil. 88 F. 363 (1823–36); Exs. 556!; Enum. 27; Tuckerm. Syn. 71.

Rocks in the county of Durham?! *Mr. Robson in herb. Borrer.* Devonshire? *Mr. Hudson.*

"*Thallus* peltate, flattish, consisting of a single leaf, affixed to the rocks by a thick, callous, central disk, orbicular, from an inch to two inches or more in diameter; its edges irregularly crenate, divided into a few shallow rounded lobes, and somewhat reflexed: *upper surface* of a dull greenish-brown when moist, changed by drying to a pale pruinose grey in the centre, whence it gradually darkens towards the edges, where it is blackish; or sometimes it is dark brown all over; naked, everywhere very rugged, with irregular pustular elevations of the cuticle, which here and there towards the edges of the thallus has the appearance of having burst, as if from being overstretched, leaving depressed, smooth, undulating interstices: *under surface* of a paler brown and subpruinose, black (in our specimens) about the centre, quite smooth

or very minutely papillose: *substance* coriaceous, thickish, flexible when moist; rigid, almost horny, but tough, when dry. *Tricæ* slightly elevated, orbicular, varying to angular and subreniform, somewhat convex; their *margin* entire, scarcely elevated; *gyri* of the *disk* sometimes concentric, but more frequently disposed in several irregular groups, usually, not constantly, leaving a minute cavity in the centre.

The fragment of a specimen from Mr. Robson in herb. Borrer has all the appearance of belonging to γ. *hyperborea*. It seems scarcely sufficient to enable us to form a decisive opinion on this plant.

PLATE X. fig. 6.

ε. *erosa*, Hoffm. Thallus thickish, splitting when old into two or three laminæ, jagged and somewhat lobed, perforated; upper side greenish-brown, naked, divided by flexuose anastomosing lines into convex arcolæ; under side paler, papillose, separately pierced, fibrous.

Lichenoides rugosum durum pullum, peltis atris verrucosis, Dill. 220. t. 30. f. 118 (1741) (fide herbarii Dilleniani cl. Lightfootio teste, *l. c. infra*).
Lichen polyrrhizos, Huds. Fl. Angl. 550 (excl. syn. Linn.) (1778).
—— *torrefactus*, Lightf. Fl. Scot. 2. 862 (1777) (sec. specim. a Lightfootio seipso recepta cl. Borrero teste in Lich. Brit. cit. infra); With. Arr. 4. 62 (excl. syn. præter Dill.).
—— *erosus*, Web. Spicil. 259 (1778); Swartz in Act. Ups. iv. 250 (fide Ach. & Schær.); Ach. in Act. Stockh. xv. 87. t. 2. f. 1; Prodr. 145.
—— *reticularis*, Westr. in Act. Stockh. xiv. 45 (fide Ach.) (1793).
Umbilicaria torrefacta, Schrad. Spicil. 104 (1794).
Lichen Cribellum, Retz. Fl. Scand. 287 (1795).
Umbilicaria erosa, Hoffm. Fl. Germ. 2. 111 (1795); Pl. Lich. 3. fasc. 4. 7. t. 70; DC. Fl. Franç. ed. 3. 2. 411.
Umbilicaria erosa α, Schær. Spicil. 93. 364; Exs. 153!; Enum. 29; Stenh. in Sched. Crit. fasc. 5 & 6. no. 127; Fries, L. Reform. 354; Summa Veg. Scand. 117; Tuckerm.! Syn. 73; Massal. Ricerch. 62. fig. 116; Nyl. N. Class. 175!
Gyrophora erosa, Ach. Meth. 103 (1803); L. Univ. 224; Syn. 65; Sm. E. Bot. t. 2066; Mong. & Nestl. Crypt. Vosges. 250!; Turn. & Borr.! Lich. Brit. 229; Hook. Fl. Scot. 2. 42; Brit. Fl. 2. 218; Tayl. Fl. Hib. pt. 2. 155; Koerber, Syst. Lich. Germ. 96.
Gyromium erosum, Wahl. Fl. Lapp. 482 (1812); Fl. Suec. 856.
Graphis ænea, δ. *dispansa* & ε. *cribrosa*, Wallr. Crypt. Germ. 342 (1831).

Highlands of Scotland, *Lightfoot*. St. Vincent's Rock near Bristol, *Hudson*. Llanberris, *Rev. Hugh Davies*. On the vitrified forts in the Highlands of Scotland; Durham; Yorkshire; North Wales, *Sir J. E. Smith*. Mangerton and other mountains in Ireland, *Dr. Taylor*. Corry Leese, Ben Nevis! *Mr. Borrer*. Ben Beck! Craig Koynoch! *Mr. W. Gardner in herb. Borrer*. Clova! *Mr. G. Lawson*. Capel Cerig, North Wales! *Mr. H.*

Piggot. Birkdale, Westmoreland! *Mr. W. Robertson in herb. Borrer.* Dartmoor! *Mr. Borrer.* Swinhope Fell, Durham! *Mr. W. Mudd.* Barmouth, N. Wales! *Rev. T. Salwey.*

