

Five onygenalean fungi from Japan

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Soils from various areas in Japan were screened for isolation of cleistothecial ascomycetes. From the recent collections, two new species of onygenalean fungi, *Gymnascella japonica* and *Gymnostellatospora frigida*, are described and illustrated. Three interesting fungi, *Aphanoascus saturnoideus*, *Arachnotheca glomerata* and *Leucothecium emdenii*, are also described as the first records from Japan.

Key Words—*Aphanoascus saturnoideus*; *Arachnotheca glomerata*; *Gymnascella japonica*; *Gymnostellatospora frigida*; *Leucothecium emdenii*; Onygenales; soil fungi.

During the past several years, many soil samples from Japan have been screened for isolation of cleistothecial ascomycetes as producers of secondary metabolites useful to the pharmaceutical industry. Of these, the present communication describes five interesting onygenalean taxa; two are novel and three are new records in the Japanese mycoflora.

Materials and Methods

Fungal isolates Five isolates, BF 31778, BF 44675, BF 46857, BF 49346 and BF 49347, were examined in this study. These isolates are maintained as living cultures in the Tsukuba Research Institute, Banyu Pharmaceutical Co., Ltd., Tsukuba-shi, Japan.

Media Cultures were grown in diffused light on several agar media, including: phytone yeast extract (PYE) (Carmichael, 1962), cornmeal (CMA), potato-carrot (PCA), oatmeal (OA), yeast-starch (YpSs) (Emerson, 1941), diluted Sabouraud (Takashio, 1972), cellulose, and horse hair-soil extract. Distinct growth on the cellulose agar, composed of 10 g of powdered cellulose, 1 g of NH₄NO₃, 0.5 g of K₂HPO₄, 0.5 g of MgSO₄·7H₂O, and 20 g of agar per liter of infusion from 1 kg of soil (Udagawa, 1960), was recorded as indicating cellulolytic ability. Spread growth on the horse hair-soil extract agar, composed of sterilized horse hairs on the soil infusion agar plate, was recorded as indicating keratinolytic ability. Colors designated are from the Kornerup and Wanscher (1978) color standard and the Rayner (1970) color chart, and are referred to with the letters M and R, respectively.

Scanning electron microscopy Scanning electron microscopy (SEM) was performed using a Hitachi Model S-4100 SEM. For SEM, ascospores were fixed in 0.5% osmium tetroxide, dehydrated in a graded alcohol series, critical-point dried, and sputter coated with platinum-palladium.

Taxonomy

Gymnascella japonica Uchiyama, Kamiya et Udagawa, sp. nov. Figs. 1, 3–7

Coloniae in "PCA" valde restrictae, paene planae, velutinae vel plus minusve floccosae, ex mycelio basali coacto tenuiter constantes, primum albae vel primulinae, deinde dilute flavae vel rubrae vel corallinae, ascomatibus abundantibus formantes; reversum brunneo-aurantiacum vel aliquantum testaceum. Coloniae in "CMA" restrictae, velutinae, paene planae, ex mycelio basali coacto tenuiter constantes, ascomatibus sparsis uniformiter formantes, albae vel dilute aurantiacae vel croceae; reversum salmoneum vel croceum.

Ascomata superficialia, saepe confluentia, globosa vel subglobosa, 30–100 µm diam, primum alba, deinde dilute flava vel flavo-rubra vel dilute aurantiaca, tarde maturescentia; hyphae peridii hyalinae vel dilute flavae, tenues et leves, septatae, 1–2.5 µm diam, ramosae et anastomosantes, postea teraperidio formantes; appendicula nulla. Asci 8-sporei, non catenati, ovoidei vel pyriformes, 7–9.5 × 6–8 µm, evanescentes. Ascosporeae hyalinae vel dilute flavae, in massa aurantiacae, irregulares, subglobosae vel ellipsoideae, saepe non aequilaterae, 3–5.5 × 2–3.5 µm, leves sed tuberculares sub SEM.

