

# The species of *Hemigrapha* (lichenicolous Ascomycetes, Dothideales) on Peltigerales

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The species of *Hemigrapha* (lichenicolous Ascomycetes, Dothideales) growing on Peltigerales are revised. *H. atlantica* sp. nov., on the cyanobacterial morph of *Sticta canariensis* from the Azores and the British Isles, *H. nephromatis* sp. nov., on *Nephroma australe* from Tasmania and New Zealand, and *H. pseudocyphellariae* sp. nov., on *Pseudocyphellaria* from Papua New Guinea are described and compared with the type species, *H. asteriscus*, which grows on species of *Peltigera* in the southern hemisphere and in Europe. *Hemigrapha* is shown to belong to the Microthyriaceae (Dothideales). Pycnothyrial anamorphs, morphologically identical to the thyrithoecea, with hyaline, non-septate microconidia and/or macroconidia, and conidiogenous cells arising from the upper conidiomatal wall, are known in *H. asteriscus*, *H. atlantica* and *H. pseudocyphellariae*. A key is given for the species of *Hemigrapha* on Peltigerales.

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## Introduction

*Hemigrapha*, a genus of lichenicolous ascomycetes, has received surprisingly little attention, although the species growing on macrolichens are quite eye-catching, commonly producing abundant black star-shaped ascocmata on the upper cortex of the host. Several species seem to be distributed in the Southern Hemisphere, and some are quite common there, although obviously very overlooked.

*Hemigrapha* was originally described as a section of the genus *Melanographa* by Müller [Argoviensis] (1882) who included here three species with lirelliform, black 'perithecia', without a continuous wall under the hymenium. Later Müller added *Melanographa tenellula*, lichenicolous on *Porina epiphylla* (Fée) Fée, to the section (Müller 1883). Müller (1887) moved the section *Hemigrapha* to the genus *Melaspilea*, and later Keissler

(1933) transferred the non-lichenized *Melaspilea* species to *Mycomelaspilea* Reinke.

Santesson (1952) mentioned *H. tenellula*, a combination not validly published in his work. Folan and Mitchell (1970) reported *H. asteriscus* as new to Ireland, a report shown here to refer to *H. atlantica* which is described below. The combination *H. asteriscus* was not validly published in the paper by Folan and Mitchell. Finally, *Hemigrapha* was raised to generic level by Hawksworth (1975), and the combination *H. asteriscus* (Müll. Arg.) D. Hawksw. was made.

Matzer (1996) provided a valuable and detailed description of the genus with an account of the species growing on foliicolous lichens, including the description of two new species. He also validated the combination *H. tenellula* (Müll. Arg.) Matzer.

The taxonomic position of the genus has not been settled. Eriksson & Hawksworth (1991) suggested that

it should be placed in the Hysteriaceae (Dothideales), although with a questionmark. No discussion on its position was given by Matzer (1996).

In the present work, we make a revision of the species of *Hemigrapha* growing on Peltigerales, with the description of several new species, and we discuss the taxonomic position of the genus. We did not study any foliicolous taxa, as they have been carefully described in Matzer's work.

## Material and methods

The specimens examined are located in the institutional herbaria AK, B, BM, E, G, HO, LG and UPS, or in the personal collections of A. Aptroot and P. Diederich.

Ascomata have been measured with a binocular dissecting microscope at a strong magnification ( $\times 40$  or  $80$ ). The microscopical examination was carried out using hand-made sections or by examining complete ascomata in water, lactic acid or lactophenol cotton blue, with or without phase contrast. All measurements have been undertaken at a magnification of  $\times 1250$ . The pigment of the ascomatal wall has been studied in water, in 5% KOH (K) and in concentrated nitric acid (N). The iodine reaction has been tested in Lugol's reagent (I), with or without pre-treatment with K. Drawings were carried out using a drawing tube. Macroscopic photographs of dry ascomata were done with a Zeiss Stereomikroskop DR (objectives of  $2\times$  or  $8\times$ ; ocular PH2.5 $\times$ ) using a Konica T3 camera; microscopic photographs were prepared with a Zeiss Photomikroskop (objectives of  $25\times$ ,  $40\times$  and  $100\times$ ).

## Results

### *Hemigrapha* (Müll. Arg.) D. Hawksw.

in D. Hawksw., Kew Bulletin 30: 191 (1975). - *Melanographa* sect. *Hemigrapha* Müll. Arg., Flora 65: 518 (1882). - Type species: *Hemigrapha asteriscus* (Müll. Arg.) Hawksw. (lectotype, selected by Santesson in Hawksworth 1975).

Lichenicolous ascomycetes. Ascomata thyriothecia, black, superficial, flat, roundish, stellate, elongate, simple or branched, sometimes confluent; upper ascomatal wall composed of one single layer of more or less parallel, radiating rows of dark brown, shortly rectangular cells, continuous above the hymenium; lower plate lacking, although the border between the host epicortex and the hymenium may become brownish; ostiole present, central, often inconspicuous, best visible while examining a whole ascoma by

microscope; ascomatal wall often breaking by irregular cracks around the ostiole, leaving the hymenium partly exposed; ascomatal wall dark reddish brown, K+ dark olivaceous brown, N-, pigment intracellular. Hymenium I-. Hamathecium of sparingly branched and occasionally anastomosed paraphysoids, which, in mature ascomata may become free at the top and tend to disappear almost completely when post-mature; periphysoid-like cells arising from the ascomatal wall in some specimens short and thick, 0(-1)-septate, possibly functioning as conidiogenous cells (see below). Asci clavate to subglobose, fissitunicate, wall apically thickened, normally with a distinct ocular chamber, laterally thin, I-, (2-)4-8 spored. Ascospores 1-3-septate, distinctly constricted at the septa (at least when mature), hyaline when young, becoming pale brownish when mature, smooth at first, but granular to distinctly verrucose when over-mature; perispore absent.

Conidiomata pycnothyria, macroscopically indistinguishable from thyriothecia with which they are often intermixed, with upper wall only; conidiophores absent. Conidiogenous cells arising from the conidiomatal wall, holoblastic, discrete, determinate, subspherical, ellipsoid to shortly ampulliform, simple or rarely 1-septate, hyaline, smooth, with no proliferations, conidia hyaline, aseptate, smooth, base truncate or not, ellipsoid, of two types: narrowly ellipsoid to rod-shaped microconidia, and larger, ellipsoid macroconidia.

