

NOTES ON PSEUDOGYMNOASCUS, GYMNOASCUS AND RELATED GENERA

R. A. SAMSON

Centraalbureau voor Schimmelcultures, Baarn

SUMMARY

The genera *Pseudogymnoascus* and *Gymnoascus* are revised. *Pseudogymnoascus* is considered to be distinct from *Gymnoascus* by the ellipsoidal to fusiform ascospores and by the morphology of the ascomatal initials. Three species of *Pseudogymnoascus*, including a new species, *P. bhattii*, are described. In the genus *Gymnoascus* 4 species are recognized. The relationship of *Gymnoascus* to *Myxotrichum*, *Pectinotrichum*, and *Neogymnomyces* and the systematic position of *Auxarthron* are discussed.

Although the Gymnoascaceae have been studied by many mycologists, much confusion still exists about the delimitation of some genera and species. In the past much attention has been paid to the taxonomic value of the peridial hyphae and their appendages. A recent comparison of a large number of strains revealed that these characters vary in the different states of development and on different nutrient media. A generic delimitation on differences of peridial hyphae and appendages seems therefore unsatisfactory. More reliable characters proved to be the shape of the ascospores, the structure of the asci, and the morphology of the ascomatal initials (VON ARX 1971).

In this paper the results of a study of the cultures of *Pseudogymnoascus* and *Gymnoascus* present in the CBS-collection are given. Furthermore the relationship of these two genera to other Gymnoascaceae is discussed.

PSEUDOGYMNOASCUS

Pseudogymnoascus Raillo in Zentbl. Bakt. ParasitKde (Abt. 2) 78: 520. 1929.

Ascomatal initials consisting of coiled ascogonia without a recognizable antheridium, borne as branches on the vegetative hyphae, producing loose wefts of ascogenous hyphae inside hyphal tufts; ascomata globose, discrete or confluent, in yellow, red, or brown shades; the peridium consisting of a network of loose wefts of mostly thin, twisted and interwoven hyphae which are smooth or encrusted with granules, becoming more darkly pigmented and thick-walled with age; appendages not distinct or simple, mostly short, thin-walled and unbranched, echinulate or covered with warts; asci 8-spored, globose to ovoid, mostly with a cylindrical stalk formed by croziers; ascospores one-celled, ellipsoid to fusiform, smooth, hyaline, yellowish or pinkish.

Imperfect state absent or represented by arthro- or aleurioconidia. Type species: *Pseudogymnoascus roseus* Raillo.

RAILLO (1929) distinguished the genus *Pseudogymnoascus* from *Gymnoascus* by the absence of spine-like projections of the peridial hyphae. Although no type material is available, there is now general agreement about the identity of the species from several cultures, most of which were isolated from soil. APINIS (1964) redescribed the species but reduced *Pseudogymnoascus* to subgeneric rank in *Gymnoascus*. The genus *Pseudogymnoascus* was maintained by CEJP & MILKO (1966) and the description of a third species, *P. caucasicus*, was given.

The absence of the spine-like projections of the peridial hyphae as suggested by RAILLO (1929) is not a sufficient criterion for separating *Pseudogymnoascus* from *Gymnoascus*. APINIS (1964) has already shown that short, thin-walled appendages are usually present in *P. roseus* and therefore he transferred the two species of *Pseudogymnoascus* to *Gymnoascus*. The study of the CBS-strains showed, however, that the genus *Pseudogymnoascus* may be retained on account of the fusiform shape of the ascospores, whereas ascospores of typical *Gymnoascus* species are oblate and those of the species belonging to *Auxarthron* are globose, thick-walled and ornamented. In *Pseudogymnoascus*, furthermore, the ascomatal initials consist of a loosely coiled ascogonium, whereas in *Gymnoascus* and *Auxarthron* they are usually formed by a swollen antheridium and a coiled ascogonium.

1. *Pseudogymnoascus roseus* Raillo in Zentbl. Bakt. ParasitKde (Abt. 2) 78: 520. 1929.

Gymnoascus roseus (Raillo) Apinis in Mycol. Pap. No. 96: 8. 1964.