Mycelio vegetativo ex hyphis hyalinis vel dilute flavis, ramosis, levibus, septatis, 1–3(–6.5) µm diam composito. Anamorphosis abest.

Holotypus BF 49346: colonia exsiccata in cultura ex solo pascuo, Nagano, in Japonia, 4.x.1993, a S. Uchiyama et S. Kamiya isolata et ea collectione fungorum, Musei et Instituti Historiae Naturalis Chiba (CBM) conservata.

Etymology: Latinized from the name Japan, referring to the country of the type locality.

Colonies on PCA growing very restrictedly, attaining a diam of 13–15 mm in 21 days at 25°C, mostly plane ex-

cept for raised center, velvety or somewhat floccose, consisting of a thin basal felt, at first White to Primrose (R), later Pale Yellow to Pastel Red (M. 3A3-8A5) or Coral (R); ascomata abundantly produced throughout the colony; reverse Brownish Orange (M. 7C5) or slightly Brick (R). Colonies on CMA growing restrictedly, attaining a diam of 18-20 mm in 21 days at 25°C, velvety, centrally raised but almost plane, consisting of a thin basal felt; ascomata evenly scattered on the felt, White to Pale Orange (M. 5A3) or Saffron (R) in color; reverse Light Orange (M. 6A4) or Saffron (R). Colonies on PYE growing very restrictedly, attaining a diam of 14-15 mm in 21 days at 25°C, conspicuously wrinkled and convolute, consisting of a tough mycelial felt, producing a sparse aerial mycelium, white; ascomata absent; reverse somewhat Greyish Red (M. 7B3) or Saffron (R).

Ascomata superficial, often confluent, globose to subglobose, 30-100 μm in diam, at first white, becoming light yellow to yellowish red or light orange, consisting of clusters of asci with delicate peridial hyphae, maturing slowly within 28 days; peridial hyphae hyaline to pale yellow, thin- and smooth-walled, septate, 1-2.5 μm in diam, branched and anastomosed, forming an incomplete network in age; appendages lacking. Asci 8-spored, singly borne, ovoid or pyriform, 7-9.5 \times 6-8 μm , evanescent.

Ascospores hyaline to pale yellowish, orange in mass, irregular in shape, subglobose to ellipsoidal, often inequilateral, 3-5.5 \times 2-3.5 μm , appearing nearly smooth (LM), tuberculate under SEM.

Vegetative mycelium consisting of hyaline to pale yellow, branched, smooth-walled, septate, often irregularly swollen, 1-3(-6.5) μm hyphae; racquet hyphae present; ascomatal initials growing as lateral branches of hyphae, swollen and a few coiled; anamorph lacking.

Cellulolytic.

At 37°C, growth is extremely reduced.

Material examined: a culture isolated from soil in pasture, Togakushi-mura, Kamiminochi-gun, Nagano-ken, Japan, 4 October 1993, BF 49346, holotype. The type specimen is deposited in the Natural History Museum and Institute, Chiba, Japan (CBM).

The taxonomy of *Gymnascella* Peck, a genus generally ignored until its recent reintroduction (Orr et al., 1977), was given in detail by Currah (1985), who noted that the ascospore characters such as size, shape, color and sculpturing are most important for distinguishing species. Currah restricted *Arachniotus* Schroeter to *A. ruber* (van Tieghem) Schroeter and transferred several other species to *Gymnascella*. He placed almost all the related genera, *Narasimhella* Thirumalachar et Mathur, *Petalosporus*

