Current status of the genus *Leptorhaphis* in the British Isles

A detailed description of the genus *Leptorhaphis* is available in the extended edition of the *Lichens of Great Britain and Ireland* by Smith *et al.* (2009), based on the modern circumscription of the genus introduced by Aguirre-Hudson (1991). The genus is only facultatively lichenised, i.e. the thallus consists of fungal hyphae loosely associated to clusters of chlorococcoid - and more rarely - trentepohlioid algae. This can be confirmed in squash mounts and microscope sections of the ascomata. It is distinguished from similar perithecial microfungi with bitunicate asci, by the narrowly fusiform to filiform and arcuate, 1–3 septate, always colourless ascospores. Its current systematic placement in the family *Naetrocymbaceae* was first suggested by Harris (1995: 59), on the basis that *Arthopyrenia*, and therefore the *Arthopyreniaceae* as understood until then, contained two unrelated groups based on the morphology of the hamathecial filaments: i.e. pseudoparaphyses *versus* paraphysoids. Also, as a result of the proposal to typify *Arthopyrenia* with *A. analepta*, which was later rejected in favour of *A. cerasi* [see Proposal to Conserve and Reject names no. 933 in *Taxon* **48**: 807 (1999)], some species formerly in *Arthopyrenia* are now referred elsewhere; e.g. the ubiquitous and pioneer species on smooth bark *Naetrocymbe punctifomis*. *Leptorhaphis*, as with species of the genus *Naetrocymbe* possesses pseudoparaphyses, which according to Eriksson (1981) consist of cellular, richly branched filaments, with cells constricted at the septum. The filaments originate from the upper part of the hymenium and grow downwards, attaching themselves to the base of the ascomal cavity, and afterwards often become detached in the upper part. This type of development is difficult to interpret from squash mounts, but the almost moniliform appearance of the interthecial filaments is diagnostic.

Three species were included in *Leptorhaphis* by Smith *et al.* (2009): *L. atomaria*, usually found on poplars, *L. epidermidis*, the type of the genus, which is solely found on birch bark, and *L. maggiana*, known from branches and young (coppiced) trunks of hazel and chestnut trees. Photographs and illustrations of the species can be found in Aguirre-Hudson (1991) and Aguirre-Hudson *et al*. (2002), and a distribution map for *Leptorhaphis epidermidis* was published by Dobson (2011). Since, two other species have been found in Great Britain: *Leptorhaphis confertior* and *L. laricis*. With this contribution we provide further taxonomic information on these species, and an updated key to all the species of the genus found in the British Isles.

Leptorhaphis confertior was found on holly trees in the Isle of Skye during an IAL organised excursion, and was reported in this journal by Cannon & Aguirre-Hudson (2012) as the second known world record. The species was known previously only from material collected by the XIX century Norwegian lichenologist J.M. Norman in the Island of Florø, situated at 61 degrees latitude north off the coast of Norway. It is distinguished from the other species in the genus by its clustered