Pseudogymnoascus vinaceus Raillo in Zentbl. Bakt. ParasitKde (Abt. 2) 78: 520. 1929.

Gymnoascus vinaceus (Raillo) Apinis in Mycol. Pap. No. 96: 9. 1964.

Gymnoascus rhougiogongylinus Wener & Cain in Can. J. Bot. 48: 325. 1970.

The *Chrysosporium* conidial state was described as *Geomyces vinaceus* Dal Vesco in Allionia 3: 14. 1957.

Ascomata globose, at first white, becoming pinkish to yellow and changing to yellow brown or reddish with age, 40–250 μ in diameter; vegetative hyphae septate, smooth, 1–3 μ in diameter, hyaline at first, then turning yellow or brownish; peridial hyphae consisting of a network of interwoven hyphae which are smooth to roughened, 2.2–3.5 μ in diameter, at first hyaline, later becoming yellow-brown to reddish and thick-walled; appendages simple, short, blunt, straight, thin-walled and up to 15 μ in length, roughened or covered with spines or warts; asci globose to ovoid, with cylindrical stalks, 5–7 μ in diameter; ascospores ellipsoid to fusiform, smooth, yellow to pinkish, yellow-brown to red-brown in mass, 3–4 \times 2–2.5 μ in size.

Imperfect state usually present as aleurioconidia, which are globose to ellipsoid with a truncate base, hyaline, 2–4.5 \times 1.5–2.5 μ .

Material examined:

CBS 395.65 = IMI 114.651 = BDUN 266, neotype of *P. roseus*, isolated from alluvial swamp soil in the Trent Valley near Attenborough, Nottinghamshire, Great Britain, by A. E. Apinis, 1949.

- CBS 387.69, isolated by P. Widden from Lodgepole pine soil (*Pinus contorta*), Kananaskis, Alberta, Canada, and sent to the CBS by G. C. Bhatt.
- CBS 691.71, isolated from alpine soils, 2400 m, 3–7.5 cm deep, Mt. Allen, Kananaskis, Alberta, Canada, isolated by J. Bissett, sent to the CBS by G. C. Bhatt.
- CBS 390.54, *P. vinaceus*, isolated from soil at Petersham, Massachusetts, USA, in 1949 by F. L. Raymond.
- CBS 319.62, *P. vinaceus*, from *Larix decidua* in Italy, isolated by G. Dal Vesco.
- CBS 320.62, from soil of a field near Turin, Italy and sent by G. Dal Vesco as type strain of *Geomyces vinaceus*.
- CBS 722.69 = TRTC 45536, type culture of *Gymnoascus rhouxiogongylinus*, isolated from soil by H. W. Wener, Ontario, Canada.
- CBS 605.70, isolated by K. H. Domsch from soil in Braunschweig (Germany).
- CBS 261.61, *Gymnoascus* spec., isolated from soil and sent for identification by C. A. Ghillini, Padua (Italy), det. D. I. Fennell. In this strain no imperfect state was found on any medium. The ascomata are white when young, becoming reddish with age. Some thick-walled peridial hyphae are present.

RAILLO (1929) described *P. roseus* and *P. vinaceus* and separated them only on account of the colour of the ascomata which are dark red in *P. vinaceus* and pinkish in *P. roseus*. APINIS (1964) distinguished the two species on the basis of the shape of the ascospores and the presence or absence of thickenings at the nodes of the peridial hyphae. The ascospores of *P. roseus* were described as being fusiform, whereas those of *P. vinaceus* were said to be lenticular. Because of the lenticular ascospores and the dark red ascomata *P. vinaceus* sensu Apinis might be *Gymnoascus reessii*.

Pinkish as well as dark red ascomata were present in the different states of development in the various strains and therefore *P. vinaceus* and *P. roseus* should be regarded as synonyms. The name *P. roseus* is chosen for the species and CBS 395.65 is suggested as the neotype.

G. rhouxiogongylinus was described by WENER & CAIN (1970) as distinct from *P. roseus* by its greenish ascospores. In the type culture, CBS 722.69, ascospores were found to be yellow when viewed singly, and yellow brown in mass. For this reason the species is considered to be indistinguishable from *P. roseus*.