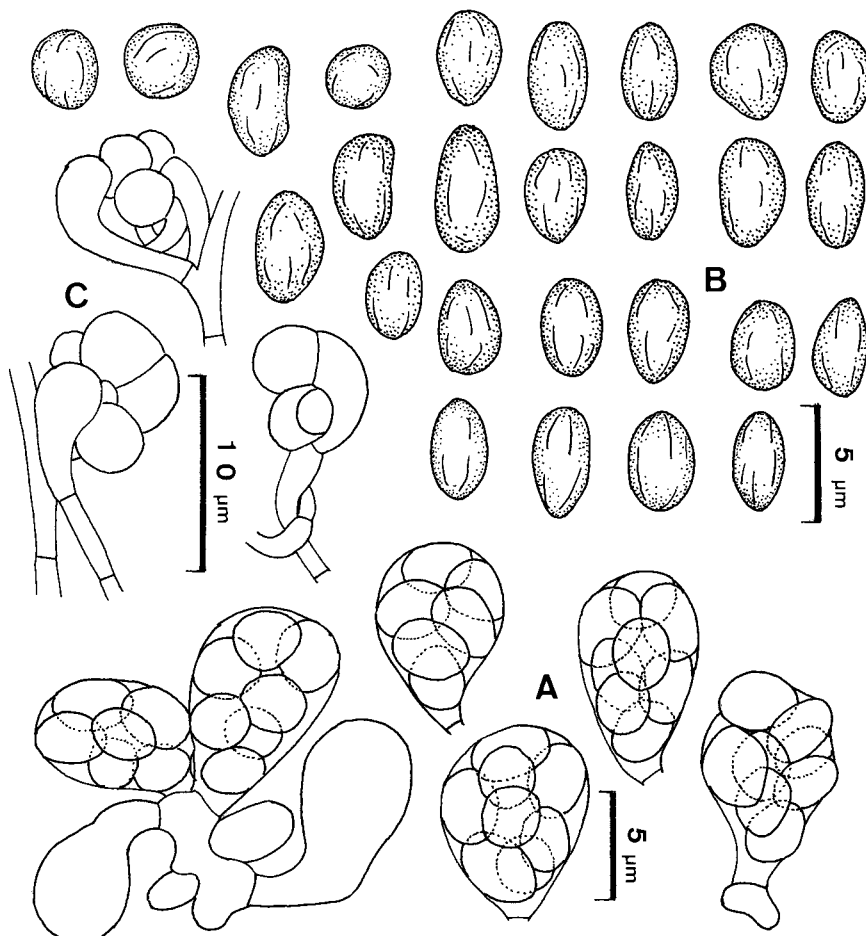


Fig. 1. *Gymnascella japonica* (BF 49346).
A. Asci. B. Ascospores. C. Ascomatal initials.

Ghosh, Orr et Kuehn, *Plunkettomyces* Orr, *Pseudoarachniotus* Kuehn and *Waldemaria* Batista in synonymy, and recognized thirteen species (Currah, 1985, 1988). Ascospores of *A. ruber* are "pulley-wheel" shaped with an equatorial groove bordered by distinct ridges, whereas those of *Gymnascella* species are oblate with or without a single equatorial rim. Although von Arx (1986), in his subsequent paper, broadened the genus concept of *Gymnoascus* to include *Acitheca*, *Arachniotus*, *Gymnascella*, and *Gymnoascoides*, we accept Currah's concept of *Gymnascella* and describe this new species as *G. japonica*.

The new species can be recognized by the following combination of features: (1) its very restricted growth on all tested media; (2) light yellow to yellowish red or light orange ascomata with a telaperidium, and (3) irregular-shaped and often inequilateral ascospores with a tuberculate sculpturing.

Gymnostellatospora frigida Uchiyama, Kamiya et Udagawa, sp. nov. Figs. 2, 8–12

Coloniae in "CMA" restrictae, plus minusve floccosae, planae, tenues, ex mycelio vegetativo submerso constantes, numerosis ascomatibus formantes, dilute sulphureae vel sulphureae; reversum dilute brunneum vel isabellinum.

