

**Arachnopezizaceae** Hosoya, J.G. Han & Baral, fam.nov.**IF551075**

Apothecia 0.2–4 mm in diam.; hymenium plane, white to yellow-orange, also black; margin with short to long hairs; sessile, with ± conspicuous subiculum of partly warted and thick-walled hyphae. Ectal excipulum of hyaline or rarely brown *textura angularis*, towards margin *textura prismatica*, with partly thick-walled, glassy wall. Hairs cylindrical or tapering, also apically swollen, usually multiseptate, thin- or thick-walled, hyaline to yellowish, smooth or warted, crystals absent. Paraphyses cylindrical, hyaline, apically sometimes flexuous, without refractive vacuolar bodies. Asci with amyloid apical ring, with croziers. Ascospores 8 per ascus, 0–7-septate, with or without sheath or appendages. Anamorph unknown or *dwayaangam*-like (conidia *staurosporoides*). Sabrobic, lignicolous, herbicolous, also on living bryophytes, desiccation-sensitive.

Holotype: *Arachnopeziza* Fuckel 1870.

The genus *Arachnopeziza* forms a genetically well-defined group distant from *Hyaloscyphaceae* (Han et al. 2014). *Polydesmia* (*Hyaloscyphaceae* trib. *Polydesmieae*) and *Velutaria* Fuckel (≡ *Tapesina* Lambotte) were previously assigned to *Arachnopezizoideae* by Korf (1953); the former is genetically unrelated (Verkley 2005), the latter better treated in *Pezizellaceae* due to the presence of VBs and a *chalara*-like anamorph. The anamorph *Dwayaangam colodena* Sokolski & Bérubé is genetically similar to *Arachnopeziza* (Sokolski et al. 2006) but not to typical *Dwayaangam* spp. (*Orbiliomycetes*). Included genera: *Arachnopeziza* Fuckel, *Arachnoscypha* Boud., *Austropeziza* Spooner, *Eriopeziza* (Sacc.) Rehm, *Parachnopeziza* Korf.

**Chaetomellaceae** Baral, P.R. Johnst. & Rossman, fam.nov.**IF551076**

Apothecia 0.2–1 mm in diam., developing beneath epidermis, early erumpent, not forming a stroma, sessile to substipitate, opening in the prohymental phase; hymenium plane to convex, whitish, exterior ochraceous to red-brown, hairless or with scattered, long brown setae. Ectal excipulum of a subhyaline to red-brown, ± thick-walled *textura angularis*, towards margin of *textura prismatica-porrecta*; without crystals. Setae absent (*Pilidium*) or present (*Chaetomella*), dark brown but pale above, thick-walled, septate, smooth, apically subclavate, straight or sometimes strongly curled above. Paraphyses simple, apically branched, without refractive vacuolar bodies, with abundant extracellular, hyaline, resinous drops. Asci cylindrical-clavate, with rounded, thick-walled, inamyloid apex, arising from croziers (where known). Ascospores 8 per ascus, hyaline, ellipsoid-fusoid, 0-septate, without sheath, lipid content ± low. Anamorph with 2 synanamorphs: (1) pycnidial, ± sessile, dark brown to black, usually opening by fissures (in *Sphaerographium* with a rostrate ostium); (2) sporodochial (in *Synchaetomella* synnematal), sessile to long-stalked, externally ochraceous to brown; both conidiomata types smooth or with scattered brown setae similar to teleomorph; conidiogenesis phialidic, acropleurogenous; conidia similar to ascospores, often with pointed ends, straight or falcate, 0–1-septate. Parasitic or saprobic on leaves, also herbaceous stems and fruits of dicots, plurivorous or host-specific, desiccation-sensitive. Worldwide, temperate to subtropical.

Holotype: *Chaetomella* Fuckel 1870.

