Further Species of the Genus Tephromela (Lecanorales)

by

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Abstract:
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Character and distribution data of four species of *Tephromela* are presented. Three lichenicolous species which have recently been recognized as belonging to *Tephromela*, are described in detail: *Tephromela campestricola* (Nyl.) Rambold & Triebel, *T. cerasina* (Müll.Arg.) Rambold & Triebel, and *T. koliensis* (Räs.) Rambold & Triebel. The inclusion of these taxa without visible thallus entailes an enlargement of the genus concept. *Tephromela colensoica* Rambold & Knoph is described as new. *Lecidea aterrima* Fée is recognized as a member of *Tephromela atra* agg.

1. Introduction

Since characters of the ascus apex have been recognized as systematically important, profound changes in the generic concepts of crustose lichens have taken place. Artificial genera like *Aspicilia*, *Lecanora* or *Lecidea* have been split up into smaller, more natural entities. This has also happened with various lichenicolous lecanoralean taxa without visible thallus, like the species formerly included in the genus *Nesolechia*.

Before *Tephromela* was reestablished (HAFELLNER in KALB 1983, HAFELLNER 1984), the species of this genus were located in various genera. Meanwhile it became evident that beside species of the lecanoroid type, ones of the aspicilioid-lecanoroid and lecideoid type also belong to this genus (HERTEL 1984, HERTEL & RAMBOLD 1985). This means that the margination type of the apothecia is not necessarily a major important character at generic level in this group of Lecanorales. Therefore, some former members of the genera *Lecanora*, *Lecidea* and *Nesolechia* have to be included in *Tephromela*.

The saxicolous species *Tephromela colensoica* which is described here as new, and the three obligately lichenicolous species which have recently been combined in *Tephromela*, have apothecia without lecanorine margins. Furthermore, the three lichenicolous species exhibit no distinct thallus. Their inclusion in *Tephromela* entailes an enlargement of the generic concept. The only lichenicolous species of the genus hitherto known is *T. armeniaca* (DC.) Hertel & Rambold, which occurs facultatively on *Sporastatia testudinea* (Ach.) Massal., always develops an extended proper thallus but also has apothecia with biatorine margins. The major differentiating characters of the lichenicolous species with indistinct thallus are given in table 1. The spectrum of thallus organization in *Tephromela* is very similar to that of two other lecanoralean genera, *Carbonea* and *Rhizocarpon*, which include species with a visible (epikapylic) as well as with an invisible (endokapylic) thallus (for definitions see RAMBOLD & TRIEBEL 1992).

Table 1: The major differentiating characters of the lichenicolous endokapylic species of *Tephromela* (violet pigmentation of hymenium and epihymenium, average ascospore size, host selection).

	Hym. vio.	Epih. vio.	Av. ascospore size [µm]	host species
T. campestricola	+	+	9.0-10.5 × 5.0-5.5	*Lecanora pseudistera*, *L.* sp.
T. cerasina	±	+	7.5- 8.5 × 5.0-6.5	*Dirinaria picta*
T. koliensis	–	–	12.0-13.0 × 6.0-6.5	*Lecanora argopholis*

Chemical and morphological data of *Lecanora cavicola* Creveld (CREVELD 1981, POELT & LEUCKERT 1984) suggested that the species might belong to *Tephromela*, combining the presence of alectorialic acid (the major substance in *T. armeniaca*) with a lecanorine margin. However, by its paraphyses, conidia and conidiophores, this species is closer to *Lecanora* s.l. Also the asci resemble those of the *Lecanora marginata* group.

The genus *Tephromela* is delimited here in the following way: autotrophic or lichenicolous, epikapylic or endokapylic, cecidogenous or not; apothecia immersed to sessile, aspicilioid, biatorine to lecanorine; paraphyses thick-walled, colourless to violet-brown, apically greenish to black-violet; asci of *Bacidia*-type; ascospores simple, very rarely one-septate; conidia cylindrical, usually developing laterally on the conidiophores.

2. The Species

Tephromela campestricola (Nyl.) Rambold & Triebel, Biblioth. Lichenol. **48**: 169. 1992
≡ *Lecidea campestricola* Nyl., Flora **67**: 389. 1884 ≡ *Phacopsis campestricola* (Nyl.) Vouaux, Bull. Soc. Mycol. France **30**: 145. 1914. **Type:** France: Pyrénées Orientales, Força Réal, 2500 m, [on *Lecanora pseudistera* Nyl. – host lichen det. H.T. Lumbsch], 30 March 1884, *W. Nylander* (H-NYL 16854! – holotype, with drawings of the author; H-NYL 5887!, PC, hb. Hue! – isotypes).

