PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 3, Part 1, pp. 1–7 (1964)

THE GENUS THUEMENELLA WITH REMARKS ON HYPOCREACEAE AND NECTRIACEAE

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(With five Text-figures)

The genus *Thuemenella* Penz. & Sacc. is revised. The new combinations *T. bicolor* (Ell. & Ev.) Boedijn, *T. cubispora* (Ell. & Holw.) Boedijn, *T. hirsuta* (Ell. & Ev.) Boedijn and the new species *T. hexaspora* Boedijn are proposed.

Descriptions are given of the families Hypocreaceae and Nectriaceae. The genera of the former family are briefly discussed.

During his visit to Java, Penzig made a large collection of fungi. Afterwards and in collaboration with Saccardo he published the new taxa in "Malpighia" between 1897 and 1902. Among the numerous Ascomycetes, a fungus with pale, fleshy stromata and one-celled, coloured spores was recognized to belong to a new genus, *Thuemenella*, described as *T. javanica* (16, 17), and assigned to the Hypocreaceae. Later the genus was placed in the synonymy of *Sarcoxylon* Cke by Clements & Shear (8), and the same was done by von Arx & Müller (2).

As part of the original collection of *Thuemenella javanica*, preserved in alcohol and numbered 3454, was left in the Herbarium at Bogor by Penzig, I had the opportunity to study this material. The diagnosis of Penzig & Saccardo proved correct, and the genus was rightly placed in the Hypocreaceae. *Thuemenella* has nothing in common with *Sarcoxylon* which is characterized by ellipsoid spores with a germslit and belongs to the Xylariaceae.

Seaver (18) in 1910 proposed the genus *Chromocreopsis* for hypocreaceous fungi with coloured, one-celled spores. In his description he mentioned that the spores were either simple or indistinctly septate. However, Müller & von Arx (13) found that the type was amerosporous, from which it becomes apparent that *Chromocreopsis* is identical with *Thuemenella*.

Thusfar *Thuemenella* has been known to have smooth spores only, so that the warted spores presently to be described in one of the species necessitate a slight emendation of the generic diagnosis.

THUEMENELLA Penz. & Sacc. emend.

Thuemenella Penz. & Sacc. *in* Malpighia **11**: 518. 1897. — Type species: *Thuemenella javanica* Penz. & Sacc.

Chromocreopsis Seaver *in* Mycologia **2**: 63. 1910. — Type species: *Hypocrea cubispora* Ell. & Holw.

Stromata superficial, hemispherical to subglobose, often irregularly lobed, smooth, fleshy, yellow or brown. Stromal tissue typically pseudoparenchymatous, hyaline to subhyaline, made up of angular, irregular, thin-walled cells. Cells of peripheral layer smaller, yellowish. Perithecia in a single layer, deeply immersed in the stroma; ostia hardly protruding; necks lined with periphyses; wall mostly distinct, yellow, consisting of a few layers of flattened cells. Asci originating from base of perithecium, typically elongated-cylindrical, narrow, thin-walled, with slightly thickened apical wall. Paraphyses thread-like, soon deliquescent. Spores uniseriate, 1-celled, subglobose to elongated or short-cylindrical, often subangular, smooth or finely warted, dark green changing to sepia in preserved specimens.

Special stress is laid on such characters as (i) the soft stroma which is made up of thin-walled cells, and (ii) the subglobose or somewhat elongated, subangular, and dark spores. The genus resembles *Creopus* Link, but has one-celled spores.

Sarawakus Lloyd (3) has only superficial resemblance to *Thuemenella*, differing from the latter as follows. The stromata are more or less corky and originate in large numbers from an extensive subiculum. The stromal tissue consists of cells with thickened cell-walls. The cortical layer is distinct and is made up of very thick-walled cells of which the lumina are nearly obliterated. The dark spores are ellipsoid. *Sarawakus* is most probably related to Xylariaceae.

THUEMENELLA JAVANICA Penz. & Sacc.

Thuemenella javanica Penz. & Sacc. *in* Malpighia **11**: 519. 1897.

Stromata waxy-fleshy, subglobose, depressed, irregular in outline, 3–7 mm diameter, smooth, yellow. Stromal tissue pseudoparenchymatous, consisting of irregular, thin-walled cells. Perithecia numbering more than 100 in large stromata, in a single layer, deeply immersed, subglobose, 110–150 μ diameter; ostia hardly protruding; necks lined with periphyses, 40–50 × 15–22 μ. Perithecial wall 14–16 μ thick, consisting of a few layers of much flattened cells. Asci originating from base of perithecia, long-cylindrical, short-stalked, thin-walled, with slightly thickened apical wall, 8-spored, 53–78 × 7–9 μ. Paraphyses thread-like, soon deliquescent. Spores uniseriate, subglobose to short-cylindrical, subangular, smooth, dark green changing to brown in preserved specimens, 6–8 μ diameter or 7–10 × 6–7 μ.

