

## ***Lichenophoma haematommatis*, a previously overlooked European soorediate species of *Cliostomum* (Lecanorales, Ramalinaceae)**

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**Abstract:** HAWKSWORTH, D. L., EARLAND-BENNETT, P. M. & COPPINS, B. J. 2006. *Lichenophoma haematommatis*, a previously overlooked soorediate species of *Cliostomum* (Lecanorales, Ramalinaceae). – *Herzogia* 19: 5–10.

Collections and drawings of *Lichenophoma haematommatis*, originally described as a lichenicolous fungus on *Loxospora elatinum* in Austria by Keissler, have been located and re-examined. The material does not represent a lichenicolous fungus but the pycnidial state of a lichen. In the absence of the holotype, Keissler's name is neotypified based on one of his later collections from a site 6–8 km from the original locality. It proved to have been based on the pycnidial state of a soorediate *Cliostomum* species, distinct from the two soorediate species of the genus known in Europe in a combination of pycnidial characters and extrolites (secondary metabolites). The new combination *Cliostomum haematommatis* comb. nov. is therefore made for this taxon. The identity of two other species referred to *Lichenophoma* is also discussed. In addition, the lichenicolous fungus *Intralichen lichenum* is also reported from *C. haematommatis*, discolouring the thallus, and is the first published report of that fungus from Austria.

**Zusammenfassung:** HAWKSWORTH, D. L., EARLAND-BENNETT, P. M. & COPPINS, B. J. 2006. *Lichenophoma haematommatis*, eine bisher übersehene soorediöse Art der Gattung *Cliostomum* (Lecanorales, Ramalinaceae). – *Herzogia* 19: 5–10.

Belege und Zeichnungen von *Lichenophoma haematommatis*, ursprünglich als lichenicoler Pilz auf *Loxospora elatinum* von Keissler aus Österreich beschrieben, wurden gefunden und nachuntersucht. Das Material ist kein lichenicoler Pilz sondern eine Flechte mit Pyknidien. Da ein Holotypus fehlt, wird Keissler's Name neotypifiziert mit einer seiner späteren Aufsammlungen von einem Fundort, der 6–8 km von der Holotypuslokalität entfernt ist. Es hat sich herausgestellt, dass eine soorediöse Art der Gattung *Cliostomum* mit Pyknidien vorliegt, die von den zwei in Europa bekannten soorediösen Arten der Gattung durch die Pyknidienmerkmale und die sekundären Flechtenstoffe unterschieden ist. Die neue Kombination *Cliostomum haematommatis* comb. nov. wird daher für dieses Taxon eingeführt. Die Identität von zwei anderen Arten der Gattung *Lichenophoma* wird ebenfalls diskutiert. Zusätzlich wird der lichenicole Pilz *Intralichen lichenum* von *C. haematommatis* gemeldet, der den Thallus verfärbt und der erste publizierte Fund aus Österreich ist.

**Key words:** Austria, coelomycetes, *Intralichen*, lichenicolous fungi, lichens, *Loxospora*.

### **Introduction**

The application of the generic name *Lichenophoma*, introduced by KEISSLER (1911) for a presumed lichenicolous coelomycete with paraphysate conidiomata growing on a lichen named as "*Haematomma elatinum*", has been an enigma in the general coelomycete as well lichenicolous lichen literature. The fungus, named *L. haematommatis*, was so unusual that SUTTON (1977: 114) remarked that the "structure of the wall, conidiogenesis, and relationship of the pseudoparaphyses to the conidiophores need to be clarified before the genus can be

placed with any degree of confidence". When HAWKSWORTH (1981) surveyed the then known lichenicolous coelomycetes, the original material could not be relocated in W so the genus was treated only under "Excluded species". However, the mycological (including lichen) collections in W were subsequently re-organized and re-curated, and during a visit of the first author to the herbarium during the 17<sup>th</sup> International Botanical Congress in Vienna on 16 July 2005, a folder containing three collections under the name *L. haematommatis* and Keissler's original drawings was located.