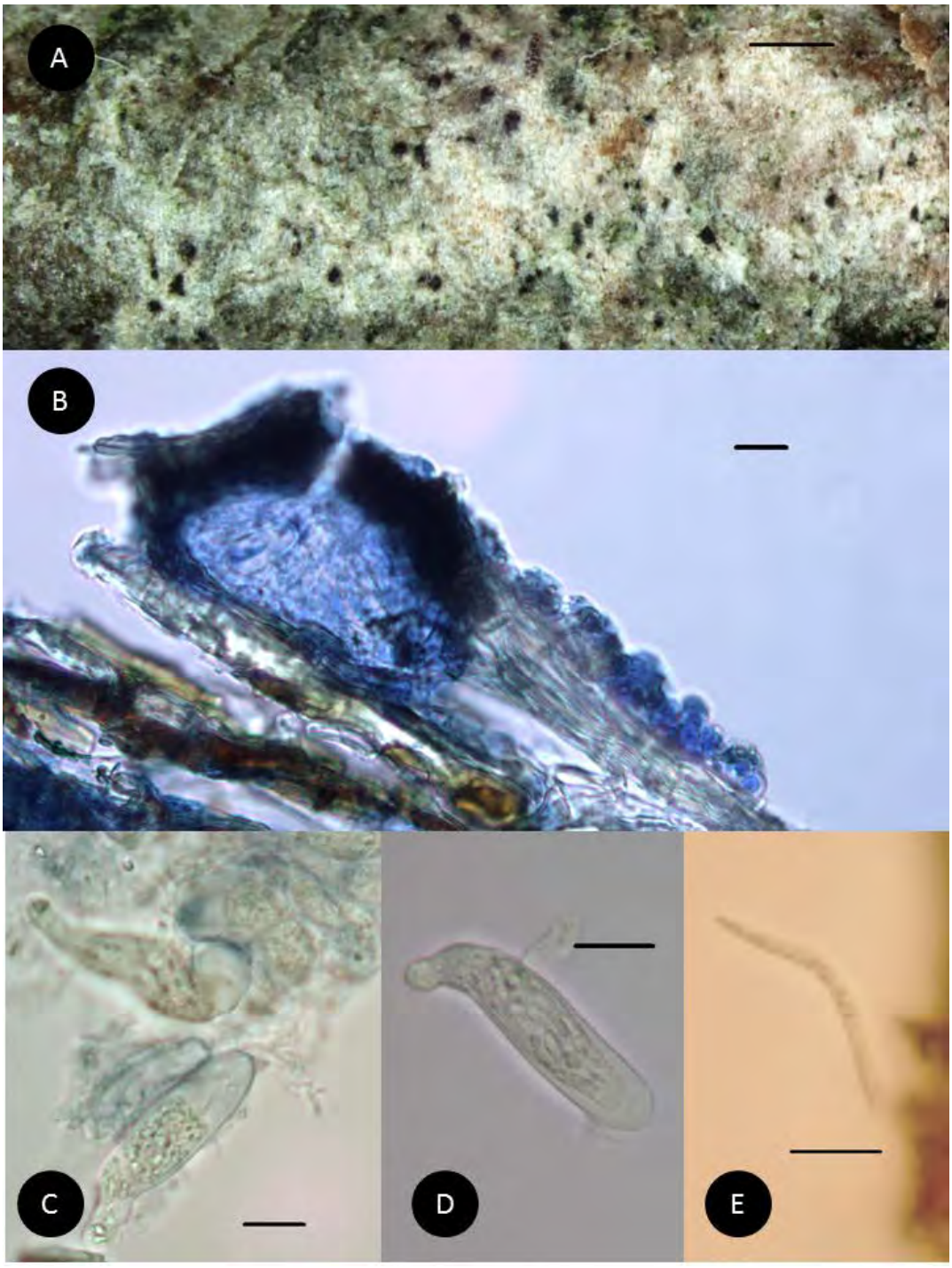
perithecia, and though inconspicuous, it is obviously very rare. A detailed description and further images of *L. confertior* can be found in Aguirre-Hudson (1991: 103–106); though in this monograph, the species was treated as a later synonym of *Leptorhaphis deformis* Norman, due to their microscopic similarities and lack of modern voucher material to confirm otherwise.

Amongst the British species of *Leptorhaphis*, *L. confertior* has relatively short ascospores, and is the sole one found on holly. As the perithecia group in irregular patches, superficially it might be confused with various arthonioid species on that host, but the presence of ostioles and the ascospore morphology are diagnostic.

British material of *Leptorhaphis laricis* was first found in the county of Essex in 2014 growing on the bark of twigs and branches of cedars, cultivated in parks and public spaces. A year later the species was found associated with the same conifer hosts and habitat in three further counties of southern England (Somerset, Suffolk and Surrey; see the section of New, Rare and Interesting Lichens of this *Bulletin*). In continental Europe it is known from *Larix* - the type, but also from deciduous trees and shrubs; e.g. birch, ash and *Genista* species (Aguirre-Hudson 1991, Aguirre-Hudson *et al*. 2005). A detailed description of this species follows:

Thallus not well delimited, immersed, visible only under the compound microscope as a thin fungal layer with hyphae occasionally associated with chlorococcoid and/or *Trentepohlia* algae around the ascomata. *Ascomata* perithecial, 100–150 (–200) µm diam., mostly circular, well delimited and arising singly, semi-immersed in the substratum with a central ostiole situated in a small depression; dimidiate (flattened) in section, up to 65 µm tall. *Involucrellum* clypeate, dark brown, almost black in water mounts, remaining unchanged after adding K, and not extending into the thallus to form a basal fringe; composed of *textura epidermoidea-intricata*, becoming *globulosa* towards the ostiole. *True exciple* colourless, consisting of a few layers of isodiametric cells forming a pseudoparenchymatous tissue and continuing below the ascoma. *Hamathecium* consisting of richly branched and cellular pseudoparaphyses *ca* 1.5 µm in diam. Hymenial gelatine blueish after IKI (check the Lugol solution is fresh by testing it first on a piece of tissue; it should change to blue not brownish). *Asci* (30–) 35–50 (–55) x 9–12 µm, cylindrical to broadly clavate, geniculate at the base, mostly 8-spored, and releasing the spores asynchronously; functionally bitunicate, the endotunica with a broad and truncated apex. *Ascospores* (27–) 34–40 x 1.5–2.5 µm, arranged in a single fascicle in the ascus, slightly twisted, narrowly fusiform, arcuate to sigmoidal, 1-septate, not constricted at the septum, apices pointed, cells ± equal, cell wall smooth, without a mucilaginous sheath. *Conidiomata* not observed.

Fig.1 (next page). *Leptorhaphis laricis*. (A) General view of ascomata and 'thallus' on substrate. (B) Cross section of ascoma showing a clypeate involucrellum and a 'thallus' consisting of hyphae with clusters of algae. (C) Hymenial gel bluish in Lugol's iodine. (D) Ascus. (E) Ascospore. (scale bar for A = 500 µm; for B, C, D & E = 20 µm).