Ascomata superficialia, discreta vel saepe confluen-

tia, subglobosa vel aliquantum irregularia, 65–160 μm diam, primum alba vel dilute sulphurea, deinde brunneo-aurantiaca vel fulva, tarde maturescentia; hyphae peridii sulphureae vel sulphureo-brunneae, incrassatae, asperulatae, septatae, 1–3 μm diam sed irregulariter inflatae, ramosae et anastomosantes, postea incompleto-reticulum formantes; appendices indistinctae, hyalinae vel dilute sulphureae, breves, 40–80(–100) \times 1.5–2 μm , asperulatae, septatae, non ramosae vel ramosae, apicem versus gradatim angustatae. Asci non catenati, 8-sporei, subglobosi vel ovoidei vel pyriformes, 6.5–9 \times 5.5–8 μm , brevi-stipitati, evanescentes. Ascosporeae ellipsoideae vel fusiformes, 4–5 \times 2–2.5 μm , plus minusve utrinque acuminatae, hyalinae, cum superficie longitudinaliter vel irregulariter striatae sub SEM.

Mycelio vegetativo ex hyphis hyalinis, rectis vel sinuosis, ramosis, levibus, septatis, 1–3(–6) μm diam composito. Anamorphosis abest.

Holotypus BF 44675: colonia exsiccata in cultura ex solo sylvae, Hokkaido, in Japonia, 2.viii.1993, a S. Uchiyama et S. Kamiya isolata et ea collectione fungorum, Musei et Instituti Historiae Naturalis Chiba (CBM) conservata.

Etymology: Latin, *frigidus*=cold, referring to its psychrophilic growth.

Colonies on CMA growing restrictedly, attaining a diam of 16–17 mm in 21 days at 15°C, more or less floc-