The examination of Keissler's material showed that the name was based not on a lichenicolous fungus but on a lichenized and previously overlooked sorediate species of *Cliostomum*.

## Taxonomy

*Cliostomum* Fr., Syst. Orb. Veg.: 116 (1825).

Type species: *C. corrugatum* (Ach.) Fr. (syn. *Lecidea corrugata* Ach.).

= *Lichenophoma* Keissler, Hedwigia 50: 296 (1911).

Type species: *Lichenophoma haematommatis* Keissler.

*Cliostomum haematommatis* (Keissler) D.Hawksw., Earl.-Benn. & Coppins **comb. nov.**

Mycobank No. MB 500767

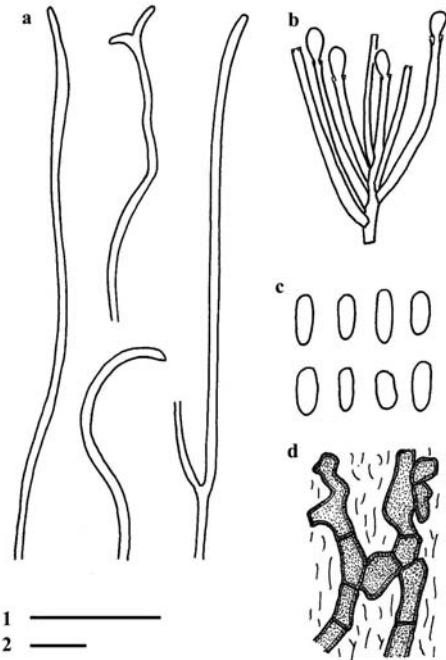
≡ *Lichenophoma haematommatis* Keissler, Hedwigia 50: 296 (1911). [Basionym.]

Type: **Austria**: Steiermark: Johnsbach, ca. 700 m [as "auf leprösen Thallus v. *Haematomma elatinum*"], July 1911, K. von Keissler (W 1912/87 – **neotypus hic designatus**).

**Description:** Thallus crustose, thin, smooth-areolate to somewhat warted, pale grey to bluish grey. Soralia arising as irregular powdery patches that can coalesce in parts, eventually covering almost the entire thallus so that it appears almost leprose. Soredia granular yellowish to pale yellow-green, c. 15–30 µm. Ascomata unknown. Conidiomata pycnidial, mainly arising singly in non-sorediate areas of the thallus, semi-immersed, with the upper half to one quarter visible above the surface of the thallus, black, matt, depressed-globose, not apiculate apically, ostiolate, mainly 80–225 µm diam in surface view; the ostiole circular, c. 20 µm wide, often appearing as a whitish cream spot. Conidiomatal wall dark brown, *textura intricata*, composed of 2–3 layers of intertwined thick-walled brown to dark brown hyphae, K+ intensifying purplish brown, the hyphae irregular in thickness, mainly 3–6(–7) µm wide, short-celled, smooth, immersed in a mucilaginous gel, friable and readily disintegrating on squashing or sectioning. Paraphyses packing the conidiomatal cavity, ± vertically orientated, hyaline, non-septate, filiform to snake-like, sparsely branched, and some with arcuate apices, densely intertwined, (30–)50–75(–80 or more) µm in length and 0.5–1.5(–2) µm wide. Conidiogenous cells arising in almost fasciculate clusters, elongate-cylindrical, hyaline, 12–15(–18) × 1.5–2 µm, with a minute apical collar, conidiogenesis enteroblastic. Conidia arising singly, not forming chains, narrowly ellipsoid, hyaline, non-septate, smooth, 3–5 × 1.5–2 µm. Thallus K+ yellow to yellowish brown, C–, KC–, PD–.

**Chemistry:** Examination of the neotype material by TLC, according to the methods in ORANGE et al. (2001), using solvent systems A and G, revealed the presence of atranorin and an unidentified compound with Rf values of 48.5 (solvent A) and 67 (solvent G). Compounds of a similar colour that give similar Rf values to the unknown include barbatic, confluent, perlatolic, and stenosporic acids. Whether the unidentified substance is one of these requires more critical chemical study, which the sparse material precluded our undertaking in this investigation.