Java, Tjibodas, on dead branches, *Penzig 852*.

Thuemenella cubispora (Ell. & Holw.) Boedijn, *nov. comb.*

Hypocrea cubispora Ell. & Holw. *in* J. Mycol. **1**: 4. 1885 (basionym). — *Chromocreopsis cubispora* (Ell. & Holw.) Seaver *in* Mycologia **2**: 63. 1910.

Stromata scattered, tubercular, with free margin, more or less contracted at base and often becoming substipitate, 0.5–1 cm across and high, at first very bright lemon-yellow and appearing pruinose, often discolouring in dried specimens; surface scarcely wrinkled when dried, punctate from the slightly protruding perithecial necks which are filled with dark spores. Asci cylindrical, 8-spored. Spores subellipsoid or cubical, smoky brown, with 1–2 oil drops, 5–7 × 4–5 μ (description after Seaver).

Iowa and Jamaica, on decaying wood and bark.

This certainly is a good member of the genus.

Thuemenella hirsuta (Ell. & Ev.) Boedijn, *nov. comb.*

Hypocrea hirsuta Ell. & Ev. *in* Bull. Labs nat. Hist. Univ. Iowa **2**: 397. 1893 (basionym). — *Chromocreopsis hirsuta* (Ell. & Ev.) Seaver *in* Mycologia **2**: 64. 1910.

Stromata gregarious or crowded, subhemispherical, coriaceous-carnose, 2–3 mm diameter, discoid, with obscure margin, brown, yellowish-white inside, contracted below, centrally attached, clothed in brown, bristle-like, septate hairs of 100–200 × 4 μ, convex or plane above, slightly roughened by the protruding perithecial necks. Perithecia buried in the stroma, ovoid, about 0.5 mm high. Asci clavate-cylindrical, swollen at the tip, 100 × 10 μ. Spores navicular-oblong or unequally ellipsoid, brown, 7–8 × 3–3.5 μ (description after Seaver).

Nicaragua, Central America, on bark.

This seems a doubtful representative of the genus, but until the type can be reexamined, the species is tentatively placed here.

Thuemenella bicolor (Ell. & Ev.) Boedijn, *nov. comb.*

Hypocrea bicolor Ell. & Ev. *in* J. Mycol. **4**: 58. 1888 (basionym). — *Chromocreopsis bicolor* (Ell. & Ev.) Seaver *in* Mycologia **2**: 64. 1910.

Stromata gregarious or densely crowded, subpatellate or irregular from mutual pressure, slightly convex, 1–3 mm diameter, cinereous, becoming dull brownish black, white inside; margin free; upper surface wrinkled when dry, punctate from the perithecial necks. Perithecia subglobose, about 0.5 mm diameter. Asci cylindrical, 70 × 5 μ, 8-spored. Spores uniseriate, ellipsoid, with 2 oil drops, smoky brown, 5 × 2–3 μ (description after Seaver).

Kansas and Missouri to Louisiana, Nicaragua, Central America, on decaying wood.

This species has also to be studied anew in order to assess its proper taxonomic position.

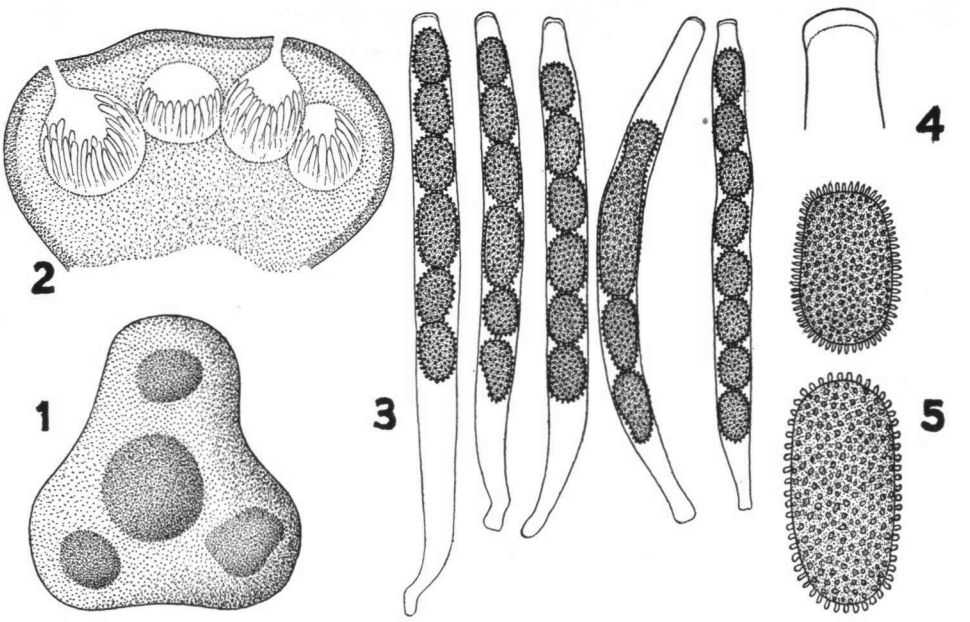
Thuemenella hexaspora Boedijn, *nov. spec.*—Figs. 1–5