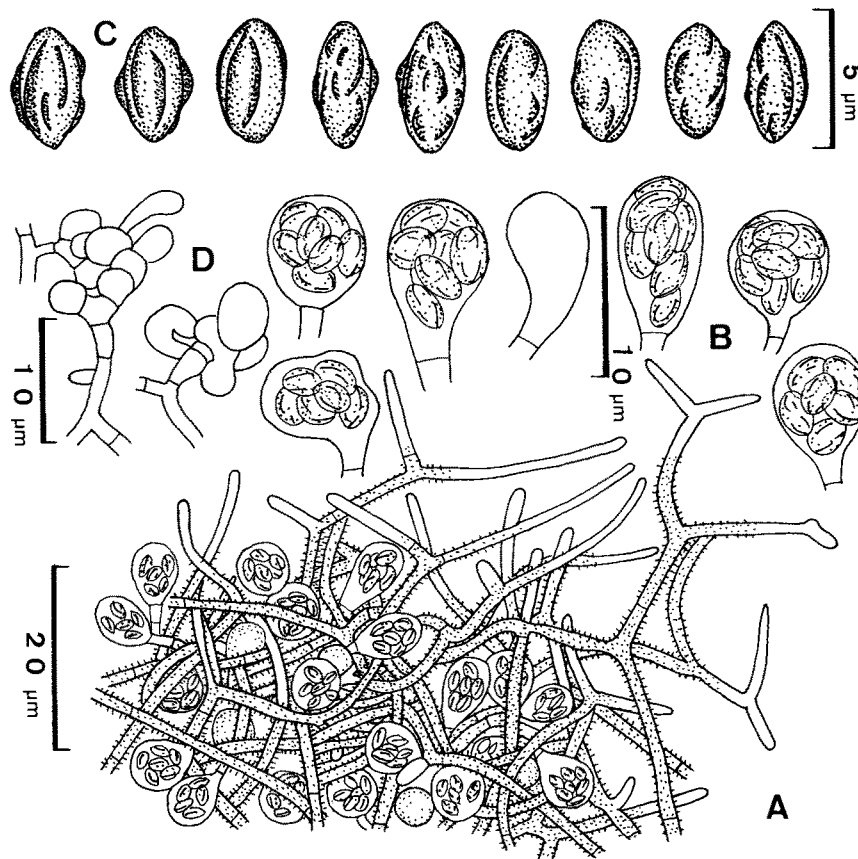
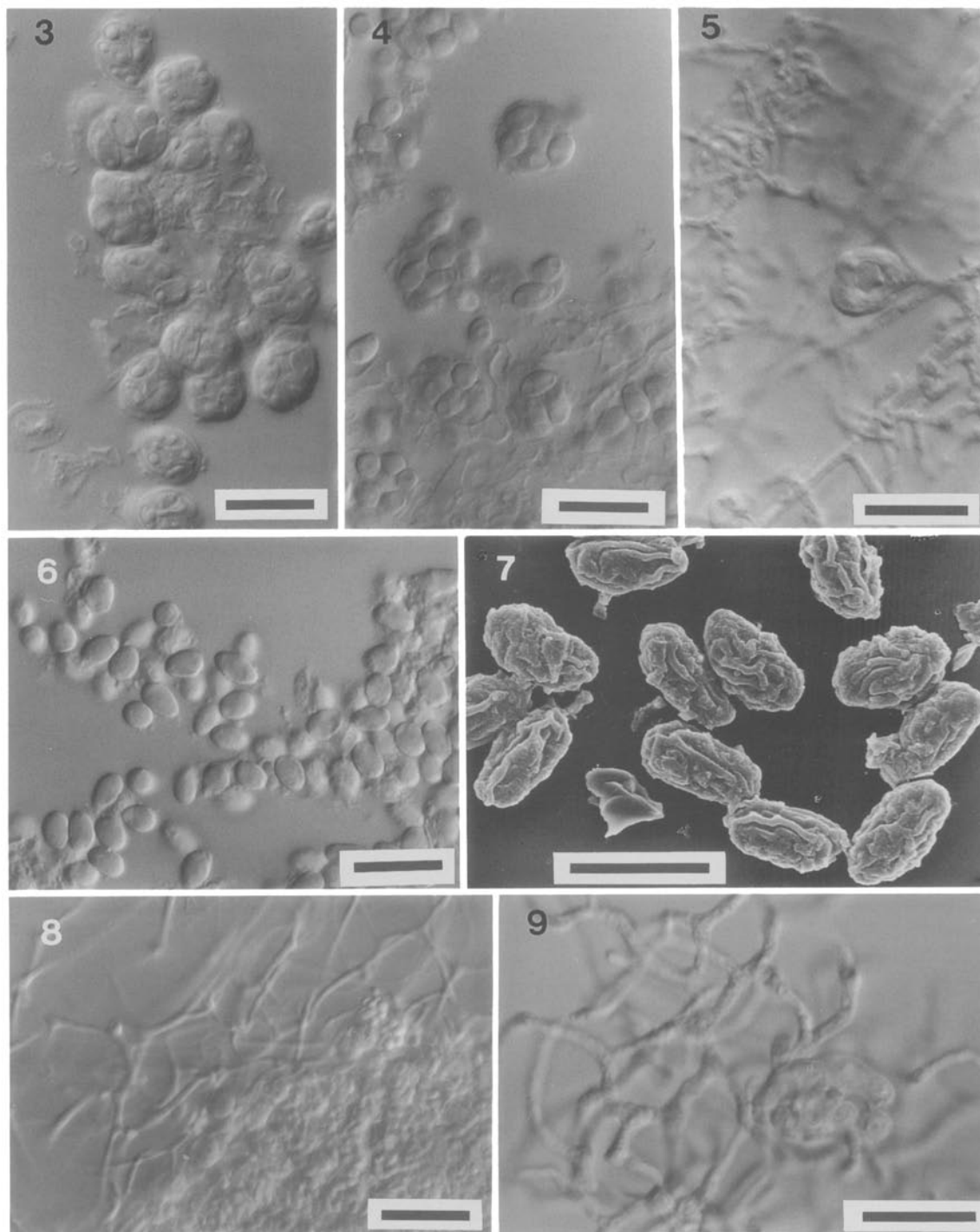


Fig. 2. *Gymnostellatospora frigida* (BF 44675).