"*Thallus* peltate, consisting of a single leaf, attached by a thick, callous, central base, suborbicular or oblong, an inch or two in diameter, flattish, but elevated towards the centre, so as to have an irregularly convex appearance, undulated, and not unfrequently erect or reflexed at the edges, rugged all over, and torn, without any order, into various rounded lobes of most uncertain size, which are most usually shallow, but occasionally reach almost to the root, and slightly imbricated: it is also perforated, chiefly towards the edges, with numerous cavities of no definite size or figure, giving to some specimens the appearance of being fringed with beautiful lacework; in other specimens the perforations are found all over the thallus, and again in others they are almost, if not altogether, wanting: *upper surface* dusky greenish-brown when moist, when dry deep brown, and frequently almost black, always naked, in a young state even, and marked with various undulating black indented lines, which, as the plant becomes older, grow more numerous, and, frequently anastomosing, divide the cuticle into irregular areolæ, which swell into pustular elevations: *under surface,* when wet, semitransparent, generally light greyish-brown, but sometimes of the same colour as the upper one, turning darker, often blackish, from drying; minutely granulated, so as to look like shagreen when magnified, entire in young specimens, in old ones ragged with irregular holes, which have elevated thickened lips, and do not extend to the upper coat of the thallus; besides which, there also grow out of the under surface, in all stages of its existence, fibres of the same colour and substance as itself, aptly compared in 'English Botany' to shavings, performing, according to Dillenius and Schrader, the office of roots: *substance* coriaceous, variable in thickness, flexible when moist, rigid and brittle when dry. *Tricæ* numerous, scattered all over the thallus, affixed by their centres, sessile or slightly elevated, flat or variously convex, varying in shape from linear through every gradation to orbicular; sometimes surrounded by a nearly entire slightly elevated *margin,* but more frequently wanting it, and consisting merely of irregular clusters of twisted *gyri**."—*Lich. Brit.*

The sporidia were not seen in the specimens of *U. Muhlenbergii* from Mrs. Merry in herb. Borrer; but in specimens of *U. Muhlenbergii* and its variety *alpina* in the same herbarium, received from America from Mr. Edward Tuckerman, jun., they were identical with those of *erosa* (see Pl. X. figs. 9 & 10).

* For the spermagonia of this form see Tulasne, *l. c.*

Specimens of *erosa* from Upsal, Sweden, *Fries fil.*; Stockholm, *Dr. Nylander*, and Saibten, *M. Philippe*, in my own herbarium, are identical with our British plant.

PLATE X. fig. 7. Sporidia. Fig. 8. Section of thallus and apothecia.

ζ. *pellita*, DC. Thallus thin, unequally lobed and crenate; upper side greenish copper-colour, smooth; under side black, papillose, reticulated and densely fibrous; tricæ immarginate, growing out into tufts of fibres.

Lichenoides pullum superne et glabrum, inferne nigrum et cirrosum, Dill. 226. t. 30. f. 130 (1741).
Lichen polyrhizos, Linn. Sp. Pl. 1618?; Lightf. Fl. Scot. 2. 864; Robson, Br. Fl. 301; With. Arr. 4. 64 (excl. syn. 2do Dill.).
—— *vellens* α, Huds. Fl. Angl. 550 (1778) (excl. var. β).
Umbilicaria vellea, Hoffm. Pl. Lich. 2. 9. t. 26. f. 3 (excl. Linn. syn.) (1791), admirable; Schrad. Spicil. 105 (excl. syn. Lightf.).
Lichen hirsutus, Westr. in Act. Stockh. 1793 (fide Ach.).
—— *pellitus*, Ach. in Act. Stockh. xv. 99. t. 3. f. 2 (1794); Prod. 149; Sm. E. Bot. t. 931.
Gyrophora pellita, Ach. Meth. 108 (1803); L. Univ. 228. t. 2. f. 10; Syn. 67; Turn. & Borr.! Lich. Brit. 238; Hook. Fl. Scot. 2. 42; Brit. Fl. 2. 219; Tayl. Fl. Hib. pt. 2. 155; Chev. Fl. Paris. 1. 644.
Umbilicaria pellita, DC. Fl. Franç. 3rd ed. 2. 409 (1805).
—— *depressa*, β. *spadochroa* F, Schær. Spicil. 83. 362 (1823–36).
Gyromium polyrrhizon, Wahl. Fl. Suec. 858 (1824–26).
Umbilicaria polyrrhizos, Fries, L. Reform. 358 (1851); Summa Veg. Scand. 117; Schær. Enum. 29; Nyl. N. Class. 175.

On the rocks called Llyn Llydaw, Snowdon; and about Llyn Cwm y Ffynnon tas; also on the summit of the mountains at Cwm Brwynog towards Ardhu near Llanberris, *Dillenius*. Highlands and Lowlands of Scotland, *Lightfoot*. Clark's Park and Paradise near Moneymusk, Aberdeenshire, *Withering*. Carnedd Llewellin, near the summit. On Moel Shabôd near Capel Cerrig, Caernarvonshire, *Mr. Griffith*. Yorkshire, *Mr. W. Brunton*. Durham, *Rev. J. Harriman*. Cheshire, *Turner and Borrer*. On rocks on Tonlagee, Co. Wicklow, *Dr. Taylor*. Scotland! *Mr. G. Donn in herb. Borrer*, without locality (fructu)! *Mr. Sowerby in herb. Borrer*. Cronkley (fructu)! *Mr. W. Robertson in herb. Borrer*. Loch Phadrick! Craig Koynoch! Clova! *Mr. W. Gardner in herb. Borrer*. Ben Ferrag! Llyn Canvay! *Mr. Borrer*. Near Lake Tumanel, Cumberland (fructu)! *Mrs. Joshua Stanger*. Barmouth, N. Wales! *Rev. T. Salwey*. Clova! *Mr. G. Lawson*.