Growing on the thallus and apothecia of *Lecanora pseudistera* and a related species, endokapylic, cecidogenous or not (fig. 1).

Apothecia round, dispersed to crowded, semi-immersed to sessile, not constricted at the base, c. 0.2-0.4 mm, max. 0.4-0.65 mm diam. Disc plane to convex, black, nitid, epruinose. Margin at first distinct or not, narrow, black, nitid, later evanescent. Excipulum max. 35-70 µm thick, lateral of the hymenium 25-40 µm thick. Ectal zone dark grey-green to violet-brown, pigmented zone c. 8-10 µm wide; hyphae 4-8 µm diam., with lumina of 2-2.5 µm diam. Inner zone pale violet to violet-brown; hyphae 3-5 µm diam., with lumina of 1-2 µm. Medullary zone not developed. Hypothecium pale yellowish-brown to brown, up to 150 µm thick; hyphae 4.5-6 µm diam.; subhymenial layer violet to violet-brown, up to 10 µm thick. Hymenium 40-70 µm high, violet, I$_{Lugol1:6}$ –, I$_{Lugol}$ –. Epihymenium violet to violet-black, 7-15 µm high; pigmentation diffuse and cap-like in the apical wall of the paraphyses, radiating into the lower hymenium. Paraphyses branched, mostly not anastomosing, up to 4 µm, (lumina 1-2 µm), apical 4-6 µm (lumina 1-2.5 µm) thick (incl. the gallertic sheaths). Asci c. 30-53 × 8-13 µm; tholus max. 7-10 µm, min. 3-4.5 µm thick; outer amyloid wall layer 0.5 µm thick, I$_{Lugol1:6}$ +

blue, ILugol + brownish; non-amyloid wall layer c. 0.5 µm thick. Ascospores ellipsoid, simple, 7-**9.0-10.5**-11 × 4.5-**5.0-5.5**-6 µm.

Pycnidia immersed in the thallus of the host lichen, c. 50 µm diam.; wall pseudoparenchymatic, violet-brown to grey-green in the upper part, hyaline in the lower part; conidiogenous hyphae similar to the *Tephromela*-type (HERTEL & RAMBOLD 1985: 489 fig. 7d-f). Conidia bacilliform, 7-9 × 0.5-1 µm.

Distribution: Known from Europe (France, Spain) and East Africa (Ethiopia).

Notes: *Tephromela campestricola* is characterized by its violet-brown hymenium, the elongate ascospores and its occurrence on *Lecanora pseudistera* and a related species. The endokapylic species occasionally causes gall-like thallus deformations of the host. The bacilliform conidia of this lichenicolous species were already described by NYLANDER (1884).

Further specimens examined:

France: Pyrénées Orientales, Amélie, super saxa aren. calcarea, 400 m, [on *Lecanora pseudistera*], 11 March 1884, *W. Nylander* (H-NYL 5888, H-NYL 16855). – **Spain**: Prov. Castellón, Alfondeguilla, Pico Femella, c. 40°N, 0°W, 400 m, on sun exposed orthocuasitic sandstone close to a cork-oak forest, [on *Lecanora pseudistera*] 20 January 1990, *V. Calatayud* (M, UPS). – **Ethiopia**: Bale Mountains: Finchaya Habera, 7°N, 39°44'E, 3500 m, secondary heathland and pastures between boulders, on S-facing slopes, accompanying crustose lichens on level rock surfaces, [on *Lecanora* sp., containing atranorin, zeorin], 28-29 December 1989, *G. & S. Miehe 297* (GZU).

Tephromela cerasina (Müll.Arg.) Rambold & Triebel, Biblioth. Lichenol. **48**: 170. 1992
≡ *Nesolechia cerasina* Müll. Arg. in Durand & H. Pittier, Bull. Soc. Roy. Bot. Belgique **30**(1): 72. 1891. **Type:** Costa Rica: San José, [on *Dirinaria picta* (Sw.) Clem. & Shear (= *Physcia picta* var. *sorediata* Müll.Arg.)], 1890, *H. Pittier 5263* (G! – holotype).