This group forms a well-defined clade unrelated to other families of *Helotiales* (Johnston et al. 2014a). *Zoellneria* was earlier confused with *Hymenotorrendiella* (*Helotiaceae*) due to its brown setae, while *Discohainesia* was misplaced in *Dermateaceae*. The two genera possess similar pycnidial and sporodochial synanamorphs. The so far purely anamorphic genera *Sphaerographium* and *Synchaetomella* are morphologically and genetically closely related to the above. *Encoelia fuckelii* Dennis belongs genetically in this family (K. Pärtel pers. comm.). *Pilidium* is a plurivorous weak parasite, causing e.g., leaf spot, attacking also fruits. Johnston et al. (2014b) suggested to adopt the more widely used anamorph names *Chaetomella* and *Pilidium* instead of *Zoellneria* and *Discohainesia*. Morphological treatments of the genera are found in Decock et al. (2005), Nannfeldt (1932), Rossman et al. (2004), and Shear & Dodge (1921). Included genera: *Chaetomella* Fuckel [anam.] (= *Zoellneria* Velen. [teleom.]), *Pilidium* Kunze [anam.] (= *Discohainesia* Nannf. [teleom.]; *Hainesia* Ellis & Sacc. [anam.]), *Sphaerographium* Sacc. [anam.], *Synchaetomella* Decock & Seifert [anam.].

**Chlorociboriaceae** Baral & P.R. Johnst., fam.nov.**IF551077**

Apothecia 0.5–10 mm in diam., disc- or cup- to ear-shaped, non-gelatinous, opening in the prohymental phase; hymenium pale to dark blue-green, rarely white; exterior smooth or felted, ± blue-green; (sub-)stipitate, erumpent or superficial, staining the substrate blue-green. Ectal excipulum of hyaline, vertically oriented *textura prismatica* or *textura intricata*, thick-walled, covered by dark green exudate; medullary excipulum of *textura intricata*, without crystals. Blue-green exudate in KOH reversibly turning yellow-green to ochraceous, not dissolved. Hairs (tomentum hyphae) on exterior present or absent, short, septate, straight to strongly coiling, hyaline or greenish, smooth or warted. Paraphyses filiform, without refractive vacuolar bodies. Asci with apical thickening with eu- or hemiamyloid ring (*Calycina*-type), with croziers. Ascospores 8 per ascus, ellipsoid-oblong to fusoid, cylindrical, or filiform, straight to slightly curved, hyaline, 0 (–3)-septate, without sheath, lipid content low to medium. Anamorph stromatic, greenish-black, multilocular; phialides with long collarettes; conidia rod-shaped. Lignicolous, also herbicolous or foliicolous, mainly desiccation-sensitive (but green stain developed in xeric wood). Worldwide, especially diverse in the Southern Hemisphere, temperate to subtropical.

Holotype: *Chlorociboria* Seaver ex C.S. Ramamurthi, Korf & L.R. Batra 1958.

Genetically, *Chlorociboria* occupies a rather isolated position within the *Helotiales*, showing a relationship with *Cyttariales* and *Erysiphales* (Schoch et al. 2009 suppl. fig. 6D, Wang et al. 2006a, b). *Encoelia glauca* Dennis belongs genetically in this family (K. Pärtel pers. comm.). Two genera, *Aeruginoscyphus* Dougoud and *Otwaya* G. Beaton, which are doubtfully distinct from each other, resemble *Chlorociboria* in staining the wood blue-green, but differ in a thin-walled *textura prismatica* oriented at a low

angle, covered by very long, thick-walled, septate hairs. Unpublished analyses of DNA sequence data of *Aeruginoscyphus* gained by G.J.M. Verkley (S. Helleman pers. comm.) suggest an unresolved position within the Helotiales. Representative treatments of *Chlorociboria* are found in Bellemère (1968), Johnston & Park (2005), and Tudor et al. (2014). Included genera: *Chlorociboria* Seaver ex Ramamurthi, Korf & L.R. Batra (= *Dothiorina* Höhn. [anam.]).