"*Thallus* peltate, sometimes simple, but generally consisting of many leaves, spreading from a common central disk, by which they are affixed to the stone, in a roundish cluster varying from 1 to 3 or 4 inches in diameter; many such clusters often forming together irregular patches of considerable extent: the leaves vary much in size, in proportion as the thallus is more or less com-

pound: when it consists of a single leaf, this is sometimes 2 inches in diameter, of an irregularly orbicular outline, with a few, rounded, shallow, crenate lobes, and nearly flat; in the more common and complicated state, each leaf is seldom an inch in diameter, usually much smaller, much and variously crumpled, suborbicular, very uncertain in the number and shape of its lobes, which are usually, however, few and shallow, their edges waved and crenate: *upper surface* of a greenish copper-colour when wet; copper-brown, sometimes blackish, when dry; very smooth and even, excepting a few scattered minute black dots, sometimes impressed, at other times slightly elevated: *under surface* invariably quite black, clothed for the most part with innumerable entangled black fibres, which most frequently are protruded beyond the edges, so as to give them the appearance of being fringed (which sometimes also they are in fact), less frequently naked here and there, or nearly all over, and then rough with minute shagreen-like granulations, and irregularly reticulated (which is most remarkably the case towards the centre), with elevated veins or threads, which are often detached, except at their extremities, so as to form a coarse lacework: *substance* coriaceous, but thin, flexible when wet, very rigid and brittle when dry. *Tricæ* rare, orbicular or elegantly lobed, flat, appressed to the thallus, to which they are affixed by the whole under side, always destitute of a *margin*, and composed entirely of numerous narrow *gyri*, which are much and variously subdivided and contorted, but seem to spread from a common centre, and frequently unfold, or grow out into elevated irregular clusters of much-branched minute black fibres, and these clusters are of more frequent occurrence than the tricæ themselves."—*Lich. Brit.*

Our British plant coincides with specimens of *U. polyrhizos* (Linn.) in my herbarium received from Fries fil., collected at Upsal, Sweden.

Plate X. fig. 11.

In Mr. Borrer's herbarium are authentic specimens! from Acharius of *G. hirsuta* and *G. vellea** which appear to be identical. In the former the sporidia were not seen, but those of the latter were double the size of those of *pellita* (see Pl. X. figs. 12 and 13), consequently showing them to be distinct species. Schærer's Exs. 137! and 138! were also identical with the Acharian specimens.

No British specimens have occurred to our notice; though Robson in his British Flora, p. 300, gives as a habitat for the

* For the spermagonia see Tulasne, *l. c.*

plant of Dillenius, 545. t. 82. f. 5, "on rocks near Settle in Yorkshire."

** *Thallus ashy-grey when dry.*

η. grisea, Hoffm. Thallus thin, crenate, somewhat lobed, papillose on both sides; upper side pale ash-coloured, naked; under mostly naked, blackish.

Lichen pulmonarius saxatilis, e cinereo-fuscus, minimus, Tourn. Instit. 549 (1719); Vaill. Paris. 116. t. 21. f. 14.
Lichenoides saxatile, foliis minus divisis, cinereo-fuscum, Dill. in Raii Syn. 73 (1724).
—— *coriaceum cinereum, peltis atris compressis*, Dill. 219.
Lichen deustus, Robs. Br. Fl. 300 (1777) t. 30. f. 117 (1741) (fide herbarii Dilleniani cl. Borrero teste).
—— *griseus*, Swartz in N. Act. Stockh. v. p. 91. t. 2. f. 3 (fide Ach.); Westr. in Act. Stockh. 1793 (fide Ach.); Retz. Scand. 286.
Umbilicaria grisea, Hoffm. Fl. Germ. 2. 111 (1795).
Lichen Dillenii, With. Arr. 4. 63 (1796).
—— *murinus*, Ach. Prodr. 143 (1798).
Umbilicaria murina, DC. Fl. Franç. 3rd ed. 3. 412 (1805); Nyl. N. Class. 175.
Gyrophora hirsuta, γ. murina, Flörke in Berlin Mag. 1810, p. 67 (fide Schærer).
Gyrophora murina, Ach. Meth. 110 (1803); L. Univ. 231; Syn. 69; Sm. E. Bot. t. 2486; Stenh. in Sched. Crit. fasc. 5 & 6. no. 132 (1825); Hook. Brit. Fl. 2. 218; Chev. Paris. 1. 643. t. 14. f. 11 *c*.
—— *grisea*, Turn. & Borr. Lich. Brit. 236 (1813).
Umbilicaria depressa, β. spadochroa A, Schær. Spicil. 82. 362 (1823-36).
Gyromium velleum, δ. murinum, Wahl. Fl. Suec. 857 (1824–26).
Graphis vellea, β. alutacea, Wallr. Crypt. Germ. 344 (1831).
*Umbilicaria vellea, γ. hirsuta, * murina*, Fries, L. Reform. 358 (1831); Summa Veg. Scand. 117.
—— *vellea, γ. spadochroa*, a. *grisea*, Schær. Enum. 24 (1850).

Found on St. Vincent's Rocks near Bristol by Mr. Dare, *Dillenius*.

"*Thallus* peltate, consisting generally of a single, orbicular, crumpled, concave leaf, from an inch to an inch and a half in diameter; sometimes of two or three smaller leaves; attached to the stone on which it grows by a callous central disk, divided at the edges into a few, shallow, rounded lobes, and irregularly notched or crenate: *upper surface* of an ash-colour, with a slight tinge of brownish-green when wet; white ash-colour and subpruinose, but still brownish towards the edges, when dry; granulated, as if minutely cracked all over, but smooth to the touch, and scarcely appearing rough to the naked eye: *under surface*, whether wet or dry, dark brown, varying to almost black, covered with a minute shagreen-like roughness, naked, or very rarely producing a few scattered branched fibres: *substance* thin, flexible when wet, and still somewhat flexible, but brittle, when

dry. *Tricæ*, except in their very youngest state, when they appear as round black dots, depressed, and almost immersed in the thallus, orbicular and reniform, surrounded when young by a *margin*, which afterwards disappears. *Disk* at first flat, very convex in a more advanced stage; its *gyri* arranged concentrically."—*Lich. Brit.*

Doubtful if of British growth, but inserted on the authority of Dillenius, whose herbarium contains only two specimens (foreign?), marked as having been received from Celsius.