2. *Pseudogymnoascus bhattii* Samson, *spec. nov.*

Ascomata discreta vel confluentia, globosa, 75–300 μ diametro, celeriter formata, 14 diebus maturantia 20°C in agar farina avenae addita; primum flava velut sulphurea, maturitate convertentia ad ochracea vel fulva; odor abest; reversum flavum vel brunneolum; hyphae vegetativae septatae, leves, 0.7–2 μ diametro, mycelium aerium sparsum; initialia ascotum irregularia e ramis lateralibus hypharum vegetativarum oriuntur; consistunt ex ascogonio convoluto, formantia glomum laxum; peridium e reticulo hypharum intricatarum constat, plerumque dilute pigmentatum et granulis flavis incrustatum, demum obscurius, appendicibus absentibus, hyphis 1.2–2.2 μ crassis compositum; asci globosi vel ovoidei, 8-sporei, plerumque pedicello cylindrico brevi praediti, ex hamis oriuntur, 5–6 \times 4.5–6.5 μ ; ascosporae continuae, fusiformes, plerumque latere uno complanatae, leves, hyalinae vel dilute flavae, agglomeratae flavae, 3.5–5.7 \times 2.0–2.7 μ status conidicus non visus.

Typus: CBS 760.71, isolatus a J. Bissett ex solo alpino, Mt. Allen, Alberta, Canada, 1963.

Etym.: The species is described in honour of the late Indian mycologist Ghirish Chandra Bhatt.

Ascomata discrete or confluent, globose, 75–300 μ in diameter, developing rapidly and ripening within 14 days at 20°C on oatmeal agar; colonies at first yellow near Sulphur Yellow (RIDGWAY 1912, Pl. 5; RAYNER 1970, 25 f) and Picric Yellow (RIDGWAY, Pl. 4; RAYNER, 23 d), in age changing to yellow brown near Ochraceous Buff and Ochraceous Tawny (RIDGWAY, Pl. 15; RAYNER, 15'b, 15'i); odour absent; reverse in yellow to brown shades; vegetative hyphae septate, smooth, 0.7–2 μ in diameter, aerial mycelium scarcely produced; initials irregular, produced as side-branches of vegetative hyphae, consisting of a coiled ascogonium, developing in a loose knot; peridium consisting of a network of interwoven hyphae, usually slightly pigmented and encrusted with yellow granules, becoming more darkly pigmented with age, the hyphae measuring 1.2–2.2 μ in diameter, without distinct appendages; asci globose to ovoid, 8-spored, usually with a cylindrical stalk and produced from croziers, 5–6 \times 4.5–6.5 μ in size; ascospores one-celled, fusiform, usually with one side flattened, smooth, hyaline to yellowish, yellow in mass, 3.5–5.7 \times 2–2.7 μ in size; imperfect state not observed.

Material examined:

CBS 760.71, type culture of *P. bhattii*, strain JB 95 isolated by J. Bissett from alpine soils, 2400 m, 2–7.5 cm deep, Mt. Allen, Alberta, Canada, in 1963 and sent to the CBS by G. C. Bhatt as "Gymnoascaceae species".

CBS 761.71, received as strain F-72 and sent for identification by P. W. Flanagan (Alaska).

CBS 762.71, isolated from the same locality as CBS 760.71, but from 7.5 to 15 cm deep and sent to the CBS as JB 135.

The fungus is known only from alpine soils in Canada (Mt. Allen, Alberta) and in Alaska. Experiments on the influence of the temperature show that the species grows within the temperature range of 10° and 25°C. Optimal growth occurs at 20°C.

P. bhattii is characterized by the yellow ascomata and the absence of distinct peridial appendages. Moreover, an imperfect state, as in *P. roseus*, is not produced.

P. bhattii shows some resemblance to *Arachniotus hebridensis* as described by APINIS (1964). According to the description, *A. hebridensis* should form golden yellow ascomata with a peridium of loosely interwoven hyphae. Unfortunately the type strain failed to produce the perfect state (VON ARX 1971) and has been reidentified as *Chrysosporium merdarium* (Link) Carmichael.