*Observations.* The ascomata of *Hemigrapha* were often considered to be apothecioid or lirelloid, with an exposed hymenium, which justified an inclusion of the species in *Melaspilea*, and of the genus in the Hysteriaceae. A careful microscopical examination of entire ascomata revealed, however, that they are typical thyriothecia (Fig. 7), with only an upper wall (basal plate lacking) (Figs 4c, 5b), and that the ascospores are released through a well-defined ostiole (Figs 4c, e, 7). In older ascomata the wall around the ostiole sometimes disintegrates or breaks, leaving small portions of the hymenium exposed (Fig. 5b). In our opinion, it is inaccurate, however, to call the upper part of such an exposed hymenium 'epihymenium'. The lower part of the hymenium might be considered to represent a hypothecium (e.g. Matzer 1996), but as there is no clear differentiation between the fertile hymenium and the cells just above the epicortex of the host, we consider them as representing a subhymenium.

The hamathecium in *Hemigrapha* is composed of paraphysoids (Fig. 6), which tend to deliquesce at maturity (see generic description). Above the hymenium in some specimens, there are peculiar cells arising from the ascomatal wall and growing downwards (Fig. 5c), which we initially believed to represent periphysoids. They are hyaline, normally

aseptate, exceptionally one-septate, ampulliform to inversely conical, and relatively thick (2.5-5 µm). After the discovery of the conidiomatal morph in some species of *Hemigrapha*, we realized that these cells are similar to the conidiogenous cells in those conidiomata (Fig. 4d). Although we never found fructifications producing asci and conidia at the same time, we believe that these cells observed in ascomata represent conidiogenous cells which might have produced conidia at an earlier state of the ascomatal development. Further studies of additional material are needed, however, to confirm our hypothesis.

Macroscopically, the ascomatal wall frequently appears as radially striate, and it is along these radial lines that the wall preferentially breaks (e. g. in a microscopical preparation, when a slight pressure is applied to the cover glass). At the margin of the ascomatal wall, the portion situated between two such radial lines often grows more quickly than the cells adjacent to these lines, which explains the irregular growth of the ascomata (Fig. 7) and the tendency to become stellate (Fig. 4a-b).

Because of its thyrtothecial ascomata with radiating rows of cells, the hamathecium formed of paraphysoids, the fissitunicate asci not becoming blue in iodine and the mostly 1-septate ascospores, the genus *Hemigrapha* clearly belongs to the Microthyriaceae (Dothideales). The Vizellaceae differ by asci arranged radially around a central column, and non-septate ascospores; ascomata of the Chaetothyriaceae are covered with an often setose layer of dark brown hyphae; the ascomatal wall in the Micropeltidaceae is composed of one to several layers of pseudoparenchymatous cells, which are not arranged in radiating rows, and the ascospores are usually multiseptate; the ascomata in the Asterinaceae are also thyrtothecoid, but the ascus wall and/or the hymenium become blue in iodine, the mycelium is superficial, often hyphopodiate, and the species all grow on living leaves, especially in the tropics (Hawksworth et al. 1995). There is one additional genus of Microthyriaceae known to grow on lichens (and also on other substrata), the genus *Lichenopeltella* Höhn. A key to 24 lichenicolous species of *Lichenopeltella* has recently been published by Diederich in Aptroot et al. (1997). The genus *Lichenopeltella* differs from *Hemigrapha* by ascomata composed of an upper and a lower plate (catathecia), by more regular, roundish, never stellate, less flattened and almost conical ascomata, and by ciliate, hyaline, smooth ascospores. The species of *Hemigrapha* on Peltigerales all develop on the upper surface of the host thallus, whilst some species of *Lichenopeltella* (e. g. both species known on *Peltigera*) are confined to the lower surface of their host.

Conidiomata of *Hemigrapha* species are macroscopically indistinguishable from ascomata, and it is

only during microscopical examination that they are recognized. It is therefore impossible to affirm with certainty that a certain specimen is composed exclusively by one of these morphs. Interestingly, these conidiomata, the wall of which is identical to that of ascomata, are the first known example of a lichenicolous coelomycete with pycnothyria, and also amongst non-lichenicolous fungi, this kind of pycnidium is very rare and poorly studied.

Pycnothyria were first described by Hughes (1952: 7, 12, 13 and 1953: 7) in *Asterina* Lév. (Asterinaceae, Dothideales) as flattened pycnidia 'with radiate upper and lower walls'. Hawksworth et al. (1995: 106, 386) use this term also for pycnidia lacking the lower wall. Pycnothyrial conidiomata are known in the dothidealean families Asterinaceae (Hughes, loc. cit.) and Microthyriaceae (Hawksworth et al. 1995: 280), but they have hardly been studied. Sutton (1980: 166-169) deals with one single pycnothyrial genus, *Kabatia* Bub., some species of which are considered to be anamorphs of *Guignardia* Viala & Ravaz (Mycosphaerellaceae, Dothideales). Müller & von Arx (1962: 546) illustrate a pycnothyrium of *Stomiopeltis batistae* Arx (Micropeltidaceae, Dothideales), referred to the form genus *Myxothyriopsis* Bat. & A. F. Vital. Nag Raj (1993: 96-97, 935-940) describes and illustrates two genera of pycnothyrial coelomycetes with appendage-bearing conidia, *Abropelta* Sutton and *Tracylla* (Sacc.) Tassi, both with unknown teleomorphic states.

We have observed and studied conidiomata in *Hemigrapha asteriscus*, *H. atlantica* and *H. pseudocypbellariae*. In some specimens, they are intermixed with ascomata, indicating that they almost surely belong to the same fungus, but in at least two specimens (*H. asteriscus* from Switzerland and *H. atlantica* from the Azores), we observed only conidiomata. As the anamorph exists in nature without the holomorph, it might be considered as useful to create a new genus of coelomycetes to deal with such specimens. However, we prefer not to introduce additional new names for these conidial morphs, as their conidial characters, but also their host specificity, should in most cases allow a correct identification as a species of *Hemigrapha*.

In *H. asteriscus*, we observed a microconidial (Fig. 2a) and a macroconidial (Fig. 2b) anamorph, but in no specimen are both anamorphs present at the same time. A microconidial anamorph has also been observed in *H. atlantica*, and a macroconidial anamorph in *H. pseudocypbellariae* (Fig. 2c).