### **Godroniaceae** Baral, fam.nov.

#### **IF551083**

Apothecia 0.3–3.5 mm in diam., urceolate to saucer-shaped; hymenium pale to dark grey or cream, opening in the mesohymenial phase; margin strongly protruding, partly hairy, exterior often furfureous-tomentose or ribbed, rusty- to greenish- or blackish-brown; sessile or with short stalk, partly arising from a common base (stromatic), erumpent. Ectal excipulum at least near margin of hyaline to yellow-ochre *textura oblita* or dark brown *textura prismatica*, at base and flanks also *textura angularis*; medullary excipulum of reddish- to dark olive-brown *textura prismatica-porrecta*, subhymenium hyaline; without crystals, exudate in KOH often releasing a yellow-brown, rarely bluish-green pigment. Paraphyses filiform, apically often slightly inflated, without refractive vacuolar bodies, partly granular-encrusted by ochraceous, pinkish, or bluish exudate. Asci with hemispherical to conical apex with amyloid apical ring (Calycina-type) or inamyloid, with croziers. Ascospores 8 per ascus, ellipsoid to fusiform or clavate to vermiform or filiform, 0–7-septate, without sheath, lipid content low to rather high. Anamorph coelomycetous, stromatic, yellowish to blackish-brown, roundish to conical or discoid, uni- or multilocular; conidiogenesis phialidic; conidia ellipsoid to fusoid or vermiform, straight or falcate or helicoid, 0–7-septate. Parasitic on bark of woody gymnosperm and angiosperm plants, rarely monocots, desiccation-tolerant. Northern Hemisphere, temperate to subarctic-alpine.

Holotype: *Godronia* Moug. & Lév. 1846.

In phylogenetic analyses, the conifericolous genera *Ascocalyx* and *Gremmeniella*, which are important pathogens causing branch cankers and dieback of young shoots, are closely related to the angiosperm-inhabiting,  $\pm$  parasitic genus *Godronia* (Suija et al. 2014). The also parasitic conifericolous genus *Atropellis* is without GenBank data but matches *Ascocalyx* in the *Fuckelia* anamorph. The four genera differ in the ectal excipulum (*textura oblita* in *Godronia* and ?*Atropellis*) and ascus apex (amyloid in *Godronia*). Despite the ionomidotic reaction in *Godronia* and *Atropellis*, a relationship to *Cordieritidaceae* is genetically not supported, while a genetically suggested placement near *Mitruula* Fr. (*Mitruulaceae*) has little morphological support. Morphological treatments on these genera are found in Groves (1965), Reid & Funk (1966), and Schläpfer-Bernhard (1968). Included genera: *Ascocalyx* Naumov (= *Bothrodiscus* Shear [anam.]), *Atropellis* Zeller & Good., *Godronia* Moug. & Lév. (= *Scleroderris* (Fr.) Bonord., *Crumenula* De Not.; *Fuckelia* Bonord., *Topospora* Fr. etc. [anam.]), *Gremmeniella* M. Morelet (= *Lagerbergia* J. Reid; *Brunchorstia* Erikss. [anam.]).

### **Helicogoniaceae** Baral, fam.nov.

#### **IF551078**

Ascomata absent or present, circular, 0.04–0.6 mm in diam., semiglobose to pulvinate, light- or dark-coloured, often  $\pm$  gelatinous, margin smooth, opening in the prohymenial phase; (sub-)sessile, immersed, erumpent or superficial. Ectal excipulum of *textura prismatica-angularis* to *textura porrecta*, cells oriented at varying angles, often immersed in  $\pm$  abundant, hyaline to brownish gel. Paraphyses simple, apex inflated or not, straight or curved. Asci cylindrical-clavate, always inamyloid, opening by an apical slit, with or without croziers. Ascospores 8 per ascus, subglobose, ellipsoid, clavate, cylindrical or filiform, 0–1 (–3)-septate, lipid content low to high; frequently budding directly conidia (often as ascoconidia enclosed in 8 balls). Anamorph hyphomycetous, also pycnidial; conidiogenesis monoblastic, annelidic, or phialidic without collarette; conidia small, ellipsoid to cylindrical, sometimes with appendages (*Eleutheromyces*). Parasitic in hymenia of mainly discomycetes, basidiomycetes, thalli of lichens, ?also saprobic. Widespread, mainly temperate, desiccation-tolerant or not.

Holotype: *Helicogonium* W.L. White 1942.