3. *Pseudogymnoascus caucasicus* Cejp & Milko in Česká Mykol. 20: 161. 1966. No ascomata were observed in the type culture. The fungus produces only stalked chlamydospore-like structures, which were described by CEJP & MILKO (1966) as belonging to the genus *Sepedonium* Link. According to the description the ascospores are fusiform, while the ascomatal initials are of the *Pseudogymnoascus* type.

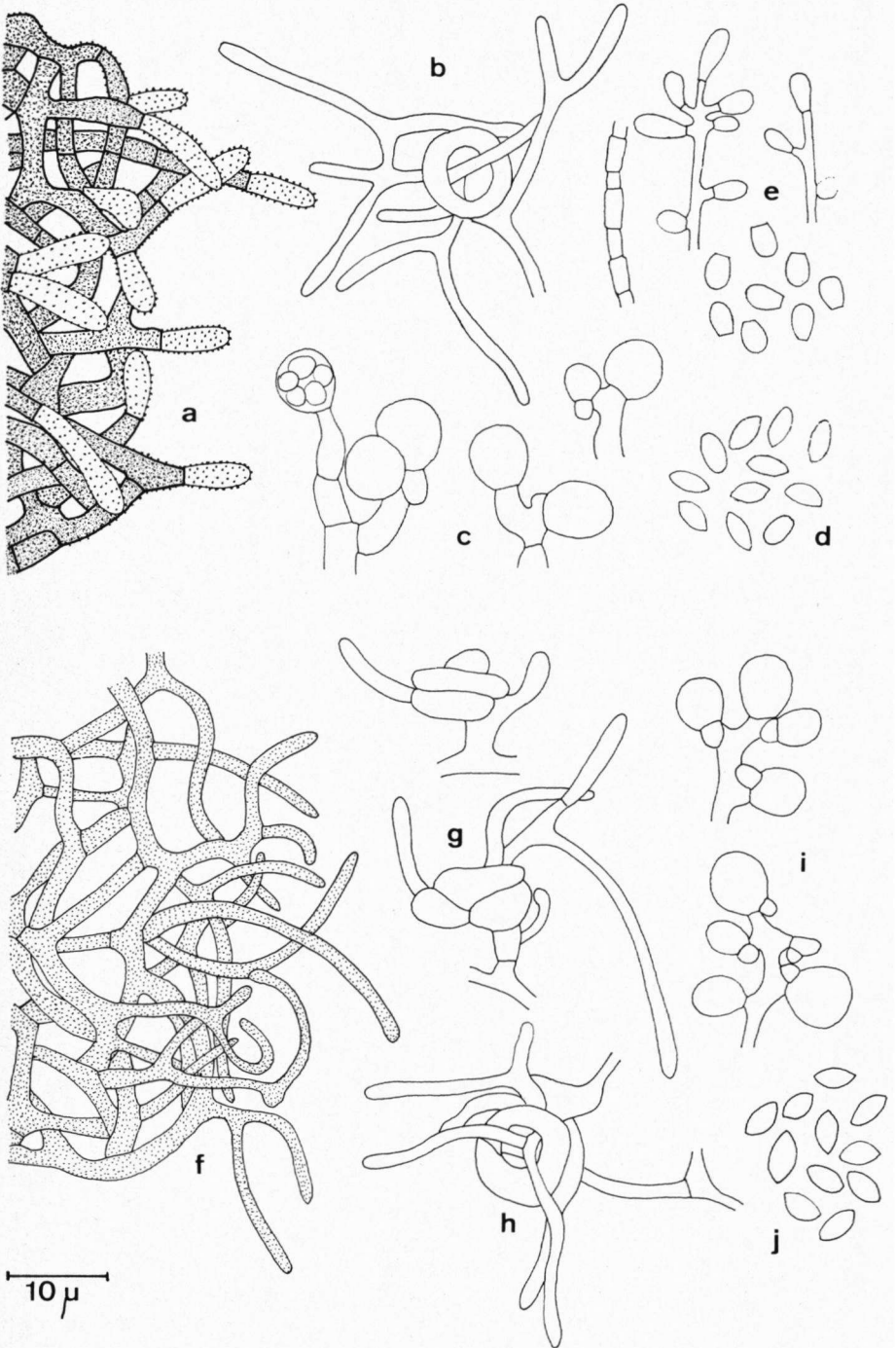


Fig. 1. a-e: *Pseudogymnosascus roseus*, a. part of peridium, b. ascomatal initials, c. formation of asci, showing croziers and stalked asci, d. ascospores, e. *Chrysosporium* conidial state. f-j: *Pseudogymnosascus bhattii*, f. part of peridium, g-h. ascomatal initials, i. formation of asci, j. ascospores.