A
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E

Key to the species of *Leptorhaphis* found in the British Isles

1. Perithecia circular, sometimes confluent, less than 300 µm diam.; if surrounded by a dark basal fringe, this is less than 50 µm wide; hymenial gel and hosts various ……..….**2**
Perithecia ellipsoidal, 300–525 µm diam., surrounded by a distinct dark basal fringe (about 50–75 µm wide), remaining as a distinct scar once the ascomata fall; hymenial gel unchanged, at most amber in Lugol's iodine; always on birch ……..…… ***Leptorhaphis epidermidis***

2. Perithecia arising singly; hymenial gel in Lugol's iodine various; ascospores 1 to 3 septate, but always > 25 µm long ……..……**3**
Perithecia confluent, 140-200 µm diam.; hymenial gel blueish in Lugol's iodine; ascospores 1-septate, 15–20 (–25) x 1.5–2 µm; on holly.... ***Leptorhaphis confertior***

3. Hymenial gel blueish in iodine ……..…….. **4**
Hymenial gel not changing colour in Lugol's iodine, at most amber; perithecia spherical to slightly ellipsoidal, 135–300 µm diam.; involucrellum of *textura epidermoidea-intricata*; ascospores 1–3 septate, (30–) 35 – 45 (–50) x 1.5 – 2.5 µm; on hazel & chestnut ..……..…….. ***Leptorhaphis maggiana***

4. Thallus whitish-grey; perithecia sessile 100–250 µm diam.; involucrellum mostly non-clypeate, of *textura globulosa*, becoming *epidermoidea-intricata* only at the base; ascospores 1–3 septate, 25–32 x 2–3.5 µm, with rounded apices; on poplars …….. ***Leptorhaphis atomaria***
Thallus inconspicuous; perithecia semi-immersed, 100–150 (–200) µm diam.; involucrellum clypeate, of *textura epidermoidea-intricata*; ascospores 1-septate, 30–40 x 1.5–2.5 µm, with pointed apices; on conifer bark, mostly larch & cedars ……..... ***Leptorhaphis laricis***

References

Aguirre-Hudson, B. (1991). A taxonomic study of the species referred to the ascomycete genus *Leptorhaphis*. *Bulletin of the British Museum (Natural History), Botany* **21**(2): 85–192.

Aguirre-Hudson, B., Farkas, E. & Lökös, L. (2002). Pyrenolichens of the Hungarian lichen flora I: The genus *Leptorhaphis* Körber. *In:* Llimona, X., Lumbsch, H.T., & S. Ott (eds) *Progress and Problems in Lichenology at the Turn of the Millenium. Bibliotheca Lichenologica* **82**: 3–18. J. Cramer, Berlin, Stuttgart.

Aguirre-Hudson, B., Farkas, E. & Lökös, L. (2005). New records of *Leptorhaphis* and other ascomycete genera from the Carpathian basin (Europe). *Herzogia* **18**: 47–50.

Cannon, P.F. & Aguirre-Hudson, M.B. (2012). New, rare and interesting lichens. *British Lichen Society Bulletin* **110**: 65.

Dobson, F.S. (2011). *Lichens. An Illustrated Guide to the British and Irish species*. The Richmond Publishing Co. Ltd, Slough, England; 496 pp.
Eriksson, O. (1981). The families of bitunicate ascomycetes. *Opera Botanica* **60**: 1–220
Harris, R.C. (1995). *More Florida Lichens, including the 10 ¢ tour of the pyrenolichens*. New York Botanical Garden, Bronx; 192 pp.
Norman, J.M. (1884). Nova genera et species lichenum florae norvegicae. *Öfvers. K. Svensk. Vetensk.-Akad. Förhandl.* **41**(8): 31– 42
Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & P. A. Wolseley (eds) (2009). *The Lichens of Great Britain and Ireland*. British Lichen Society, London; 1046 pp.

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Lichens on man-made substrates

It is well known that the surface of all materials exposed to the environment will, sooner or later, become colonized by different groups of living organisms. The extent of colonization will depend on the environmental conditions and on the characteristics of the substratum. Lichens are well adapted to colonize bare and stable surfaces in many climatic conditions, giving rise to a biological mosaic of colours and textures. In addition to natural substrata, these include a host of human-manipulated or manufactured ones (i.e. artifacts), including fashioned stonework, asphalt, glass, concrete, cement, plaster, ceramic and terracotta tiles, bricks, processed wood products, and various types of metals (Brightman & Seaward 1977).

Peculiarities and colonization of lichens

Growth on external surfaces, whether natural or man-made, presents challenges especially of water availability. Owing to their poikilohydric nature lichens can survive in various climatic conditions. Many lichens have limited mechanisms to prevent desiccation; they dehydrate and remain dormant when their environment dries out, but can rehydrate when water becomes available again. Lichens usually absorb water directly into the thallus through aerosol, mist and water vapors, due to this nature lichens can live long in dry areas.

Lichens are well known natural sensors of changing environment and the presence or absence of particular species and the composition of communities may be indicative of one or more identifiable factors. Lichens can be used as an early warning system for other biota which without remedial action would subsequently