Distinct from *U. hirsuta* by the different sporidia (see Pl. X. fig. 12).

PLATE X. fig. 14.

θ. deusta, Linn. Thallus thin, crenate, slightly lobed, naked on both sides; upper side greenish-brown, rugged and reticulated; under, ash-coloured, smooth.

Lichen deustus, Linn. Sp. Pl. 1618 (excl. syn. Vaill. & Dill.) (1763), fide herb. Linn. cl. Borrero teste); Huds. Fl. Angl. 550 (rev. Daviesio teste); Lightf. Fl. Scot. 2. 861.

—— *proboscideus*, Afzel. in Act. Stockh. 1788 (fide Ach.); Ach. Prodr. 147 (in part).

Umbilicaria mesenterica, Schrad. Spicil. 103 (1794).

Gyrophora proboscidea α. (in part), Ach.! Meth. 105 (1803); L. Univ. 220; Syn. 64; Sm. E. Bot. t. 2484; Turn. & Borr.! Lich. Brit. 222; Hook. Fl. Scot. 2. 41; *α*, Brit. Fl. 217; Heppe, Fl. Wurzb. 69; Johnst. Fl. Berw. 2. 99; Chev. Fl. Paris. 1. 644; Koerber, Syst. Lich. Germ. 96.

Gyromium proboscideum, Wahl. Fl. Lapp. 483 (1812); Fl. Carpath. 394; Fl. Suec. 857.

Umbilicaria polymorpha, β. deusta, Schær. Spicil. 88. 363 (1823–36); Exs. 148!; Enum. (in part) 26.

Graphis corrugata α, Wallr. Crypt. Germ. 338 (1831).

Umbilicaria proboscidea α. (in part), Fries, L. Reform. 354 (1831); Summa V. Scand. 117; L. S. 128 (fide Nyl.); Nyl. N. Class. 157!

St. Vincent's Rocks near Bristol and about Llanberris, *Hudson*. Highland rocks of Scotland, *Lightfoot*. North of England and Wales, *Sir J. E. Smith*. Rocks near the summit of Hedgehope, Northumberland, *Dr. G. Johnston*. Ben Lawers, Scotland! *Mr. Borrer*.

"*Thallus* peltate, flattish, but umbonated in the centre, and rather elevated and undulated at the edges, consisting generally of a single leaf, affixed to the rock by a thick callous central disk, which scarcely ever forms any stalk, or sometimes, though rarely, of many leaves growing together and diverging from a common centre: leaf orbicular, from an inch to an inch and a half in diameter, irregularly crenate at the edges, and often here and there divided into a few shallow rounded lobes: *upper surface* a dull greenish-brown when moist, when dry changing to a

pale pruinose grey in the centre, whence it gradually darkens towards the edges, where it is nearly black; in some specimens all over blackish; always marked, especially about the centre, with elevated reticulated veins, which are very conspicuous in most individuals, though occasionally almost wanting: *under surface* quite smooth, except now and then a few granulations towards the central part, naked, of a smoky-brown, varying in depth, somewhat palest when wet, and always lightest near the middle: *substance* thin, between coriaceous and membranous, flexible when moist, and often scarcely rigid, though very brittle, when dry. *Tricæ* numerous, scattered all over the thallus, quite sessile, though affixed only by their centre, depressed, usually orbicular, but varying to angular and reniform, surrounded by an entire elevated *margin*. *Disk* nearly flat; its *gyri* either concentric or arranged in several parcels, lying together without any regular order, and often leaving in the middle a subtriangular cavity."—*Lich. Brit.**

Swedish specimens from Stenhammer and Nylander, labelled *Umbilicaria proboscidea* (L.) Fries, are identical.

b. *fimbriata*, Turn. & Borr. Thallus edged with a few black, branched, tooth-like fibres.

Gyrophora deusta, β. *fimbriata*, Turn. & Borr. Lich. Brit. 222.
—— *proboscidea*, Moug. & Nest. Stirpes Vosges. 249!

Similar in substance, colour, and every other respect with 'a,' except in having the edges of the thallus here and there toothed and fringed with a few scattered black branching fibres; evidencing an approach to *proboscidea*. There are also occasionally a few fibres sprinkled over the underside.

Highlands of Scotland! *Mr. Borrer*. Between Glen Callater and Lochnagar, Scotland! *Mr. J. Tatham*. Clova! and about Loch Phadrich! *Mr. W. Gardner in herb. Borrer*. Swinhope Fell, Durham! *Mr. W. Mudd*. Glenmalure, co. Wicklow, *Mr. Isaac Carroll*.

Specimens in my herbarium collected at Tourmalet, Pyrenees, by M. Philippe and Mr. Spruce, coincide with this state.

c. *corrugata*, Turn. & Borr. Thallus thin, rough with elevated reticulations.

Umbilicaria corrugata, Hoffm. Pl. Lich. 2. 65. t. 43. f. 4–7 (1794), admirable; Massal. Ricerch. 61. fig. 113.
Lichen proboscideus (in part), Ach. Prodr. 147 (1798).
Gyrophora proboscidea, β. *exasperata*, Ach.! Meth. 105 (1803).