Material examined:

CBS 373.67 = Type culture of *P. caucasicus*, isolated from forest soil in 1964 near Lake Riza, Caucasus, USSR, sent to the CBS by O. Fassatiová.

GYMNOASCUS

Gymnoascus Baranetzky in Bot. Ztg 30: 158. 1872.

Ascomatal initials consisting of swollen antheridia and coiled ascogonia, produced as outgrowths of vegetative hyphae; after copulation the initials becoming coiled, developing in a compact mass of ascogenous hyphae; ascomata globose, discrete or confluent, in yellow, yellow-brown, red-brown, or brown shades; the wall consisting of a network of loose wefts of pigmented, sometimes elongated, thick-walled hyphae; appendages hook- or spine-like, usually short, straight or uncinat, smooth or echinulate; asci 8-spored, globose to broadly clavate, stalked, produced from croziers; ascospores one-celled, oblate, hyaline to yellowish, smooth.

Imperfect state absent or represented by arthro- or aleurioconidia. Type species: *Gymnoascus reessii* Baranetzky.

The genus *Gymnoascus* was revised by ORR *et al.* (1963a) with the recognition of 5 species. In subsequent papers several species, formerly described as *Gymnoascus*, were transferred to *Auxarthron* (ORR *et al.* 1963d). In his revision of British Gymnoascaceae, APINIS (1964) proposed a wider concept of the genus *Gymnoascus* and included in it *Pseudogymnoascus* and *Auxarthron*.

ORR (1970) erected a new genus, *Neogymnomyces*, to accommodate *Gymnoascus demonbreunii* Ajello & Cheng (1967). *Neogymnomyces* was said to differ from *Gymnoascus* by the hyaline, sinuous, blunt, peridial hyphae, which are rounded at the ends. The examination of cultures of *N. demonbreunii* (CBS 427.70 and others) showed that the ascospores are oblate, while the ascomatal initials are of the same type as in other species of *Gymnoascus*. In addition the ascospores were not smooth-walled as in other species of *Gymnoascus*, but covered with fine echinulations. The genus *Neogymnomyces* is closely related to *Gymnoascus* and the distinction between the two genera seems to be arbitrary.

The main distinction between *Gymnoascus* and *Myxotrichum* is, according to ORR *et al.* (1963d), the presence of hooks or spines in ascomata of the former and the presence of short spines and elongate appendages on ascomata of the latter. Moreover, *Myxotrichum* can be easily distinguished from *Gymnoascus* by the dark peridium. In *Myxotrichum*, furthermore, the ascospores are ellipsoid or broadly fusiform, as in *Pseudogymnoascus*. The genus *Pectinotrichum* Varsavsky & Orr, type species *P. llanense* Varsavsky & Orr, has several characters in common with *Myxotrichum*, but differs by oblate ascospores, the structure of the peridium, and the nature of the conidial state. VARSAVSKY & ORR (1971) characterized the genus by the light ascomata and the pectinate appendages. In the type strain of *Pectinotrichum llanense* the ascomata are brown at maturity, while the appendages are straight and only brownish pigmented.

MOREAU *et al.* (1959) indicated a relationship of the new genus *Gymnoascopsis* with *Gymnoascus*. This genus is characterized by clavate asci and multiseptate ascospores. It may be related to *Ascosorus* P. Henn. & Ruhl as redescribed by VON ARX (1963). These two discomycete-like genera are only known as herbarium specimens.

1. *Gymnoascus reessii* Baranetzky in Bot. Ztg 30: 158. 1872.

Myxotrichum coprogenum Sacc. in *Michelia* 2: 372. 1874.

Myxotrichum coprogenum var. *malacense* Sacc. & Paol. in *Syll. Fung.* 10: 593. 1892.