In addition to the species studied by us, which all develop on lichens belonging to the Peltigerales, Matzer (1996) studied and described three additional species of *Hemigrapha*, growing on foliicolous lichens, viz. *H. phaeospora* Matzer & Lücking on *Phylloporis phyllogena* (Müll. Arg.) Clem., *H. strigulae* Matzer on species

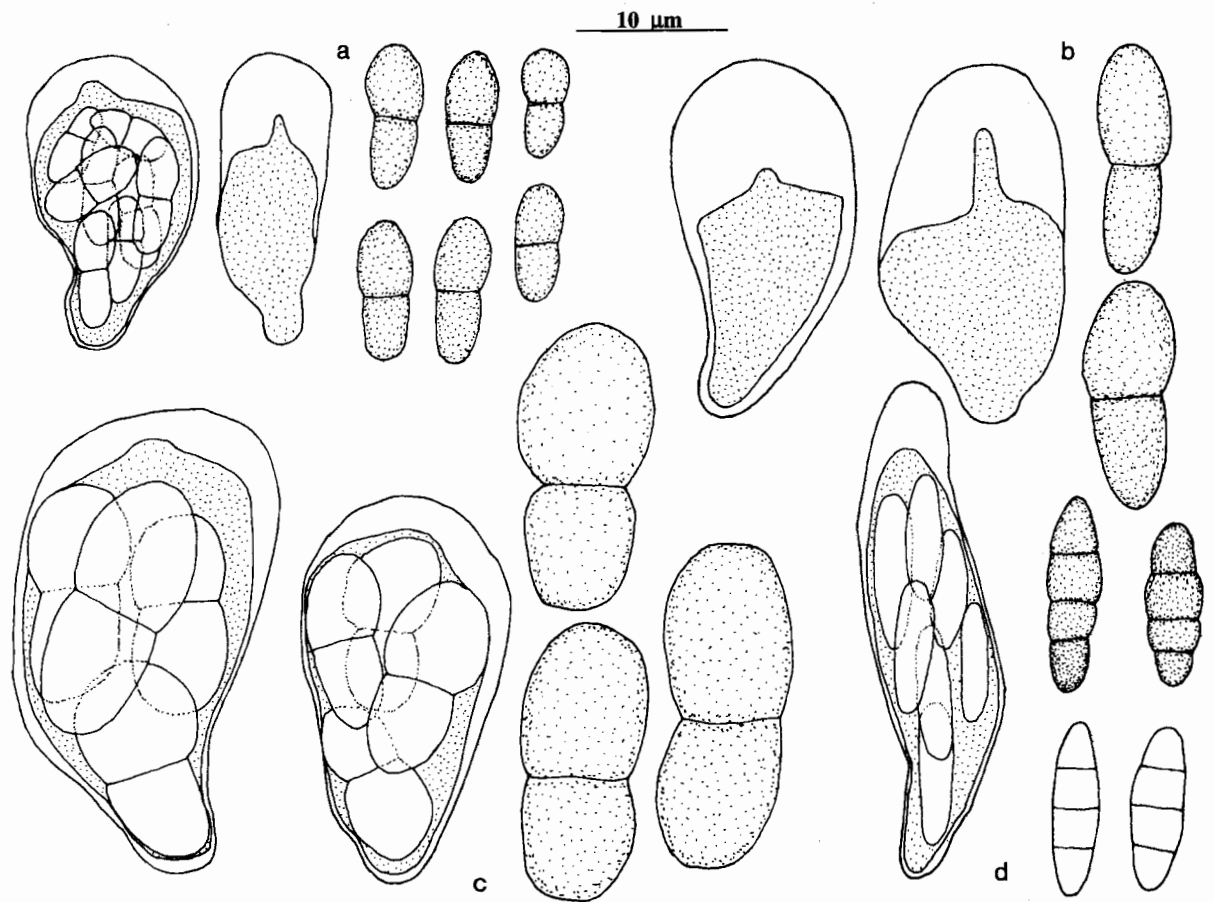


Fig. 1. Asci and ascospores of *Hemigrapha* species on Peltigerales. a, *H. asteriscus* (asci: Wedin 4093; ascospores: Wedin 2990, in water); b, *H. atlantica* (Diederich 8024, in Lugol); c, *H. nephromatis* (asci: holotype; ascospores: Wedin 2792, in water); d, *H. pseudocypbellariae* (holotype, in water).

of *Strigula* and *H. tenellula* (Müll. Arg.) Matzer on species of *Porina*. The taxa on foliicolous lichens differ from those on Peltigerales by the narrower, more elongate and branched ascomata, which are not or rarely roundish, and by the presence of dark vegetative hyphae easily visible under the stereomicroscope (Matzer 1966), which might be an adaptation to the foliicolous way of life.

When Müller (1882: 518-519) created *Hemigrapha* (as a section of *Melanographa*), he included three species, viz. *M. asteriscus* Müll. Arg., *M. dictaenella* (Nyl.) Müll. Arg. and *M. epigraphella* (Nyl.) Müll. Arg. We have examined one specimen of *M. epigraphella* (G, herb. Müller Argoviensis), which seems to be a type. As the apothecia in that specimen are distinctly lirelloid with an exposed, slit-like disk, as the hymenium is said to become bluish in iodine (Nylander 1868: 55), and as the specimen is quite small, we did

not study it further by microscope. This species surely doesn't belong to *Hemigrapha*. No specimen of *M. dictaenella* could be located in G.

***Hemigrapha asteriscus* (Müll. Arg.)  
D. Hawksw.**

Kew Bulletin 30: 191 (1975). - *Melanographa asteriscus* Müll. Arg., Flora 65: 519 (1882). - Type: Australia, New South Wales, Mt. Kosciusko ['Koscinszko' on the label], on *Peltigera* '*dolichorrhiza*', Findley s.n. (UPS!, two isotypes in one envelope; also three isotypes in G, fide Matzer 1996: 105).