* For the spermagonia see Tulasne, *l. c.*

Umbilicaria proboscidea γ, DC. Fl. Franç. ed. 3. 3. 410 (1805).
Gyrophora proboscidea γ, Ach. L. Univ. 221 (1810).
—— *proboscidea* α. (in part), Ach. Syn. 64 (1814).
—— *deusta*, γ. *corrugata*, Turn. & Borr. Lich. Brit. 222 (1813).
Umbilicaria proboscidea α. (in part), Fries, L. Reform. 354 (1831).
Gyrophora proboscidea (in part), Chev. Fl. Paris. 1. 644 (1836).
Umbilicaria polymorpha, β. *deusta* (in part), Schær. Enum. 26 (1850).

Highlands of Scotland! *Mr. Borrer.*

Similar in all respects to 'a,' except in its upper surface having extremely prominent reticulations, rising to nearly a line in height, and looking like a series of erect curled squamæ.

d. *mesenteriformis*, Turn. & Borr. Thallus thickish, the upper side rough with elevated reticulations, and somewhat papillose.

Lichen mesenteriformis, Wulf. in Jacq. Misc. 2. 85. t. 9. f. 5 (fide Turn. & Borr.) (1781).
Gyrophora deusta, δ. *mesenteriformis*, Turn. & Borr. Lich. Brit. 222 (1813).

Highlands of Scotland! *Mr. Borrer.*

Upper surface of the thallus singularly rugose, almost papillose. The reticulations nearly as prominent as in 'c,' and sometimes growing out into new leaves: substance considerably thicker than in the other states.

I must refer here a specimen! amongst Mr. Spruce's Lichenes Pyrenæi collected at Lac Lehon.

PLATE X. fig. 15.

ι. *proboscidea*, DC. Thallus thickish, unequally lobed, fringed at the edges, naked on both sides; upper side greenish-brown, rugged; under, ash-coloured, smooth.

Lichenoides corneum, marginibus eleganter fimbriatis, Dill. 218. t. 29. f. 116 A (1741); Fl. Dan. t. 471. f. 1, 2 (fide Turn. & Borr.).
Lichen proboscideus, Linn. Sp. Pl. 1617 (excl. syn. Amœn. Acad. & Dill.) (1763) (fide herb. Linn. cl. Borrero teste); Huds. Fl. Angl. 551; Wulf. in Jacq. Misc. 2. 80. t. 9. f. 2 (fide Turn. & Borr.); Hedw. Crypt. 2. 5. t. 1 A (fide Turn. & Borr.); Retz. Scand. 288; With. Arr. 4. 65; Sm. E. Bot. t. 522, two upper figures.
—— *polyrrhizos*, Weis. Crypt. 81 (1770); Web. Spicil. 265.
—— *crinitus*, Lightf. Fl. Scot. 860 (1777).
—— *cylindricus*, Afzel. in Act. Stockh. 1788 (fide Ach.); Ach. Prodr. 148.
—— *foliaceus umbilicatus, peltis turbinatis truncatis perforatis*, Linn. Fl. Lapp. 359 (Sm. 2nd ed. 1792).
Umbilicaria crinita, Hoffm. Pl. Lich. 2. 67. t. 44. f. 1, 2, 3, 4, 5, 6, 8 (1794); Massal. Ricerch. 61. fig. 111.
Gyrophora cylindrica α, Ach. Meth. 107 (1803); L. Univ. 223; Syn. 65; Hook. Fl. Scot. 2. 42; Brit. Fl. 2. 218; Johnst. Berw. 2. 99; Wallr. Crypt. Germ. 339; Tayl. Fl. Hib. pt. 2. 155; Koerber, Syst. Lich. Germ. 97.
Umbilicaria proboscidea α, DC. Fl. Franç. 3rd ed. 3. 410 (1805).

Umbilicaria proboscidea, β. *cylindrica*, Fries! L. Reform. 356 (1831); Summa V. Scand. 117.
Gyromium cylindricum, Wahl. Fl. Lapp. 483 (1812); Fl. Suec. 857.
Gyrophora proboscidea α, Turn. & Borr.! Lich. Brit. 219 (1813).
Umbilicaria polymorpha, α. *cylindrica* A. & D, Schær. Spic. 86 (1823–36); a. *monophylla*, Exs. 143!; b. *polyphylla*, Exs. 146!; a. *crinita*, & d. *fimbriata*, Enum. 26.
Gyrophora crinita, Chev. Fl. Paris. 1. 644 (1836).
Umbilicaria cylindrica, Tuckerm. Syn. 71 (1848); Nyl. N. Class. 175.
—— *varia*, *var. proboscidea*, Leight. Brit. Lich. Exs. 95!

On Snowdon on the rocks called Llyn Llydaw, and near Llyn Cwm y Ffynnon tas; also on the summit of the mountains from Cwm Brwynog towards Ardhu near Llanberris. On lofty rocks of the Berwyn Mountain, *Dillenius*. Rocks on the Highland mountains, as on Goatfield in the Isle of Arran, on the mountains of Breadalbane, Ben Nevis in Lochaber, *Lightfoot*. On rocks in the mountainous parts of Dartmoor, Devonshire, *Mr. Newberry*. Summit of Carnedd Llewellin, *Mr. Griffith*. Scotland, Wales, and North of England, *Sir J. E. Smith*. On Cheviot, *Mr. Winch*. Near the summit of Hedgehope, Northumberland, *Dr. G. Johnston*. On rocks at Connavalla, Ireland, *Dr. Whitley Stokes*. On Mangerton, Ireland, *Dr. Taylor*. Rocks about Loch Phadrick! rocks Stroine-dhu! summit of Carlowrie! *Mr. W. Gardner in herb. Borrer*. Birkdale, Westmoreland! *Mr. W. Robertson in herb. Borrer*. Clova! *Mr. G. Lawson*. Scawfell! *Mrs. Joshua Stanger*. Yorkshire! *Mr. G. Dixon*. Summit of Arran Mowddy! *Mr. Borrer*. Falcon Clints, Teesdale, co. Durham! *Mr. W. Mudd*.