Gymnoascus reessii var. *deilephilae* P. Hennings in *Hedwigia* 42: 185. 1903 (Beiblatt).

Gymnoascus corniculatus Orr & Plunkett apud Orr & al. in *Mycopath. Mycol. appl.* 21: 11. 1963.

Ascomata globose, in yellow to red brown shades, 50–450 μ in diameter; peridial hyphae smooth to roughened, bearing short, branched or unbranched, thick-walled appendages up to 25 μ in length; asci globose to clavate, 8–11 μ in diameter; ascospores oblate, yellowish, 2.5–4.2 \times 1.5–3 μ in size; imperfect state absent.

For a detailed description see ORR *et al.* (1963a: 2; 1963b: 135–158) and BENJAMIN (1956: 315).

The taxa listed above can be considered as synonyms of *G. reessii*, because the original descriptions prove their identity. ORR *et al.* (1963a) stated that *G. corniculatus* is very similar to *G. reessii* and may be considered as merely a variety of that species. The comparison of the strains designated as *G. corniculatus* by ORR *et al.* (1963a) with other strains identified as *G. reessii* showed the identity of the two taxa.

Material examined:

CBS 111.12, received from E. Dale.

CBS 102.20, received from R. E. Clausen.

CBS 259.61, isolated from soil, Sahara, received from J. Nicot.

CBS 260.61, isolated from rabbit dung by G. F. Orr, San Diego, California, USA.

CBS 391.64 = NRRL A-10.225 = 0-162, isolated from lizard dung by G. F. Orr, Oildale, California, USA.

CBS 392.64, isolated by G. F. Orr from soil in California, USA.

CBS 497.64, isolated by W. Gams from soil of a wheatfield at Kiel (Germany).

CBS 462.62 = NRRL A-10.097 = 0-217, *G. corniculatus*, isolated from soil near Inyokern, California, USA.

CBS 410.72 = NRRL A-10.099, type culture of *G. corniculatus*, isolated from soil, Loalinga, California, USA, and received from D. I. Fennell, Peoria.

CBS 409.72 = NRRL A-10.076, isolated from the same locality as CBS 410.72 and received as *G. corniculatus* from D. I. Fennell, Peoria.

2. *Gymnoascus longitrichus* Orr & Kuehn apud Orr & al. in *Mycopath. Mycol. appl.* 21: 9. 1963.

Ascomata globose, in yellow to yellow brown shades, 50–250 μ in diameter; peridial hyphae smooth to roughened, bearing short as well as long appendages which are elongate and curved at the apex, up to 450 μ in length; asci globose to

subglobose, 6–8 μ in diameter; ascospores oblate, yellowish, $3\text{--}3.7 \times 2.2\text{--}3 \mu$ in size.

For a detailed description see ORR *et al.* (1963a: 9).

Material examined:

CBS 366.64 = IFO 8167 = 0–32, type culture of *G. longitrichus*, isolated from soil, Mercy Hot Springs, California by G. F. Orr.

CBS 350.64 = 1–160, isolated from the same locality by G. F. Orr.

3. *Gymnoascus uncinatus* Eidam in Cohn, Beiträge Biol. Pfl. 3: 292. 1880.

Myxotrichum uncinatum (Eidam) Schroeter in Cohn, Krypt.-Fl. Schles. 3 (2): 212. 1893.

Ascomata globose, in yellow to brown shades, 150–1000 μ in diameter; peridial hyphae smooth to roughened, bearing short and long appendages which are elongated and usually uncinata at the apex, up to 300 μ in length; asci globose to ovoid, 6–9 μ in diameter; ascospores oblate, yellowish, $2.5\text{--}5.5 \times 1.5\text{--}3.2 \mu$ in size; imperfect state *Chrysosporium*-like.

For a detailed description see ORR *et al.* (1963a: 5).

Material examined:

CBS 164.26, received from A. Nannizzi.

CBS 507.65 = IMI 111.025 = ATCC 16006, isolated by E. Varsavsky from soil in Italy and sent to the CBS by G. F. Orr.