Growing on the thallus of *Dirinaria picta*, endokapylic, not cecidogenous (fig. 2).

Apothecia round, dispersed, crowded to confluent, sessile, not constricted at the base, c. 0.2-0.4 mm, max. 0.4-0.7 mm diam. Disc plane to convex, black, nitid, epruinose. Margin at first distinct or not, narrow, black, nitid, later evanescent. Excipulum max. 35-80 µm thick, lateral of the hymenium 25-40 µm thick. Ectal zone violet to orange-brown; hyphae 3-5 µm diam., with lumina of 1-2 µm diam. Inner zone orange to violet-brown, hyphae 3-4 µm diam., with lumina of 1-2 µm. Medullary zone not developed. Hypothecium orange to orange-brown, up to 110 µm thick; hyphae 2-4 µm diam.; subhymenial layer colourless to yellowish brown or pale violet, up to 15 µm thick. Hymenium 40-60 µm high, pale violet to violet, ILugol1:6 –, ILugol –. Epihymenium violet to violet-black, 8-15 µm high; pigmentation diffuse and cap-like in the apical wall of the paraphyses, radiating into the lower hymenium. Paraphyses branched, rarely anastomosing, 2-3 µm (lumina 1-2 µm), apical 3-5 µm (lumina 1-2 µm) thick (incl. the gallertic sheaths). Asci c. 35-53 × 10-14 µm; tholus max. 7-9 µm, min. 4-7 µm thick; outer amyloid wall layer 0.5-1 µm thick, ILugol1:6 + blue, ILugol + brownish; non-amyloid wall layer c. 0.5 µm thick. Ascospores ellipsoid to subglobose, simple, 6.5-**7.5-8.5**-10 × 4.0-**5.0-6.5**-7 µm.

Pycnidia not observed.

Distribution: The species occurs in both hemispheres and is known from Central and South America (Costa Rica, Venezuela, Brazil) and West Africa (Ivory Coast).

Notes: *Tephromela cerasina* combines the characters of a lichenicolous growth habit and a violet pigmented hymenium like *T. campestricola.* The ascospores are less elongate and no gall-like formations to the host species are observable. By its strict host selection and its anatomical characters, this species is easily to recognize.

Further specimens examined:

Venezuela: Ridgecrest, 6 mi NW of Maracay, 1000 m, on *Curatella delineacea*, 21 January 1969, *T.H. Nash III 1941* (ASU). – **Brasilia**: Rio Grande do Sul, Santa Maria da Rocca do Monte, 30 April 1897, *G.A. Malme 1284* (UPS). – **Ivory Coast**: Cercle of Daloa, Issia, 240-260 m, on a small tree in the outskirt of a low wood close to open rocks, 2 August 1954, *R. Santesson 10403c* (UPS).

Tephromela koliensis (Räs.) Rambold & Triebel, Biblioth. Lichenol. **48**: 170. 1992.
≡ *Nesolechia koliensis* Räs., Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo **12**(1): 156. 1939.
Type: Finland: Karelia borealis, Pielisjärvi, Koli, [on *Lecanora argopholis* (Ach.) Ach. (sterile)], 12 June 1924, *V. Räsänen* (H! – holotype).

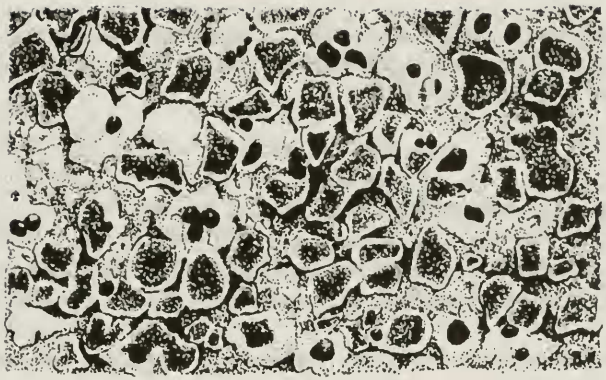
Growing on the thallus of *Lecanora argopholis*, endokapylic, not cecidogenous (fig. 3).