"*Thallus* peltate, ascending, composed usually of numerous imbricated curled leaves, attached to the rock by a thick central callous disk, which is sometimes drawn up into a sort of stalk, whence they spread in nearly a circular form, making patches of 1 or 2 inches in diameter: the leaves, taken individually, vary in shape from orbicular through every intermediate degree to cuneiform, and are divided very irregularly, some down to the centre, others slightly, into rounded lobes, the edges of which are crenate or dentate, and everywhere fringed with black branched compressed fibres, a line or two long, composed of the substance of the thallus itself, so that they may perhaps most properly be regarded as elongated teeth, though they have entirely the appearance of cilia of a different substance: these, from the remarkably undulated mode of growth of the edges of the thallus, often look at first sight as if they were disposed in two or three rows: the *upper surface* is of a dull greenish-brown when moist; and of a smoky-grey, with a pruinose appearance, and sometimes speckled with white, when dry; always roughish with minute elevated reticulations of the cuticle, very visible in

some specimens, but in others scarcely to be detected: the *under surface* is quite smooth and naked, except occasionally a few scattered fibres, which are either branched or simple, shorter and usually much paler than those which fringe the edges of the thallus: it is of a pale ash-colour near the centre, but gradually darker towards the edges, where it is brown, with a greenish tinge when moistened: *substance* coriaceous, flexible when moist, extremely rigid and almost horny when dry, but still tough. *Tricæ* plentifully produced all over the thallus, and often clustered, turbinate in their first state, afterwards becoming supported upon extremely short peduncles, mostly orbicular, but not unfrequently reniform, surrounded by a nearly entire undulated *margin*, nearly of the same height as the *disk*, so that the whole surface is flat; the *gyri* are mostly concentric, leaving in the centre a subtriangular cavity, but are not rarely disposed in various parcels, lying together without any regular order."—*Lich. Brit.*

Specimens in my own herbarium collected "in alpibus Jemtlandiæ"! by Fries fil.; "ad rupes in Pyrenæis orientalibus"! by Dr. Cam. Montagne and M. Philippe, are identical.

b. *denticulata*, Turn. & Borr. Edges of the thallus coarsely fringed and toothed.

Lichenoides corneum &c., Dill. 218. t. 29. f. 116 B.
Lichen proboscideus, Sm. E. Bot. t. 522, two lower figures.
Gyrophora cylindrica, β. *denticulata*, Ach. Meth. 107.
—— *cylindrica* α. (in part), Ach. L. Univ. 223.
—— *proboscidea*, β. *denticulata*, Turn. & Borr. Lich. Brit. 219.
Umbilicaria polymorpha, α. *cylindrica* B, Schær. Spic. 87; Exs. 144!
—— *polymorpha*, α. *cylindrica*, b. *denticulata*, Schær. Enum. 26.

Rocks about Loch Phadrick! rocks, Ben-na-Bourd! *Mr. W. Gardner in herb. Borrer.* Clova! *Mr. G. Lawson.* Summit of Arran Mowddy! *Mr. Borrer.* Galtymore, co. Tipperary! *Mr. I. Carroll.*

In all respects similar to 'a,' except that the marginal fibres are coarser and larger, and more evidently a prolongation of the thallus.

A "forma minor in alpibus maritimis Liguriæ occiduæ," received by me from Prof. De Notaris, seems referable here.

c. *denudata*, Turn. & Borr. Edges of the thallus almost naked.

Umbilicaria crinita, Hoffm. Pl. Lich. 2. 67. t. 44. f. 7.
Gyrophora proboscidea, γ. *denudata*, Turn. & Borr. Lich. Brit. 219.
Umbilicaria polymorpha, α. *cylindrica* C, Schær. Spicil. 88; Exs. 145! (not

characteristic, at least in my copy; but specimen! in herb. Borrer received from Schærer good).

Umbilicaria polymorpha, α. cylindrica, c. *nudiuscula,* Schær. Enum. 26.

Highlands of Scotland, *Turner and Borrer.* Summit of Glyder! Falcon Clints! Westmoreland Mountains! *Mr. Borrer.*

d. *exasperata,* Turn. & Borr. Thallus polyphyllous, ragged, rough on the upper side.

Gyrophora proboscidea, δ. exasperata, Turn. & Borr. Lich. Brit. 219.

County of Durham, *Mr. Robson.*

Remarkably curled and undulated, and divided into numerous small irregular laciniæ: upper surface remarkably rough.

I have seen no specimens, but this and *denudata* appear to be connecting links with *θ. deusta.*

PLATE X. fig. 16. Section of thallus and apothecium. Fig. 17. Ascus. Fig. 18. Sporidia.

2. *Umbilicaria pustulata,* Hoffm. Thallus thin, torn, and lobed, papillose and naked on both sides; upper side pale olive-green, blistered and sprinkled with fibrous glomeruli; under side brownish, deeply pitted: sporidia in asci, one or two, very large, oblong, pale, wrinkled or reticulated on the surface, 3-septate?