Ascomata usually round when young, round or distinctly star-shaped when older, sometimes also

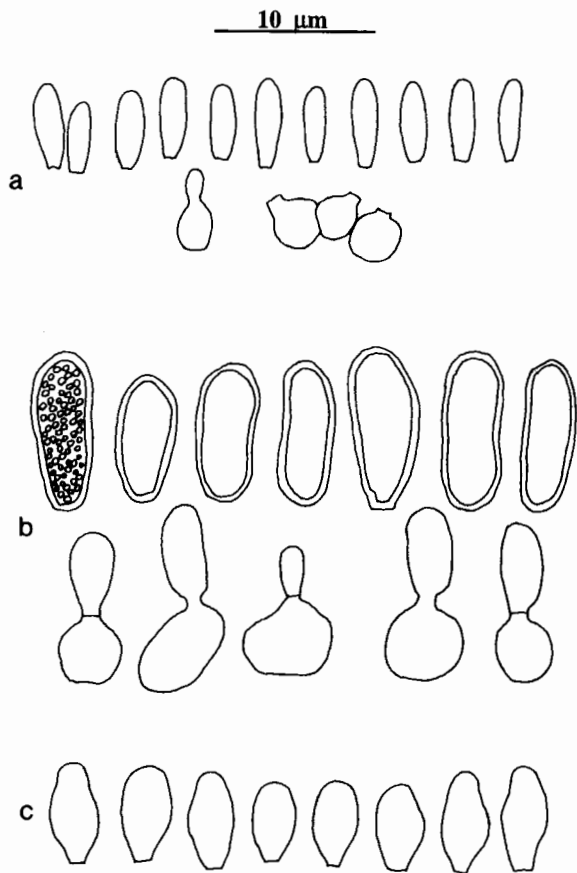


Fig. 2. Conidia and conidiogenous cells of some *Hemigrapha* species. a, *H. asteriscus*, microconidial morph (Sipman 30351, in water); b, *H. asteriscus*, macroconidial morph (Wedin 2990, in water; note lipid droplets figured in one living conidium); c, *H. pseudocyphellariae*, macroconidial morph (holotype, in LCB).

elongate or branched, up to 0.8 mm in diam. Hymenium up to 35 µm tall. Paraphysoids in mature ascomata thin and indistinct, 0.5-1.5 µm wide, not or only slightly swollen between septa, apices somewhat thickened; periphysoid-like cells (conidiogenous cells?, see above) abundant in some specimens, generally non-septate, c. 4-6 × 3-6 µm. Asci 8-spored, broadly clavate, 16.5-24.5 × 9.5-14 µm. Ascospores 1-septate, 7.5-11.5 × 3.5-4.5 µm.

Conidiomata intermixed with ascomata. Macroconidial conidiogenous cells shortly ampulliform, 3.5-5.5 µm in diam., 4.5-5(-6) µm long. Macroconidia ellipsoid, sometimes slightly curved or narrower in the middle, not or indistinctly truncate at the base, (8-)8.5-10(-10.5) × 2.5-2.7(-3) µm, wall c. 0.3 µm thick. Microconidial conidiogenous cells subspherical to

shortly ampulliform, 2-3 µm in diam., 2-3.5 µm long. Microconidia narrowly ellipsoid to rod-shaped, thin-walled, distinctly truncate at the base, (4.5-)4.8-5.2 × 1.3-1.5 µm. – Figs 1a, 2a-b, 3, 4.

*Hosts.* Commensalistic on species of *Peltigera*. The single European specimen is in a poor condition, as it is attacked simultaneously by two other lichenicolous fungi, but it most probably belongs to *Peltigera hymenina* (Ach.) Delise. The names written on the herbarium labels of the non-European specimens include *P. chilensis*, *P. dolichorhiza* and *P. rufescens*, but none of these identifications seems to be reliable. As long as no revision of the southern hemisphere *Peltigera* species is available, we hesitate in identifying these hosts.

*Distribution.* We have examined specimens from Switzerland, Australia (New South Wales and Tasmania), New Zealand (North Island and South Island), Argentina (Rio Negro, Tierra del Fuego), Brazil (São Paulo) and Chile (Cautin, Tierra del Fuego, Valdivia) (Fig. 3). The species has furthermore been mentioned in the literature from Australia (Victoria, Devills Gully, on *P. 'dolichorhiza'*, 1885, Wilson, herb. Bouly de Lesdain) by Keissler (1933), and from Brazil (Rio de Janeiro, Serra da Mantiqueira, Itatiaia, between Registro do Picú and Agulhas Negras, on *P. 'dolichorhiza'*, vi 1978, Kalb & Plöbst, herb. Kalb) by Matzer (1996: 105).

*Observations.* *Hemigrapha asteriscus* shows considerable variation in the morphology of the ascomata, ranging from round, patch-like or distinctly star-shaped to elongate, simple or branched (Figs 4a-b). This variation is often found within the same specimen, and is mainly due to different stages in the ascoma development: the young ascomata are roundish, and some later become more stellate due to the irregular growth of the ascomatal wall.

*H. asteriscus* was originally described from Australia (New South Wales) by Müller (1882) and is reported here as new to South America and to New Zealand. The report from Ireland by Folan and Mitchell (1970) is based on a specimen of *H. atlantica* which is described below. We were surprised to see one single European specimen on *Peltigera*, which, in addition has only conidiomata. As the conidiomatal characters are the same as those of the microconidial morph of southern hemisphere material, we consider the specimen as belonging to the same species, *H. asteriscus*.

*Additional specimens examined.* Switzerland: Valais: Val d'Herens, S of Sion, Les Haudères, c. 4 km S of Evolène, Forêt de Tauge, coord. c. 605.5/103.0, c. 1600



Fig. 3. World distribution of *Hemigrappa asteriscus*.

m, on *Peltigera cf. hymenina*, vii 1990, H. Sipman 30351 (B, with *Corticifraga fückelii* and *Illosporium carneum*).

Australia: Tasmania: Hobart, Mount Wellington, E slope, 42°55' S, 147°15' E, 600 m, iii 1988, A. & M. Aptroot 22862 p. p. (herb. Aptroot, herb. Diederich); NW Tasmania, Sumac Spur 2, S of Arthur River, 1980, G. Kantvilas 650/80 (BM); Southwest Conservation Area, along Gordon River Rd, close to Little Florentine River, 42°44' S, 146°25' E, c. 440 m, 1990, M. Wedin 3036 (UPS).