**Fig. 1:** *Cliostomum haematommatis*. **a** – Paraphyses which arise amongst the conidiogenous cells. **b** – Fascicle of conidiogenous cells. **c** – Conidia. **d** – Surface of conidioma showing the dark swollen hyphae immersed in a gelatinous matrix. **a**, **b** and **c** drawn from W 1911/87 (neotype) and **d** drawn from W 1911/69. Scale bars = 10 µm (1 refers to **a**–**c**; 2 refers to **d**).



**Illustrations:** HAWKSWORTH (1981: 77, fig. 35A–B – reproduced from KEISSLER 1911), KEISSLER (1911: 297, fig. 2 a–b – original drawing W 1911/1366), and KEISSLER (1930: 587 fig. 113 – original drawing W 1930/138; 588 fig. 114 – original drawing W 1930/139).

**Ecology:** On mainly smooth bark of deciduous trees. The thallus of W 1912/87 is infected with *Intralichen lichenum* which was not cited from Austria by HAWKSWORTH & COLE (2002), and appears to be a first report for the country.

**Distribution:** This species is currently known only from Austria, from which it was reported from a second locality in Steiermark by KEISSLER (1913). It was also cited from France by KEISSLER (1930: 588, 1933: 390) “An sterilem Thallus auf *Quercus*”, but the specimen on which that record was based was located in W (**France**, Oise: Fôret de Compiègne, au Mont St Marc, [Nov. 1923], Abbé E. Cottureau, W 1925/10 416) and found to represent the pycnidial state of *Cliostomum griffithii*, which has similar sized pycnidia, and a thallus which is K+ yellow, but lacks soredia and has more intensely K+ purple conidiomatal walls.

**Typification:** The original locality for *Lichenophoma haematommatis* was given as: “In thallo leproso *Haematommatis elatini* Mass. in valle flumina ‘Enns’, dicto ‘Gesäuse’, ad Gesäuse-Eingang, ca. 600 m. s. m., mense Julio 1910 leg. C. de Keißler [Herb. Mus. Palat. Vindob.]”. This collection is no longer present in W, where the original drawings used in the 1911 publication are preserved (W 1911/1366), but there are three later collections annotated by Keissler, two from Austria and one from France. The two Austrian collections were both made in July 1911 at Johnsbach, about 6–8 km south-east of the original locality, Gesäuse-Eingang. From the altitudinal data given by KEISSLER (1913), the Johnsbach site was probably just north of the “Bergsteigerfriedhof”, a cemetery for climbers. Keissler had a “?” on one collection (W 1912/69), while the other (W 1911/87) has a preserved slide and is probably that on which the drawings in KEISSLER (1930: 587–588) were based (and which are also preserved as W 1930/138 and 139). As the French specimen belongs to a different non-sorediate species (*Cliostomum griffithii*) and the soredia were a key feature of what Keissler perceived to be the host lichen and were well-illustrated in his 1930 publication, we select W 1911/87 as neotype for his name here.

**Additional specimen examined:** **Austria**, Steiermark: Johnsbach (Gesäuse), [as “auf lep-rösen Thallus von *Haematomma elatinum*”], July 1911, K. von Keissler (W 1912/69).