Stroma subglobosum saepe irregulariter lobatum, glabrum, carnosum, luteum, parvum, 0.5—1 mm diam., 0.5 mm altus. Perithecia 2–12, omnino immersa, sphaerica, 216–288 μ diam. in collum breve 72–96 × 36-48 μ abrupte attenuata. Asci e basi perithecii oriundi, cylindracei, paraphysati, apice subtruncati, leniter incrassati, 3–8 plerumque 6 spori, 94–110 × 7–9.5 μ. Sporidiis breviter cylindraceis, verruculosis, atro-viridis, 12–26 × 7.5–12 μ.

Hab. in ramis corticatis emortuis. Typus: BO 11605.

Stromata soft fleshy, 0.5–1 mm diameter, up to 0.5 mm high, slightly irregularly lobed in outline, pale yellow (about Citron Yellow, Ridgway). Stromal tissue pseudoparenchymatous, consisting of hyaline to subhyaline, isodiametric to elongated, angular, thin-walled cells of variable size 5–26 μ long. Cells at the periphery smaller, very pale yellow. Perithecia 2–12, easily distinguishable under a handlens as grey-green spots, deeply immersed, in a single layer, globose, 216–288 μ diameter; necks 72–96 × 36–48 μ, lined with periphyses; ostia slightly protruding. Perithecial wall yellow, 12–14 μ thick, composed of a few layers of flattened cells 12–29 × 2–4.5 μ. Asci originating from base of perithecium, long-cylindrical, short-stalked, thin-walled, with slightly thickened cell-wall at attenuated apex, 3–8-spored, usually 6-spored, 94–110 × 7–9.5 μ. Spores uniseriate, irregular as to shape and size, mostly short-cylindrical with broadly rounded ends, but sometimes at one end attenuated, 12–26 × 9.5–12 μ, dark green, changing to sepia in preserved specimens, finely warted; contents homogeneous, usually with some indistinct oil drops. In 8-spored asci the spores are all nearly of the same size, but if there are fewer than 8, some spores are considerably larger, sometimes attaining a length of up to 50 μ. Larger spores often tend to have coarser warts. Paraphyses thread-like, soon deliquescent.

Java, Tjibodas, on dead branch, April 1930, *Boedijn 639* (BO 11605).



Figs. 1-5. *Thuemenella hexaspora* Boedijn — 1. Stroma seen from above. — 2. Section of stroma. — 3. Asci. — 4. Tip of ascus. — 5. Two spores, the larger one with slightly coarser warts.

In this remarkable species meiosis seems irregular and disturbed, which is apparent from the variable number and shape of the ascospores.

As already pointed out, Penzig & Saccardo placed *Thuemenella* in the Hypocreaceae, a family of Hypocreales. The Hypocreales, however, have been gradually abandoned by most authors, and the family transferred to the Sphaeriales, where the Hypocreaceae—a rather ill defined family—appeared not sharply delimited from the Nectriaceae. It is not surprising, therefore, that later authors tended to fuse both families. Munk (14) was the only author to keep the two apart, rightly so in my opinion. This also prevents the 'family' from becoming too unwieldy. Whereas I am in favour of distinguishing between Hypocreaceae and Nectriaceae, there now is a tendency with most authors also to accept a third family, the Hypomycetaceae, separated from the Nectriaceae. The two first-named families may be characterized as follows.

HYPOCREACEAE

Stromata superficial, subglobose, cushion-shaped, flattened or club-chaped, soft-fleshed but cottony in one genus, white, yellow, red, greenish or brown, composed of irregular, thin-walled cells. Perithecia 1-layered, deeply immersed, opening to the outside; necks more or less elongated, lined with periphyses; perithecial wall present although often inconspicuous. Asci originating from the bottom of the

perithecia, long-cylindrical, narrow, thin-walled, with weakly developed apical plate. Spores uniseriate, subglobose, short-cylindrical, or ellipsoid, 1-celled or mostly 2-celled (the cells often already separating in the ascus), colourless or green when fresh, brown or sepia in preserved material, smooth, punctate, finely echinulate or warted. Paraphyses thread-like, mostly soon deliquescent.