Apothecia round, dispersed or not, semi-immersed to sessile, not constricted at the base, c. 0.15-0.25 mm, max. 0.25-0.35 mm diam. Disc plane to convex, black, nitid, epruinose. Margin at first distinct or not, narrow, black, nitid, later evanescent. Excipulum max. 20-25 µm thick, lateral of the hymenium 20-25 µm thick. Ectal zone red to reddish brown; pigmented zone c. 7-10 µm wide; hyphae 3-7 µm diam., with lumina of 1-2.5 µm diam. Inner zone pale brown to yellowish brown, hyphae 3-5 µm diam., with lumina of 1-2 µm. Medullary zone not developed. Hypothecium pale brown, yellow- to orange-brown, up to 120 µm thick; hyphae 4-7 µm diam.; subhymenial layer yellow-brown or not distinct. Hymenium 45-55 µm high, colourless to pale brownish, I$_{Lugol1:6}$ –, I$_{Lugol}$ –. Epihymenium greyish to olivaceous brown, c. 10 µm high; pigmentation diffuse and cap-like in the apical wall of the paraphyses, radiating into the lower hymenium. Paraphyses poorly branched, mostly not anastomosing, c. 2 µm (lumina 1-2 µm), apical 4-7 µm (lumina 1.5-2 µm) thick (incl. the gallertic sheaths). Asci c. 30-55 × 9-13 µm; tholus max. 8-13 µm, min. 5-9 µm thick; outer amyloid wall layer 0.5-1 µm thick, I$_{Lugol1:6}$ + blue to brownish blue, I$_{Lugol}$ + brownish; non-amyloid wall layer c. 0.5 µm thick (masse axiale not clearly obvious). Ascospores ellipsoid, simple, very rarely one-septate, (9-) **12-13** (-16) × (5-) **6-6.5** (-7) µm.

Pycnidia not observed.

Distribution: Known from Finland.

Notes: *Tephromela koliensis* does not show a strong violet-brown pigmentation of the paraphyses in contrast to the other two lichenicolous species treated in this paper. The hymenium is either colourless or has only a slight brownish tinge. The ascospores of this species are relatively large. All specimens examined grow on a sterile subfruticose lichen thallus, containing atranorin, zeorin and fatty acids, which most likely belong to the chemodeme II of *Lecanora argopholis* (VÄNSKÄ 1984). One host specimen (leg. *S. Ahlner*, 24 August 1936, H) is also infected by the lichenicolous fungus *Rosellinula frustulosae* (Vouaux) R. Sant., which is restricted to *L. argopholis* and *L. frustulosa* (Dicks.) Ach. (see HAFELLNER 1986, SANTESSON in ERIKSSON & HAWKSWORTH 1986: 311). Therefore, it seems very likely that the host lichen is *L. argopholis* in all the cases. By the characters mentioned above and its restriction to this host, *T. koliensis* cannot be confused with any other lichenicolous fungus.



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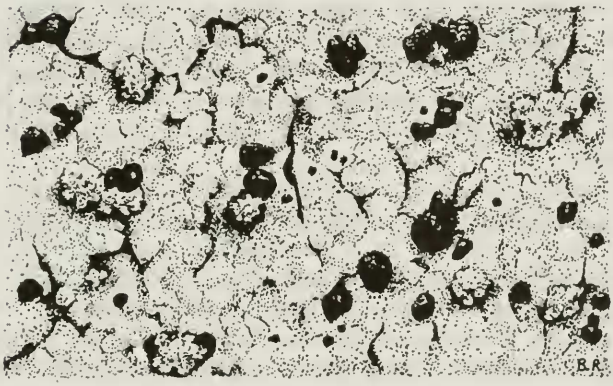

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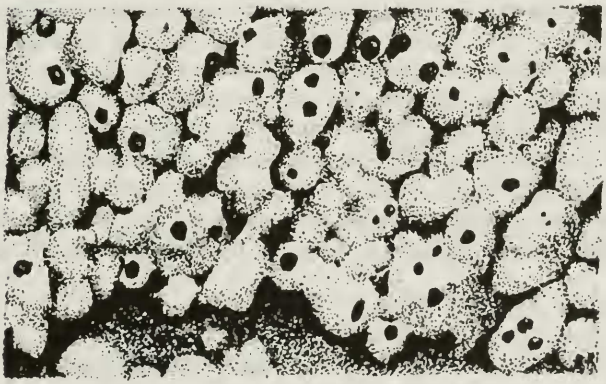

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Fig. 1: *Tephromela campestricola* growing on *Lecanora pseudistera* (isotype, H-NYL 5887).
Fig. 2: *Tephromela cerasina* growing on *Dirinaria picta* (*G.A. Malme 1284*, UPS).
Fig. 3: *Tephromela koliensis* growing on *Lecanora argopholis* (*S. Ahlner*, UPS).
– Scale: 1 mm.