New Zealand: North Island: South Auckland: Urewera Nat. Park, Taupeupe saddle, along track from Huiarau Summit, 38°38' S, 177°01' E, c. 920 m, 1992, M. Wedin 3992a (UPS); Gisborne: Urewera Nat. Park, Lake Waikaremoana, along Ruapani Track, 38°44' S, 177°08' E, c. 760 m, 1992, M. Wedin 4093 (UPS; also to be distributed in Santesson Fungi Lichenicoli Exsiccati). South Island: Nelson: Nelson Lakes Nat. Park, 1.5 km SE of St. Arnaud, along St. Arnaud Range Track, 41°48' S, 172°51' E, c. 625 m, 1990, M. Wedin 2628a (UPS); NW of Nelson Forest Park, Mt Arthur, track from Flora Saddle to Mt Arthur Hut, 41°11' S, 172°43' E, 1995, M. Wedin 4974 (UPS); NW of Maruia Springs, E of Springs Junction, along Rough Creek Walk, c. 975 m, 1990, M. Wedin 2746a (UPS); Southland: Longwood State Forest, 19 km NNW Riverton, Purakino River Camp, along Granity Stream, 46°11' S, 167°55' E, c. 150 m, 1990, M. Wedin 2990 (UPS, AK); Westland: Westport, Cape Foulwind, 41°45' S, 171°28' E, 1981, Walker s. n. (BM).

Argentina: Rio Negro: Lago Nahuel Huapi, in valley leading from Puerto Blest to Lago Frias, xii 1937, Kalela 95d (UPS); Reserva Nacional Nahuel Huapi, c.

30 km SW of Bariloche, 3 km SE Villa Mascardi, along Arroyo Negro, 41°27' S, 71°28' W, c. 1000 m, 1989, M. Wedin 1867 & Messuti (UPS). Tierra del Fuego: Ushuaia, on *P. 'chilensis'*, v 1896, Dusén 254b (UPS); N of Harberton, Mozen, on *P. 'rufescens'*, 1902, Skottsberg (UPS).

Brazil: São Paulo: Serra da Mantiqueira, Campos do Jordão, Parque Estadual de Campos do Jordão, 22°40' S, 45°30' W, c. 1500 m, ix 1997, A. Aptroot 41749 (herb. Aptroot, herb. Diederich).

Chile: Cautin: Conguillo Nat. Park, at NE base of Volcan Llaima, E shore of Laguna Conguillo, along the track up to Sierra Nevada, S-exposed slope, 38°38' S, 71°37' W, c. 1080 m, iii 1989, M. Wedin 1747 (UPS). Tierra del Fuego: Isla Grande, Rio Caleta, xii 1986, S. Stenroos 2116 (UPS); Canal Whiteside, Puerto Yartou, 1941, R. Santesson S 317, S 319 (UPS). Valdivia: Rio San Pedro, Malihue, ix 1940, R. Santesson S 398 (UPS); Lago Riñihue, Riñihue, Cerro Tralcan, ix 1940, R. Santesson S 347 (UPS).

### ***Hemigrappa atlantica* Diederich & Wedin sp. nov.**

*A Hemigrappa asterisco* ascosporis majoribus 13-15 × 4.5-6 µm differt.

Typus: Great Britain, Scotland, VC 97, Westernness, Morvern, Killundine, NW of Beinn Dubh, costal woodland below cliff, grid 17/59.47, 6 ii 1992, B. Coppins & A. O'Dare 14857 (E: holotypus). Isotypes are planned to be distributed in Santesson Fungi Lichenicoli Exsiccati.