Lichen crustæ modo saxis adnascens, verrucosus, cinereus, et veluti deustus, Tourn. Instit. 549. (1719) (fide Turn. & Borr.); Vaill. Paris. 116. t. 20. f. 9.

Lichen pulmonarius saxatilis, inferne reticulatus, et lacunatus, superne cinereus, ac verrucosus; receptaculis florum et seminibus nigricantibus, et veluti deustus, Micheli, 89. t. 47 (1729).

Lichenoides pustulatum cinereum et veluti ambustum, Dill. 226. t. 30. f. 131 A. & B (1741); Fl. Dan. t. 597. f. 2 (fide Turn. & Borr.).

Lichen pustulatus, Linn. Sp. Pl. 2nd ed. 1617 (1763); Fl. Lapp. 359; Lightf. Fl. Scot. 2. 858; Robson, British Fl. 300; Huds. Fl. Angl. 549; Pottich. Palat. 3. 250; Web. Spicil. 261; Leers, Fl. Herborn. 265; Humb. Fl. Frib. 28; Retz. Scand. 287; With. Arr. 4. 64; Ach. Prodr. 146; Sm. E. Bot. t. 1283; Westr. 161, cum icone (fide Turn. & Borr.).

Umbilicaria pustulata, Hoffm. Pl. Lich. 2. 13. t. 28. f. 1, 2, & t. 29. f. 4 (1791); Schrad. Spicil. 102; DC. Fl. Franç. 3rd ed. 3. 411; Hook. Fl. Scot. pt. 2. 42; Brit. Fl. 2. 219; Stenh. in Sched. Crit. fasc. 5 & 6. no. 125; Fries, L. Reform. 350; S. V. S. 117; Chev. Fl. Paris. 1. 642.

—— *pustulata α,* Tuckerm. Syn. 70; Bohler, Lich. Brit. 125!; Schær. Enum. 25; Leight. Brit. Lich. Exs. 166; Koerber, Lich. Germ. 93; Nyl. Nouv. Class. in Cherb. Mém. 3. 175.

Lecidea pustulata, Ach. Meth. 85 (1803); Schær. Spicil. 106. 190; Exs. 156!

Gyrophora pustulata, Ach. L. Univ. 226 (1810); Syn. 66; Moug. & Nestl. Stirp. Vosges. 60!; Turn. & Borr. Lich. Brit. 232; Purton, Midl. Fl. 2. 598; Heppe, Fl. Wurzb. 71; Tayl. Fl. Hib. pt. 2. 155; Spruce's Lich. Pyren.!

Gyromium pustulatum, Wahl. Fl. Upsal. 424 (1820); Fl. Suec. 858.
Graphis pustulata, Wallr. Crypt. Germ. 345 (1831).
Lasallia pustulata, Merat, Paris. 202 (183); Massal. Mem. 118.
Macrodictya pustulata, Massal. Ricerch. 59. fig. 109 (1852).

On rocks and stones in mountainous districts. By the road from Pennorvay to Dolbelmen, and under Keven Lees Castle, *Dillenius*. Malvern Hills, *Stokes*. Old wall, about half way between Caernarvon and Beddgelart, *Rev. H. Davies*. Near Biddiston Lighthouse, Cheshire, *Mr. Bradbury*. Near Halifax, *Mr. Bolton*. Nant Hevynant Vale, near Snowdon, *Turner and Borrer*. Near Bantry, Ireland (fruit), *Miss Hutchins*. Ireland, *Dr. Taylor*. Highland mountains of Scotland, *Lightfoot*. Dartmoor! Devonshire (fruit), *Sir W. J. Hooker*. Hey Tor! Moel Hebog! Loch Sligachan, *Mr. Borrer*. North Wales, *Rev. T. Salwey*. Nesscliffe! Caer Caradoc! Shropshire.

"*Thallus* a single leaf, attached to the rock by a thick, callous, central disk, orbicular in its youngest state, but afterwards varying from orbicular to elliptical, or sometimes quite irregular in its form, from 1 to 8 or 10 inches in diameter; flat, except at the edges, where it is elevated, cleft at first into a few, shallow, rounded lobes, which, as the plant grows older, deepen and become torn, so as to be entirely shapeless: *upper surface* pale dull olive-green when moist; whitish ash-colour, with more or less of a brownish or sometimes of a glaucous tinge, when dry, and, then particularly, palest at the centre; uneven in every part, except sometimes for a very small space round the centre, with pustular elevations of the whole substance of the thallus, of an elliptical figure, and varying in size from that of hempseed to that of turnip-seed, large and small being mixed together without any order, though they generally decrease in size towards the edges of the thallus; the whole surface, as well of the pustules as of the interstices, is rough with minute granulations (bearing no slight resemblance, in miniature, to those on the surface of *Lycoperdon Proteus*), which are most evident at the centre, and scarcely observable in any other part by the naked eye, and produces also scattered clusters of black branching fibres, most numerous towards the border, where they often become confluent; similar fibres generally lining the edges of any cavities in the thallus, and sometimes that of the whole thallus itself (as represented in the upper fig. in E. Bot.), with a beautiful black continuous fringe: *under surface* brownish olive-green when wet; when dry, varying from dark brown to ash-colour, and generally slightly pruinose, naked, minutely granulated and full of cavities, exactly corresponding with the pustules of the upper surface, which in some specimens are so numerous, that the under surface has at first sight the appearance of a