Further specimens examined:

Finland: Regio kuusamoënsis: Salla k:n Vuorijärvi, Jänisköngäs, på klippa vid vartenfallet, 24 August 1936, *S. Ahlner* (H, UPS). – **Russia**: Karelskaya, Sortavala, [Palosaari], Ruskiiriutta, ad rupem praeruptam, 18 August 1939, *V. Räsänen* (H).

Tephromela colensoica Rambold & Knoph – **sp. nov.**

Type: Brazil: Rio de Janeiro, [Cróte des Orynes], [no date], *A. Glaziou 5119* (PC, hb. Fée! – holotype, containing atranorin and colensoic acid; beside *Buellia* sp., *A. Glaziou 3507*).

Diagnosis: *Tephromelae atrae* similis est, thallo acido colensoico continente, apotheciis immarginatis et discis convexis.

Thallus creamy whitish, areolate. Hypothallus black, at the thallus margin and between the areoles. Apothecia immarginate, shiny black, subconvex, semi-immersed to immersed. Excipulum indistinct. Hypothecium rose-violet to orange, incrusted. Hymenium violet; epihymenium dark violet-brown. Paraphyses c. 5 µm, apically 5-6 µm diam., with lumina of 1.5-2 µm, apically 1.5 µm diam. Asci (scarcely developed), 55-60 × 15 µm. Ascospores (not free) c. 10-11 × 6-7 µm.

Pycnidia not observed.

Chemistry: Containing atranorin, colensoic acid (analyzed by mass spectroscopy).

Distribution: Known only from the type locality in Brazil.

Notes: The type material of this species was cited in FÉE (1873) as "*Lecidea punctata* F. non Eschw." (= *Buellia punctata* (Hoffm.) Massal.) with the collection numbers 3507 and 5119. Material for both numbers is included in one capsule in the hb. Fée in PC. While no. 3507 belongs to *Buellia*, no. 5119 is a species of *Tephromela*, to which the text of FÉE (1873) obviously refers and which is described here as new. Habitually it resembles *Lecidea aterrima* Fée, which has been recognized to belong to the *Tephromela atra* agg. The latter contains atranorin and α-collatolic acid as major substances, and exhibits a violet hymenium and immarginate, adnate to semi-immersed apothecia. Material of *T. atra* agg. with similar appearance also from Brazil, has been distributed in the exsiccata K. Kalb, Lich. Neotropici under the name *Lecidea oreinodes* (Koerb.) Weber & Hertel (no. 233). Specimens of *T. atra* agg. with aspicilioid or lecideoid habitus are also known from the Australasian region, the Subantarctic Islands and from South Africa (HERTEL 1984, RAMBOLD 1989). Recently, two members of the *T. atra* group with α-collatolic acid have been described as new in the rank of species by KALB (1991): *T. nashi* Kalb from Mexico and *T. elixii* Kalb from Venezuela.

Further specimens examined:

Brazil: Prov. Rio de Janeiro, Cróte des Orynes, 8 August 1869, *A. Glaziou "3490"* (M!; 2 specimens: one specimen was found growing beside the isotype material of *Lecidea aterrima* Fée[1]).

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[1] *Lecidea aterrima* Fée, Bull. Soc. Bot. France **20**: 317 (1873) ≡ *Aspicilia aterrima* (Fée) Hue, Nouv. Archiv Muséum ser. 5, **2**: 25. 1912 ["1910"] ≡ *Lecanora aterrima* (Fée) Zahlbr., Cat. Lich. Univ. **5**: 363. 1928. Type: Brazil: Rio de Janeiro, Cróte des Orynes, 8 August 1869, *A. Glaziou* 3490 (PC, hb. Fée! – holotype, M! – 2 isotypes, containing atranorin and α-collatolic acid, alectoronic acid. [The isotype material in M is heterogenous: one of the three specimens with no. 3490 is growing beside *Tephromela colensoica*; another contains only *T. colensoica* and therefore is not part of the type collection) ≡ *Lecidea atroflavens* Kremp., Flora **59**: 319. 1876 – (nom. illeg. – ICBN Art. 63.1) ≡ *Lecanora atroflavens* (Kremp.) Vainio, Acta Soc. Fauna Fl. Fennica **7**: 98. 1890.

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