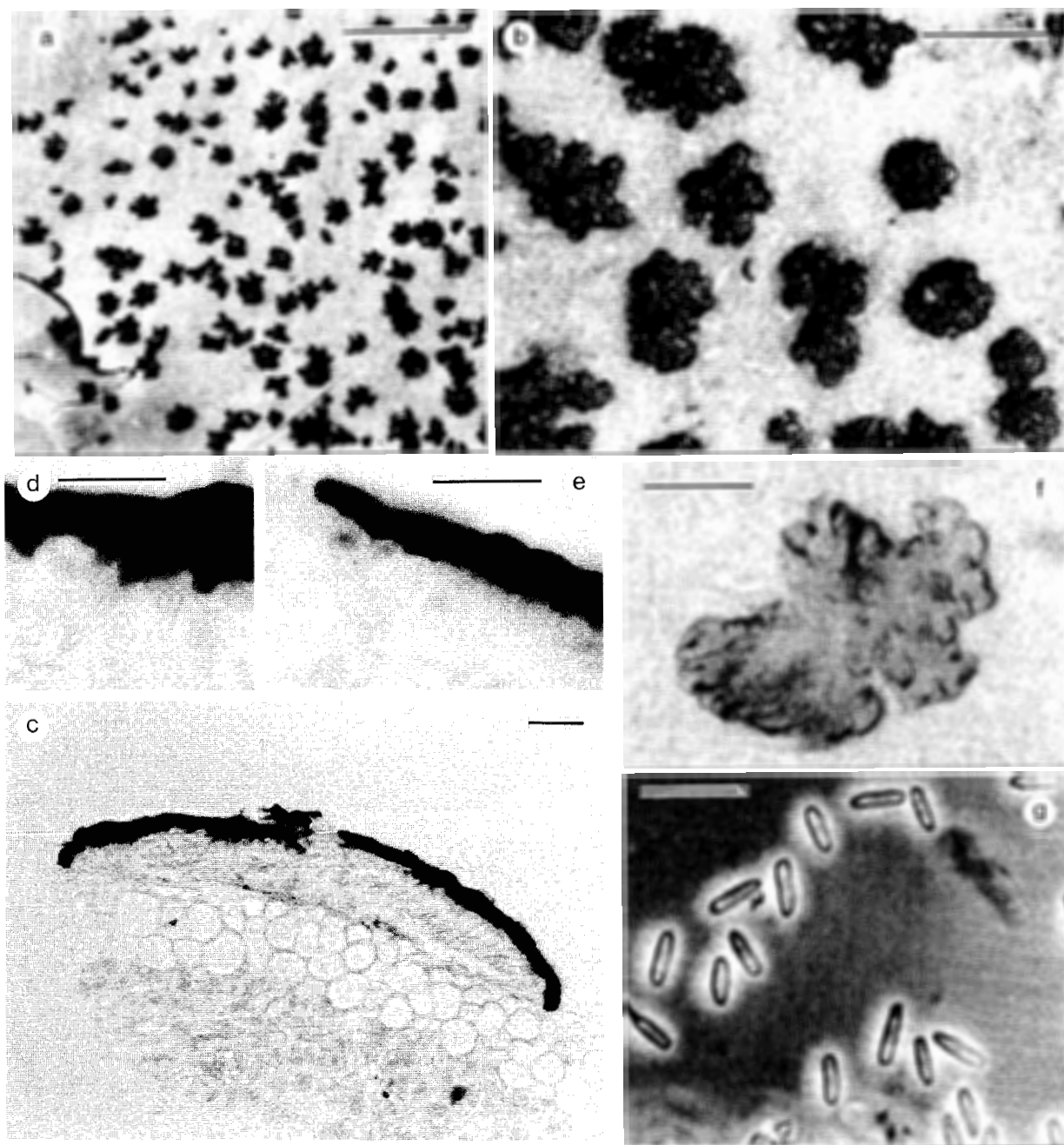


Fig. 4. *Hemigrapha asteriscus*. a-b, ascomata on the thallus of *Peltigera*; c, section through an ascoma; d, conidiogenous cells; e, section through the ascomatal wall close to the ostiole; f, young ascoma; g, microconidia. a-b (isotypus, UPS), c-e (Wedin 2990, in LCB), f-g (Sipman 30351, in water, g: phase contrast). – Scale bars 1 mm (a), 250  $\mu$ m (b), 20  $\mu$ m (c), 10  $\mu$ m (d-g).

Ascomata round to slightly star-shaped, 0.15-0.6 mm in diam. Hymenium up to 45  $\mu$ m tall. Paraphysoids in mature ascomata thin and indistinct, 1-1.5  $\mu$ m in diam.; paraphysoid-like cells (conidiogenous cells?, see above) abundant, generally non-septate, 3-11  $\times$  2.5-4  $\mu$ m. Asci

8-spored, broadly clavate to subglobose, 21-23  $\times$  10-14  $\mu$ m. Ascospores hyaline when young, brownish and distinctly verruculose at maturity, 1-septate, constricted at the septum, 13-15(-17)  $\times$  4-6  $\mu$ m.

Conidiomata intermixed with ascomata. Micro-

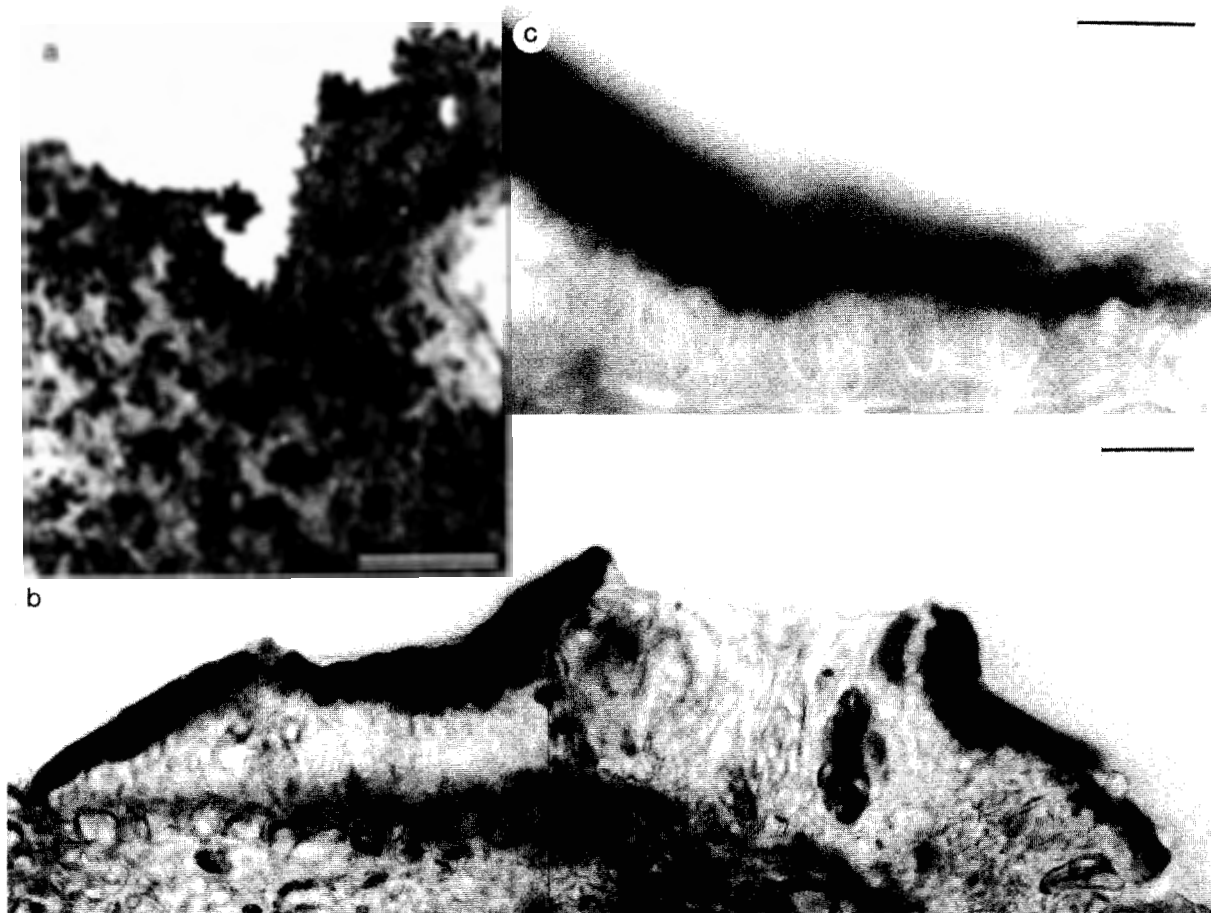


Fig. 5. *Hemigrapha atlantica* (Diederich 8024). a, ascomata on the thallus of *Sticta canariensis* (cyanobacterial morph); b, section through an ascoma (in water; note one ascus with mature, brown ascospores, and one with immature, hyaline ascospores); c, conidiogenous cells arising from the ascomatal wall. – Scale bars 1 mm (a), 20  $\mu\text{m}$  (b), 10  $\mu\text{m}$  (c).

conidia rod-shaped to slightly bent, basally somewhat truncate,  $5\text{--}7 \times 2 \mu\text{m}$ . – Figs 1b, 5, 8.