CBS 408.72 = NRRL 3610, neotype of *G. uncinatus*, isolated by R. K. Benjamin from dung, received from D. I. Fennell, Peoria.

4. *Gymnoascus dugwayensis* Orr & Kuehn in Mycologia 64: 65. 1972.

The fungus was described by ORR & KUEHN (1972) as producing yellow-orange or green ascomata bearing short simple or branched appendages and oblate ascospores, $3.6\text{--}4.0 \times 2.0\text{--}2.7 \mu$ in size. *G. dugwayensis* differs from the other species of *Gymnoascus* by the presence of appendages possessing apically recurved hooks.

Doubtful species:

The following species are regarded as doubtful, because no type material was available or the descriptions are too scanty.

G. aurantiacus (Peck) Sacc. in Syll. Fung. 8: 823. 1889. – *Gymnoascella aurantiaca* Peck in J. Mycol. 1: 57. 1885.

G. bourquelotii Boudier in Bull. Soc. mycol. Fr. 8: 44. 1892.

G. candidus Eidam in Jber. schles. Ges. vaterl. Kult. 6: 161. 1887. – *Arachniotus candidus* (Eidam) Schroeter.

G. durus Zukal in Ber. dt. bot. Ges. 8: 295. 1890.

G. johnstonii (Masse & Salmon) Orr & Kuehn in Mycopath. Mycol. appl. 21: 8. 1963. – *Myxotrichum johnstonii* Masee & Salmon in Annls Bot. 16: 64. 1902.

No type material of this fungus is known. The transfer to *Gymnoascus*, proposed by ORR *et al.* (1963a), is based on Masee's drawings in NY. Until

the fungus is found again, *Myxotrichum johnstonii* may be better regarded as a doubtful species.

G. myriosporus Rostrup in Meddr. Grønland 18: 12. 1894.

G. ossicola Rostrup in Bot. Tidsskr. 21: 45. 1897. – *Nannizzia ossicola* (Rostrup) Apinis. – *Rollandina ossicola* (Rostrup) Apinis.

G. (Myxotrichum) racovitzae Lagarde in Archs Zool. exp. gén. 53: 281. 1913.

G. reticulatus Zukal in Verh. zool.-bot. Ges. Wien 37: 40. 1887.

ORR *et al.* (1963b) proposed the name *Auxarthron reticulatum* (Zukal) Orr & Kuehn. However, the fungus was described as having smooth, more or less lenticular ascospores. The description and illustrations given by ZUKAL (1887) indicate that *G. reticulatus* might be identical with *G. reessii*. Unfortunately the type is not available for study.

Excluded species:

G. aureus Eidam in Jber. schles. Ges. vaterl. Kult.: 64: 161. 1887. – *Amauroascus aureus* (Eidam) von Arx.

G. brevisetosus Kuehn in Mycologia 48: 813. 1956. – *Auxarthron zuffianum* (Morini) Orr & Kuehn.

G. californiensis (Orr & Kuehn) Apinis in Mycol. Pap. No. 96: 12. 1964. – *Auxarthron californiense* Orr & Kuehn.

G. confluens Sart. & Bain. in Bull. Soc. mycol. Fr. 29: 261. 1913. – *Arachniotus confluens* (Sart. & Bain.) Apinis. – *Arachniotus citrinus* Masee & Salmon, see also VON ARX (1971).

G. demonbreunii Ajello & Cheng in Mycologia 59: 682. 1967. – *Neogymnomycetes demonbreunii* (Ajello & Cheng) Orr.

G. eidamii Cocconi in Memorie R. Accad. Sci. Ist. Bologna 5 (2): 32. 1891. – *Auxarthron zuffianum* (Morini) Orr & Kuehn.