## Discussion

When examining Keissler's material, we first considered the identity of the "host" of the presumed lichenicolous fungus, but could find no satisfactory name for the sorediate crust on two of the specimens, while the third was non-sorediate *Cliostomum griffithii*. The sorediate patches most strongly recall the always sterile *Lecanora compallens*, but the soredia in that species are generally more greenish in colour and it contains usnic acid and zeorin (VAN HERK & APTROOT 1999). Keissler's confusion with the species now called *Loxospora elatinum* is understandable as there are some superficial similarities, although the chemical reactions are quite different (the thallus and soredia of *L. elatinum* are K+ bright yellow, C-, and PD+ yellow to orange). On examining the pycnidia, we were struck by the presence of the sterile filaments which had been figured by KEISSLER (1911, 1930); the term adopted for such a filament by SUTTON (1980: 644) is "paraphysis", defined as a "sterile hypha which is free at the apex; often produced amongst fertile conidiophores or conidiogenous cells". Such paraphyses are extremely rare amongst coelomycetous fungi, and almost all genera with them have dark brown conidia. However, VOUAUX (1914: 285) had noted the similarity of *Lichenophoma* to the descriptions and illustrations of the species now called *Cliostomum griffithii* made by LINDSAY (1872: 263, pl. 12 figs 37–42). We therefore examined that work and found that his illustrations of the pycnidia of that species and also that now called *C. corrugatum* (loc. cit.: figs 26–27) were almost identical to those of Keissler – the only major difference being that Lindsay did not illustrate a section of the conidioma or its wall structure. Indeed, we found the conidiomatal wall so friable that even using a freezing microtome we were unable to obtain satisfactory sections to present here.

Further, the conidiomata in all three of Keissler's collections are distributed evenly over the thalli with no indications of them causing any damage; where localized discolorations did occur in the specimens they proved to be associated with separate infections of *Intralichen lichenum*. That one of Keissler's specimens was clearly pycnidial *C. griffithii*, and the others a sorediate taxon with similar conidiomatal features forced us to conclude that this species was also actually a sorediate *Cliostomum*. We therefore make the formal transfer of Keissler's epithet into *Cliostomum* here.

We recognize *C. haematommatis* as a distinct species in the genus on the basis of three features: the size of the conidiomata and conidia, the presence of soredia, and the different extrolite chemistry. *Cliostomum corrugatum* has pycnidia 200–500 µm diam and produces atranorin in the thallus and usnic acid in the ascomata, while *C. griffithii* has pycnidia 100–200 µm diam and produces atranorin and roccellic acid (FOX 1992: 214). Neither *C. corrugatum* nor *C. griffithii* are sorediate. The possibility that *C. haematommatis* might be some sorediate lichen overgrowing *C. griffithii* was dismissed as no roccellic acid was found in the material.

Two other sorediate species have previously been recognized in the genus: *C. flavidulum* (HAFELLNER & KALB 1992: 61) which contains atranorin and fumarprotocetraric acid along with traces of protocetraric acid, and further also the fatty acids roccellic and caperatic acids (EKMAN 1997). That species usually occurs on old deciduous trees and is known from Europe, Madeira, the Pacific Northwest, and Tasmania (SANDERSON 2006). The second sorediate species is *C. leprosum* which generally also has apothecia and pycnidia to 400(–600) µm diam with conidia only (2–)2.5–3 × 1.5–2 µm and contains atranorin and caperatic acid in the thallus and usnic acid in the apothecia (TØNSBERG 1992: 131–132). *C. leprosum* therefore seems closest to *C. corrugatum* with which it shares the large pycnidia and usnic acid-containing apo-

thecia; it occurs on mature trunks of conifers in Fennoscandia, Canada, and the UK (EKMAN 1997, HITCH 2005).

Two additional species have been referred to *Lichenophoma*, but neither seem to be congeneric with *Cliostomum*. VOUAUX (1914: 285) described *L. opegraphae*, of which no original or other material has been located, and stated it had a network of septate (not non-septate as in *Cliostomum*) filaments and simple often unequal-sided conidia  $3.5\text{--}5 \times 1.5\text{--}2 \mu\text{m}$ . HAWKSWORTH (1981: 78) suggested Vouaux's name might be based on the microconidial stage of an *Opegrapha* species; this could well be *O. rufescens*. The second is *L. arecae* which was described and figured from lesions on the leaves of the betel-nut palm *Areca catechu* in Taiwan by SAWADA (1959: 127, pl. 11 figs 34–37), but not validly published (Art. 36.1). Sawada's fungus formed necrotic patches with dark brown margins on the leaves, the paraphyses were straight, rigid and not flexuose, dichotomously branched and septate, the conidiogenous cells ampulliform and somewhat pointed, and the conidia fusiform. His fungus requires restudy, but was evidently a plant pathogen, not lichenized, and quite unrelated to *Cliostomum*.

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