Conidial states as far as known representing *Trichoderma* Pers. ex Fr., *Cephalosporium* Corda, and *Stromatocrea* W. B. Cooke.

On dead vegetable material and soil.

The family comprises the following genera.

Thuemenella Penz. & Sacc. — A genus of which at present five species are known.

Hypocrea (Fr.) Fr. — This is by far the largest genus of the family: more than one hundred species have been assigned to it. It is well characterized by its two-celled, hyaline, ovoid or short-cylindrical spores, each of which fall apart into 2 part-spores while still in the ascus.

Creopus Link. — This is a genus of about nine species. Most of its characters are the same as those of the previous genus, but the spores are dark green, changing to brown in preserved specimens. Some authors, Dingley (10) and Müller & von Arx (13) unite the genus with *Hypocrea*, but I am not prepared to follow them. Many ascomycetous genera are distinguished on spore colour only; in Agaricales and Deuteromycetes spore colour is even of paramount significance. Spore colour in general is a character of great value for classification and identification of fungi.

Podostroma Karst. — A genus comprising nine species, and neatly defined by its club-shaped, often large stromata.

Hypocreopsis Karst. — I can distinguish only two species in this genus, viz. *H. riccioidea* (Bolt. ex Fr.) Karst. and *H. rhododendri* Thaxter. Both are well characterized by their large, radially lobed stromata and their two-celled, colourless spores which do not fall apart.

Except for *Dozya* Karst., the synonyms listed by Müller & von Arx (13) should be disconnected from *Hypocreopsis*. *Myrmaeciella* Lindau and *Porphyrosoma* Pat. do not belong to either Hypocreaceae or Nectriaceae. *Stilbocrea* Pat. on the other hand is a good nectriaceous genus to be placed in the neighbourhood of *Sphaerostilbe* Tul.

Phaeocreopsis Sacc. & Syd. apud Lindau. — There are two species, *P. hypoxyloides* (Speg.) Sacc. & Syd. and *P. pezizaeformis* Boedijn. The genus is characterized by a cushion-shaped stroma which is sometimes concave above and has the perithecia in a single layer at the upper side. The two-celled spores are brown and do not fall apart like in *Hypocrea*.

Protocrea Petch. — The three species of this genus are characterized by a loose, cottony subiculum which surround the perithecia. This character may be difficult to observe in preserved material, but this is no reason to ignore the character and to sink the genus into the synonymy of *Hypocrea*.

NECTRIACEAE

Perithecia subglobose to pear-shaped, single, scattered, gregarious, or arising from a subiculum or a stroma, not completely sunken in the stroma, but superficial or immersed with the base; perithecial wall consisting of several layers of cells, on the outside sometimes provided with warts, hairs, or other appendages; colour predominantly red or orange, sometimes also yellow or blue; ostia apical, more or less distinctly papillate; the canal leading to the ostia lined with periphyses. Asci mostly arising from bottom and sides of the perithecium, cylindrical, thin-walled, with small apical plate, sometimes with short stalk. Spores 1–2-seriate, elliposid to more or less elongated, 1–2-celled, many-celled to muriform, colourless or almost so, smooth, punctate, striate, or warted. Paraphyses thread-like, finally mostly deliquescent.

Conidial states representing *Fusarium* Link ex Fr., *Cylindrocarpon* Wollenw., *Cylindrocladium* Morgan, *Stilbella* Lindau, *Tubercularia* Tode ex Fr., and *Volutella* Tode ex Fr.

Saprophytic on vegetable matter, parasitic on plants or on insects, especially scale-insects, or hyperparasitic on the mycelium of leaf-fungi, especially Asterinaceae and Meliolaceae.

I take the genera listed below to be good members of the family, but many others are in need of critical study before they can be satisfactorily placed. The genera here accepted are: *Pseudonectria* Seaver, *Nectriella* Nitschke, *Nectria* Fr., *Mycocitrus* Möller, *Sphaerostilbe* Tul., *Stilbocrea* Pat., *Nectriopsis* Maire, *Calonectria* De Not., *Gibberella* Sacc., *Actiniopsis* Starb., and *Thyronectria* Sacc.

I would like to thank Prof. Dr. H. C. D. de Wit, Wageningen, for his help in preparing the Latin diagnosis.

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