The type genus *Helicogonium* forms only ascogenous hyphae, asci, and a phialidic hyphomycetous anamorph, and was previously placed in *Saccharomycotina* (Cain 1948, White 1942). The asci are formed in ascomata of *Leotio-* and *Orbiliomycetes* between their paraphyses, or in hymenia of basidiomycetes, and often produce ascoconidia. The parasitic mode of life is easily overlooked unless both types of meiosporangia are present (Baral 1999). Fruitbody-forming teleomorphs here tentatively included in the family appear to represent ancestors of *Helicogonium* because of their similar inamyloid asci, budding ascospores (*Gelatinopsis polyconidiata* Baral & G. Marson with balls of ascoconidia), and fungicolous growth (*G. hysteroapatellae* Baral & G. Marson with reduced apothecia immersed in hymenium of host, Baral & Marson 2001). DNA sequences are available only for *Gelatinipulvinella* (Hosoya & Otani 1995), *Geltingia* and *Eleutheromyces* (Suija et al. 2014), which cluster in a clade with *Phacidiaceae* and *Tympanidaceae*. Included genera: *Eleutheromycella* Höhn. [anam.], *Eleutheromyces* Fuckel [anam.], *Gelatinipulvinella* Hosoya & Y. Otani (= *Aureohyphozyma* Hosoya & Y. Otani [anam.]), *Calloriopsis* Syd. & P. Syd., *Gelatinopsis* Rambold & Triebel, *Geltingia* Alstrup & D. Hawksw., *Helicogonium* W.L. White (= *Myriogonium* Cain) (without ascomata).

### **Marthamycetaceae** Baral, Lantz, Hustad & Minter, fam.nov.

#### **IF551080**

Ascomata apothecial, 0.3–8 mm in diam., circular to elongate, partly confluent, lenticular in cross section when young, developing within substrate, erumpent, cleistohymenial (opening in the mesohymenial phase), covering layer splitting into  $\pm$  irregular lobes or teeth with adhering host tissue; hymenium white, cream or blue-green-grey, rarely yellow or orange-rose,  $\pm$  pruinose, closing on drying or not, exterior pale to dark, lobes sometimes white-fimbriate. Ectal excipulum  $\pm$  reduced, of isodiametrical, hyaline to dark brown cells, crystals sometimes present in lobes, inner face of lobes often entirely covered by more hyaline periphysoids not embedded in gel. Paraphyses densely septate, frequently anastomosing, apically unbranched or often branched and flexuous, covered by granular exudate. Asci cylindrical-clavate, apex rounded or conical, thick- or thin-walled, inamyloid, rarely with amyloid ring, arising from croziers. Ascospores 8 per ascus, rarely polysporous, ellipsoid to cylindrical or filiform, non- or transversely 1–7 (–13)-septate, rarely muriform, straight or curved, hyaline, without sheath, lipid content low to high. Anamorph unknown. Saprobic on leaves or woody plant substrate, desiccation-tolerant. Worldwide, tropical to arctic-alpine.

Holotype: *Marthamycetes* Minter 2003.

This group, which was formerly named propoloid fungi, is here considered to deserve the rank of a family. It does not cluster with the Rhytismataceae, where it was traditionally placed, nor with the Phacidiaceae, instead it is found unresolved at the base of the Helotiales. Due to a very different ascoma structure it should not be included in the Helotiales. In the two available phylogenetic analyses (Hustad & Miller 2011, Lantz et al. 2011), the family falls into two clades according to ascospore shape: (1) Propolis and Mellitiosporium (spores cylindrical-ellipsoid), and (2) Cyclaneusma, Marthamyces and Naemacyclus (spores filiform). The unsequenced Mellitiosporiella, Propolina and Phragmiticola might therefore belong to the former clade. Phragmiticola deviates from all others by amyloid apical rings similar to Phacidiaceae, Propolina by multispored asci, and Mellitiosporium by muriform spores. A survey on Marthamyces (as Propolis) is found in Sherwood (1977), and on Propolis in Minter (2003). Included genera: Cyclaneusma DiCosmo, Peredo & Minter, Marthamyces Minter, Mellitiosporiella Höhn. (?= Propolidium Sacc.), Mellitiosporium Corda, Naemacyclus Fuckel (= Lasiostrictis (Sacc. & Berl.) Sacc.), Phragmiticola Sherwood, Propolina Sacc., Propolis (Fr.) Corda (= Propolomyces Sherwood).