*Host.* Commensalistic on the thallus of the cyanobacterial morph of *Sticta canariensis* (Bory) Delise (= *S. dufourii* Delise).

*Distribution.* This species is known from the Azores and the British Isles (Ireland and Scotland) (Fig. 8).

*Observations.* The first specimen of this species was collected in Ireland in 1965 by Folan. As the ascomata in that material didn't contain any ascospores, it was provisionally determined as *H. asteriscus*, and published by Folan & Mitchell (1970) under that name. Santesson, however, regarded this determination as doubtful (Cannon et al. 1985), and our discovery of fertile material has confirmed this opinion.

The new species, *H. atlantica* differs from *H. asteriscus* by the larger ascospores.

*Additional specimens examined.* Azores: Fayal: Calderira Grande, v 1937, H. Persson (UPS). Sao Miguel: Lagoa do Congro, iv 1937, H. Persson (UPS). Terceira: SW of Agualva, iv 1937, H. Persson (UPS).

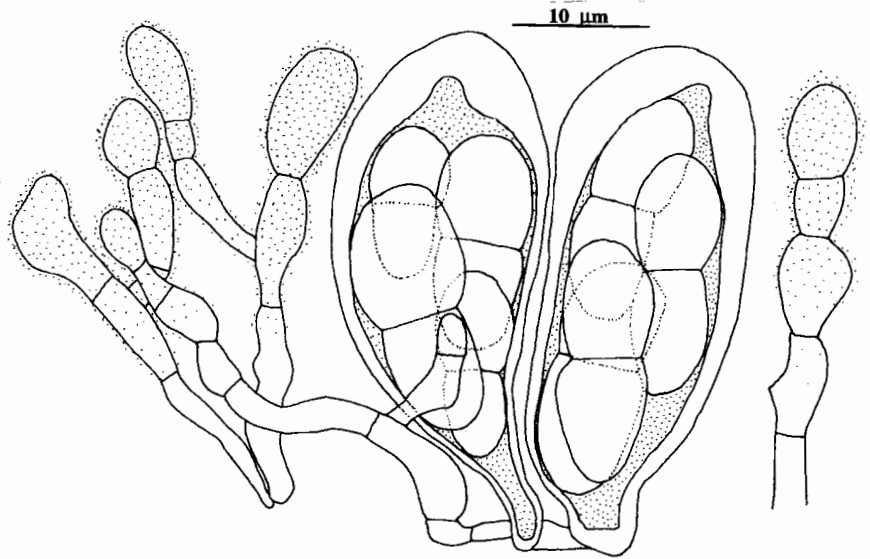
Great Britain: V. C. 104, North Ebudes: Isle of Skye, Tokavaig wood (coord. NG 61 12), v 1987, P. Diederich 8024 (herb. Diederich, E, LG, UPS). - Ireland: V. C. H 16, West Galway: Co. Galway, Derryclare Wood, alt. c. 50', i 1965, A. C. M. Folan s. n. (UPS).

### ***Hemigrapha nephromatis* Wedin & Diederich sp. nov.**

A *Hemigrapha asterisco* et *H. atlantica* ascosporis



Fig. 6. *Hemigrapha nephromatis* (Wedin 2792, in water), asci with ascospores, and paraphysoids.



majoribus (14.5-)16-21.5(-24.5) × (7-)7.5-8.5(-9.5) μm et ascis (2-)4-sporis majoribus 22-37 × 15-22 μm differt.

Typus: New Zealand, South Island, Nelson, Nelson Lakes Nat. Park, 1.5 km SE of St. Arnaud, along St. Arnaud Range Track, 41°48' S, 172°51' E, c. 625 m, 1990, M. Wedin 2635 (UPS: holotypus; AK, HO, herb. Diederich: isotypi).

Ascomata round to slightly star-shaped, up to 0.5 mm in diam. Hymenium up to 45 μm tall. Paraphysoids (2-)2.5-4(-5.5) μm wide, swollen between the septa, apically brownish, covered with granules, distinctly thickened and c. (3.5-)4-6.5 μm wide. Asci (2-)4-spored, broadly clavate to subglobose, 22-37 × 15-22 μm. Ascospores 1-septate, distinctly constricted at the septum, hyaline when young, becoming brownish, (14.5-)16-21.5(-24.5) × (7-)7.5-8.5(-9.5) μm; some of the spores may be found aborted and shrivelled in the ascus.

Conidiomata not seen. – Figs 1c, 6, 8.

*Host.* Commensalistic on *Nephroma australe*.

*Distribution.* We have seen specimens from Australia (Tasmania) and from New Zealand (North Island and South Island) (Fig. 8).

*Observations.* *H. nephromatis* is distinguished from all other species on Peltigerales by the much larger ascospores and asci, which furthermore are (2-)4-spored (Fig. 1c).

*Additional specimens examined.* Australia: Tasmania:

Styx River near Pagoda Hut, near Maydena, 1963, Bratt 864 (BM).

New Zealand: North Island: Wellington: Tongariro Nat. Park, along track from Whakapapa Village to Silica Springs, close to Waikare Stream, 39°13' S, 175°32' E, c. 1150 m, 1990, M. Wedin 2335 (UPS, AK, herb Diederich). South Island: Canterbury: Boyle River [SE of Lewis Pass], 1981, D. Galloway s. n. (BM); Arthur's Pass Nat. Park, c. 4 km N of Otira, at Kelly's Shelter, 42°48' S, 171°34' E, c. 350 m, 1990, M. Wedin 2792 (UPS); Nelson: Nelson Lakes Nat. Park, 1.5 km SE of St. Arnaud, along St. Arnaud Range Track, 41°48' S, 172°51' E, c. 650 m, 1990, M. Wedin 2650 (UPS).

### *Hemigrapha pseudocyphellariae* Diederich & Wedin sp. nov.

*A Hemigrapha asterisco* et *H. atlantica* ascosporis 3-septatis, 11-13 × (3-)3.5-4 μm, ascis 8-sporis, claviformibus, 32-35 × 7-8.5 μm, ascomatibus minoribus, ad 0.2 mm diam., et macroconidiis ellipsoideis vel rhomboideis, truncatis, 5-6.5 × 2.5-3(-3.5) μm differt.