coarse network; the interior of the cavities black, and rather more minutely granulated than the other parts: *substance* coriaceous, thin, very flexible when wet, but exceedingly brittle when dry. *Tricæ* of extremely rare occurrence, scattered among the tufts of flocculi, principally towards the edges of the thallus; patelliform, sessile, yet slightly elevated, urceolate when young, afterwards subturbinate, orbicular, their largest size about equal to that of rape-seed; their *margin* at first raised, thick, often very rugged and even flocculose, sometimes entire or only waved, gradually becoming narrower, and at length obliterated, as the *disk*, which in the young fruit is concave, becomes flat, and at last slightly convex. This part is, in all its stages, opake, and of an uneven appearance, when observed with a glass; in old convex tricæ it is occasionally rugged with irregular warts, usually depressed at the centre, and approaching more or less nearly to the appearance of imperfect *gyri*. These warts in our specimens do not assume a concentric arrangement, but are either scattered singly or clustered into little groups."—*Lich. Brit.* *Sporidia* one or two in each ascus, of a very large size, oblong, pale, and wrinkled with network, without apparent septa, though not unfrequently three darker lines may be seen like horizontal septa*.

It would seem that the external darker portion of the cortical layer of the apothecium frequently developes into minute, branched, thick, fleshy fibres, which increase into the tufts or flocculi above mentioned.

Specimens in my own herbarium from Upsal, collected by Fries fil. and Dr. Nylander; from Italy, Prof. De Notaris; from Aste, M. Philippe; from S. de Amoreira, Estremadura, S. de Cintra, and S. de Gerez, Nos. 21, 32 & 107 of Dr. Fr. Welwitsch's 'Cryptotheca Lusitana,' are in all respects identical with our British plant.

Mr. Menzies' specimen from the Cape of Good Hope! in herb. Borrer, mentioned in Lich. Brit. 234, is smoother and less granulated on both surfaces, tinged of an ochrey-red; the apothecia very numerous, much more sessile, their margins entire or irregularly waved and undulated, but not at all fibrous. Sporidia similar to those of British specimens. A specimen in my own herbarium received from Prof. De Notaris, collected by Zeyher at the Cape of Good Hope, and labelled "*Lasallia* (Gyrophora, *Eschw.*) *porphyrea*, De Not.," appears identical with Mr. Menzies' in structure and sporidia. The thallus when wetted becomes of a vivid scarlet hue.

Of the two specimens of *G. Pennsylvanica* in herb. Borrer!

* For the spermagonia see Tulasne, *l. c.*

mentioned in the note, Lich. Brit. 235, as received from Mrs. Merry, the under surface of one was very finely and less conspicuously granulated, whilst that of the other was very coarsely granulated, but not more so than is observable in Devonshire specimens! of *U. pustulata* in the same herbarium. The upper surface was smoother and browner, though still with the pale yellow tinge; the pustules less numerous and rounder, but still variable. The apothecia were sessile, either simple or gyrate from compression and aggregation. The sporidia in both are identical with those of our *U. pustulata*, of which we cannot but regard them as varieties or states.

Specimens of *U. Pennsylvanica*! and of *U. pustulata* β. *papulosa*! from North America, from Mr. Tuckerman, in herb. Borrer, had sporidia identical with our *U. pustulata*.

Fée describes the sporidia of *U. pustulata* as elliptical, 4-celled.

PLATE X. fig. 19. Section of thallus and apothecium, younger state. Fig. 20. Section of ditto, older state. Fig. 21. Sporidium.

EXPLANATION OF PLATE X.

Fig. 1. Section of thallus and apothecium of *Umbilicaria pustulata*, Hoffm., from Tulasne.
Fig. 2. *Umbilicaria polyphylla*, Schrad.: sporidia.
Fig. 3. *Umbilicaria anthracina*, Ach. & Schær. Exs. 154: *a*, ascus and paraphyses; *b*, sporidia.
Fig. 4. Sporidia of *Umbilicaria flocculosa*, Hoffm.
Fig. 5. Sporidia of *Umbilicaria ænea*, β. *hyperborea*, Schær. Exs. 150.
Fig. 5*a*. 1. Section of thallus and apothecia of *Umbilicaria ænea*, β. *hyperborea*, Schær. Exs. 151. 2. Sporidia.
Fig. 6. Sporidia of *U. arctica*, Ach. Specimen from Mr. Robson.
Fig. 7. Sporidia of *U. erosa*, Hoffm.
Fig. 8. Section of thallus and apothecium of *U. erosa*, Hoffm.
Fig. 9. Sporidia of *U. Muhlenbergii*, var. *alpina*, from Mr. Tuckerman.
Fig. 10. Sporidia of *U. erosa*, from Mr. Tuckerman.
Fig. 11. Sporidia of *U. pellita*, DC.
Fig. 12. Sporidia of *U. vellea*, Ach., from himself, in herb. Borr.
Fig. 13. Sporidia of *U. depressa*, var. *hirsuta*, Schær. Exs. 137.
Fig. 14. Sporidia of *U. grisea*, Hoffm.
Fig. 15. Sporidia of *U. deusta*, Linn. and Turn. & Borr.
Fig. 16. Section of thallus and apothecium of *U. proboscidea*, DC.
Fig. 17. Ascus of *U. proboscidea*, DC.
Fig. 18. Sporidia of *U. proboscidea*, DC.
Fig. 19. Section of thallus and apothecium of *U. pustulata*, Hoffm., in a young state.
Fig. 20. Section of same in a mature state.
Fig. 21. Sporidium of *U. pustulata*, Hoffm.

The sporidia are all equally magnified, and therefore in relative proportion.