G. flavus Klöcker in Hedwigia 41: 80. 1902. – *Talaromyces flavus* (Klöcker) Stolk & Samson (1972).

G. gypseus Nannizzi in Atti Accad. Fisiocr. Siena 2: 94. 1927. – *Nannizzia gypsea* (Nannizzi) Stockdale.

G. luteus Sacc. in Syll. Fung. 11: 437. 1894. – *Talaromyces luteus* (Sacc.) Stolk & Samson (1972).

G. rousiogongylinus Wener & Cain in Can. J. Bot. 48: 325. 1970. – *Pseudogymnoascus roseus* Rallo.

G. ruber van Tieghem in Bull. Soc. bot. Fr. 24: 159. 1877. – *Arachniotus ruber* (van Tieghem) Schroeter.

G. setosus Eidam in Bot. Zentbl. 10: 107. 1882. – *Myxotrichum setosum* (Eidam) Orr & Kuehn.

G. stipitatus Lindfors in Svensk. bot. Tidsskr. 14: 270. 1920. – *Myxotrichum stipitatum* (Lindfors) Orr & Kuehn.

G. subumbrinus A. L. Smith in Trans. Br. mycol. Soc. 5: 424. 1917. – *Auxarthron umbrinum* (Boudier) Orr & Kuehn.

G. sudans Vailonis in Vytauto Didž. Univ. mat. gamos Fak. Darb. 11: 115. 1963. – *Byssochlamys nivea* Westling (see STOLK & SAMSON, 1971).

G. umbrinus Boudier in Bull. Soc. mycol. Fr. 8: 43. 1892 – *Auxarthron thaxteri* (Kuehn) Orr & Kuehn. – *G. umbrinus* Boudier var. *thaxteri* (Kuehn) Apinis in Mycol. Pap. No. 96: 14. 1964. – *Auxarthron umbrinum* (Boudier) Orr & Kuehn.

G. verrucosus Eidam in Jber. schles. Ges. vaterl. Kult. 64: 162. 1887. – *Amauroascus verrucosus* (Eidam) Schroeter.

G. verticillatus A. L. Smith in Trans. Br. mycol. Soc. 1: 154. 1896. – *Actinodendron verticillatum* (A. L. Smith) Orr & Kuehn.

According to HUGHES (1968) and ORR & KUEHN (1971), these names must be rejected, because the type material proved to be identical with the hyphomycete *Oncocladium flavum* Wallroth.

G. vinaceus (Raiillo) Apinis in Mycol. Pap. No. 96: 9. 1964. – *Pseudogymnoascus roseus* Raiillo.

G. zuffianus Morini in Memorie R. Accad. Sci. Ist. Bologna 4 (10): 205. 1889. – *Auxarthron zuffianum* (Morini) Orr & Kuehn.

AUXARTHON

Auxarthron Orr & Kuehn in Can. J. Bot. 41: 1439. 1963.

Type species: *Auxarthron californiense* Orr & Kuehn.

The genus *Auxarthron* was erected by ORR & KUEHN (1963b) to accommodate species with swollen septa of the peridial hyphae, formerly classified in *Gymnoascus* and *Myxotrichum*. The genus was not accepted by APINIS (1964) and UDAGAWA (1966), because they could also observe peridial hyphae with swollen septa in other species of *Gymnoascus* and *Myxotrichum*. Although this character probably is not significant for distinguishing genera, the genus *Auxarthron* may be retained on account of the globose to subglobose, usually thick-walled, ornamented ascospores (DOMSCH & GAMS 1970; VON ARX 1970, 1971). *Auxarthron* is related to *Amauroascus* and *Arachnotheca*, but differs from these two genera in possessing dark ascomata with distinct appendages.

ORR *et al.* (1963c) in their monograph of the genus *Auxarthron* accepted 7 species. In a later paper ORR & KUEHN (1971) recognized *Auxarthron brunneum* as a synonym of *A. umbrinum* and proposed the combination *A. thaxteri* (Kuehn) Orr & Kuehn (= *Myxotrichum thaxteri* Kuehn). Recently a new species, *A. pseudoauxarthron* Orr & Kuehn (1972), was described, bringing the total number of species to 8.

The separation of the species in the genus *Auxarthron* is primarily based on the structure of the appendages. However, in all species of *Auxarthron* the ascomata have the same size, shape and colour, with globose, thick-walled, roughened to echinulate ascospores measuring 2 to 4.5 μ in diameter. Moreover, the imperfect state in all species is represented by arthro- or aleurioconidia. The taxonomic value of the peridial hyphae and the appendages in this genus is, however, questionable, and the number of species in *Auxarthron* should be reconsidered.

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