### **Tympanidaceae** Baral & Quijada, fam.nov.

#### **IF551081**

Ascomata apothecial,  $\pm$  circular, 0.15–3 mm in diam. (rarely 3–11 mm, Holwaya), sometimes in dense aggregations, often slightly gelatinous, opening in the mesohymenial phase; sessile or stalked, erumpent or superficial; pale cream to red-brown, blue-green, or mostly dark olivaceous to black; margin and exterior smooth or powdery, rarely with marginal lobes, not closing on drying. Ectal excipulum of textura globosa to textura prismatica or textura intricata under a high angle, embedded in  $\pm$  abundant, pigmented exudate, pigment usually KOH-inert, rarely ionomidotic, strongly gelatinized or not; sometimes with crystals. Paraphyses cylindrical to capitate, straight, unbranched,  $\pm$  densely septate; embedded in hyaline or brownish mucilage or granular, amorphous exudate, without refractive vacuolar bodies. Asci cylindrical-clavate, inamyloid, rarely with amyloid apical ring incl. entire ascus wall, apically and/or laterally thick-walled, arising from croziers. Ascospores (4–)8 per ascus, globose, ellipsoid, or vermiform, hyaline, 0–15(–21)-septate, also with longisepta, lipid content low or high, multiguttulate; often budding numerous ascoconidia inside living asci enclosed in 8 balls. Anamorph pycnidial (Chondropodium, Collophora, Periperidium, Sirodothis), uni- or multilocular, also synnematal (Dendrostilbella, Crinula) or hyphomycetous (Myriodiscus). Conidiophores hyaline, phialidic, often acropleurogenous, also reduced; conidia minute, aseptate, ellipsoid, cylindrical or allantoid, but in Durandiella large, falcate, (1–)3-septate. Corticolous, lignicolous, or resinicolous, especially on conifers, also angiosperms and bamboo (Myriodiscus), often associated with necroses, also saprobic, desiccation-tolerant. Worldwide, mainly temperate.

Holotype: *Tympanis* Tode 1790.

Previously assigned to Bulgariaceae, Dermateaceae or Helotiaceae, the included genera are here placed together for their morphological and genetic resemblance. Phylogenetic analyses by Quijada & Baral (in prep.) suggest that the fam. Tympanidaceae forms a sister group to Phacidiaceae, from which it is morphologically quite different. The included genera share similar anamorphs (except for Durandiella) and inamyloid asci (except for Claussenomyces pseudotsugae (J.W. Groves) Ouell. & Piroz.). Collophora is genetically connected to Tympanidaceae, and resembles anamorphs of, e.g., Pragmopora. Chondropodium is similar to Micropera (Dermateaceae), but lacks a ionomidotic reaction. Micraspis (Phacidiaceae) is tentatively placed here mainly because of its budding ascospores and septate macroconidia (see DiCosmo et al. 1984). The production of ascoconidia is typical of Tympanis and Claussenomyces p.p. (probably also of Myriodiscus = Gelatinomyces, which is described as multispored). The genus Claussenomyces is heterogeneous and requires further investigation. Descriptions of the genera are found in Boedijn (1935), Damm et al. (2010), Groves (1954, 1967), Korf & Abawi (1971), Ouellette & Pirozynski (1974), and Sanoamuang et al. (2013). Included genera: Claussenomyces Kirschst. (= Dendrostilbella Höhn. [anam.]), Collophora Damm & Crous [anam.], Durandiella Seaver (= Chondropodium Höhn., Gelatinosporium Peck [anam.]), ?Micraspis Darker (= Periperidium Darker [anam.]), Myriodiscus Boedijn (= Ascotremellopsis Teng & S.H. Ou, = Gelatinomyces Sanoamuang, Jitjak, Rodtong & al.), Grovesiella M. Morelet, Holwaya Sacc. (= Crinula Sacc. [anam.]), Pragmopora A. Massal., Tympanis Fr. (= Sirodothis Clem. [anam.]).