Typus: Papua New Guinea, Madang prov., Huon Peninsula, Finisterre range, Yupna valley, Teptep village, 5°57' S, 146°33' E, c. 2500 m, on *Pseudocyphellaria argyracea*, 30 vii 1992, P. Diederich 10805 (LG: holotypus; herb. Diederich: isotypus).

Ascomata round to slightly star-shaped, up to 0.2 mm in diam., cells 3.5-6 × 2-4.5 μm. Hymenium c. 25 μm. Paraphysoids in the single collection indistinguishable.

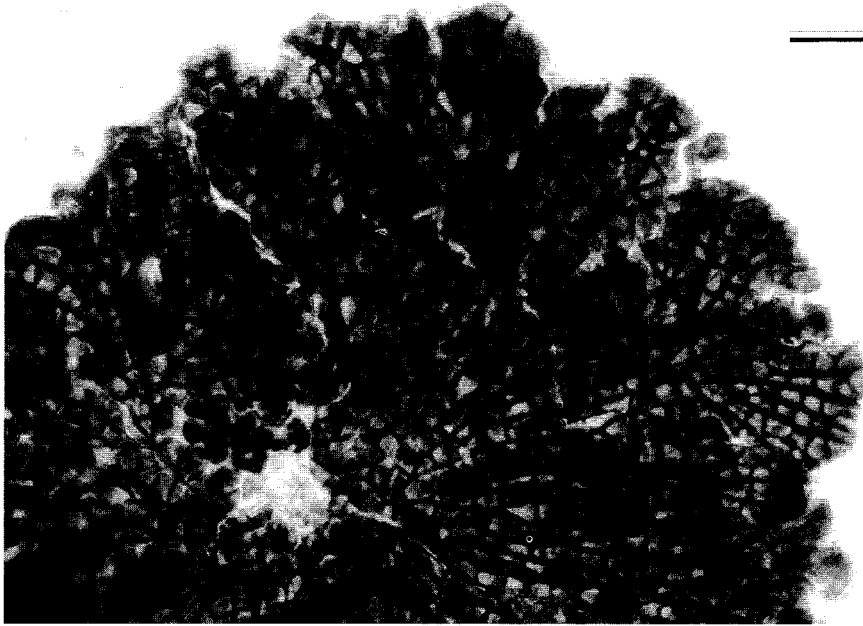


Fig. 7. *Hemigrapha pseudocyphellariae* (holotype), ascomatal wall (in water; note the ostiole, and the irregular, lobed margin of the ascoma). – Scale bar 20  $\mu$ m.

Asci 8-spored, clavate,  $32-35 \times 7-8.5 \mu$ m. Ascospores 3-septate, hyaline and not constricted at septa when young, brownish and distinctly constricted when mature, not distinctly verruculose,  $11-13 \times (3-)3.5-4 \mu$ m.

Conidiomata intermixed with ascomata. Conidiogenous cells not observed. Macroconidia broadly ellipsoid to almost rhomboid,  $5-6.5 \times 2.5-3(-3.5) \mu$ m, distinctly truncate at the base. – Figs 1d, 2c, 7, 8.

*Hosts.* On *Pseudocyphellaria argyracea* (Delise) Vain. and *P. crocata* (L.) Vain. The fungus is mainly growing in decolorized parts of the host thallus, which are otherwise devoid of lichenicolous fungi, and seems therefore to be parasitic.

*Distribution.* Known only from the type locality in Papua New Guinea (Fig. 8).



Fig. 8. World distribution of *Hemigrapha atlantica* (★), *H. nephromatis* (●) and *H. pseudocyphellariae* (⊗).

*Observations.* This species is remarkable, as it is the only member of the genus with 3-septate ascospores. The asci are also narrower and longer than in the other species studied (Fig. 1d). The macroconidia are peculiar as they are distinctly broader in the middle, often almost rhomboid (Fig. 2c), in contrast to those of *H. asteriscus*, which are often narrower in the middle (Fig. 2b).

The single known specimen is quite rich in ascomata and conidiomata, but appears to be in a poor condition, is probably too old, and possesses a high percentage of empty fructifications. Although we would have preferred to have at least one additional specimen of this species, we nevertheless describe it as new, as it gives us precious information on the variability of the different characters within the genus, and also on the coevolutionary diversification of the genus within the Peltigerales.

Kondratyuk & Galloway (1995) report 51 species of lichenicolous fungi, belonging to 21 different genera, on species of *Pseudocyphellaria*. The absence in their list of any species of *Hemigrapha* indicates that *H. pseudocyphellariae* might be a rare taxon.

*Additional specimen examined.* Papua New Guinea: Same locality as the type, on *P. crocata* (originally intermixed with *P. argyracea*, chosen as the holotype), P. Diederich 13740 (herb. Diederich).

### A key to the species of *Hemigrapha* on Peltigerales

1. Ascospores 3-septate, 11-13 × (3-)3.5-4 µm; asci 8-spored, claviform, 32-35 × 7-8.5 µm; ascomata up to 0.2 mm in diam.; macroconidia broadly ellipsoid to almost rhomboid, 5-6.5 × 2.5-3(-3.5) µm; on *Pseudocyphellaria* ..... *H. pseudocyphellariae*
1. Ascospores 1-septate; asci broadly claviform to subglobose; ascomata generally larger ..... 2
2. Ascospores mainly 16-21.5 × 7.5-8.5 µm; asci (2-) 4-spored, 22-37 × 15-22 µm; on *Nephroma australe* ..... *H. nephromatis*
2. Ascospores smaller; asci 8-spored, smaller ..... 3
3. Ascospores 13-15 × 4-6 µm; asci 21-23 × 10-14 µm; microconidia 5-7 × 2 µm, rod-shaped to slightly bent; on *Sticta canariensis* (cyanobacterial morph) *H. atlantica*
3. Ascospores 7.5-11.5 × 3.5-4.5 µm; asci 16.5-24.5 × 9.5-14 µm; microconidia (4.5-)4.8-5.2 × 1.3-1.5 µm, narrowly ellipsoid to rod-shaped; macroconidia ellipsoid, sometimes slightly curved or narrower in the middle, (8-)8.5-10(-10.5) × 2.5-2.7(-3) µm; on *Peltigera* ..... *H. asteriscus*

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