A. Margin of ascoma showing appendages. B. Asci. C. Ascospores. D. Ascomatal initials.

cose, plane, thin, with vegetative mycelium submerged, producing abundant ascomata, Pastel Yellow (M. 2A4) or Sulphur Yellow (R); margins thin, broadly submerged; reverse Light Brown (M. 6D4) or Isabelline (R). Colonies on PYE growing restrictedly, attaining a diam of 18–20 mm in 21 days at 15°C, somewhat floccose, convoluted or wrinkled, deeply furrowed, consisting of a thin

basal felt, Pale Yellow (M. 2A3) or Straw (R); ascomata absent; reverse uncolored. Colonies on diluted Sabouraud agar growing restrictedly, attaining a diam of 18–19 mm in 21 days at 15°C, floccose, somewhat radially sulcate, consisting of a thin white mycelial felt, producing abundant ascomata on the felt, Pastel Yellow (M. 2A4) or Sulphur Yellow (R); margins thin, broad;



Figs. 3–9. *Gymnascella japonica* (BF 49346) and *Gymnostellatospora frigida* (BF 44675).
3–7. *G. japonica*. 3, 4. Asci. 5. Ascomatal initial. 6, 7. Ascospores (LM and SEM). 8, 9. *G. frigida*. 8. A part of ascoma. 9. Ascomatal initial. Scale bars: 3–6 = 10 μm ; 7 = 5 μm ; 8 = 20 μm ; 9 = 10 μm .

reverse Pale Yellow (M. 3A3) or Straw (R).

Ascomata superficial, discrete or often confluent, subglobose or somewhat irregular in shape, 65–160 μm in diam excluding the appendages, at first white to pale yellow, later becoming brownish orange or fulvous due to the development of peridial hyphae, maturing slowly within 21–28 days; peridial hyphae yellow to yellowish brown, thick-walled, asperulate, septate, 1–3 μm in diam, sometimes irregularly swollen, branched and anastomosed, forming an irregularly reticulate network in age; appendages indistinct from the peridial elements, arising as the free apices of the peridial hyphae, hyaline to pale yellow, short, 40–80(–100) \times 1.5–2 μm , asperulate, septate, unbranched or branched, gradually tapering to a slender tip. Asci singly borne, 8-spored, subglobose to ovoid or pyriform, 6.5–9 \times 5.5–8 μm , short-stipitate, evanescent. Ascospores ellipsoidal to fusiform, 4–5 \times 2–2.5 μm , more or less acuminate at both ends, hyaline, with surface striate by longitudinal or somewhat irregular ridges (under SEM).

Vegetative mycelium consisting of hyaline, straight or sinuous, branched, smooth-walled, septate, 1–3(–6) μm diam hyphae; ascomatal initials arising from a hyphal cell as lateral branches, becoming coiled; anamorph not seen.

Cellulolytic.

At 25°C, colonies grow slowly, usually not exceeding 10 mm in diam in 21 days. At 37°C, growth is nil.

Material examined: a culture isolated from forest soil, Mt. Daisetsu, Kamikawa-cho, Kamikawa-gun, Hokkaido, Japan, 2 August 1993, BF 44675, holotype. The type specimen is deposited in the Natural History Museum and Institute, Chiba, Japan (CBM).

The gymnoascaceous genus *Gymnostellatospora* was originally described for a single species, *G. japonica* Udagawa, Uchiyama et Kamiya, based on three isolates from Japanese soil (Udagawa et al., 1993). The striking characters of the genus are yellowish brown to reddish brown ascomata, pale brown and asperulate peridial hyphae forming an incompositoperidium-type network, short, straight, simple, asperulate appendages, hyaline to pale yellow, fusiform ascospores with wing-like longitudinal crests, and lack of an anamorph. These characteristics, especially the fusiform and ridged ascospores, suggest a relationship with the genera *Byussoascus*, *Myxotrichum* and *Pseudogymnoascus* in the Myxotrichaceae. Similar ascospore ornamentation is found in *Pseudogymnoascus alpinus* Müller et von Arx and *P. dendroideus* Locquin-Linard (Müller and von Arx, 1982; Locquin-Linard, 1982). Unlike the two species of *Gymnostellatospora*, *P. alpinus* produces small, white ascomata, which are composed of inconspicuous peridium of loose, curved hyphae and short, recurved, often dichotomously branched appendages. *Pseudogymnoascus dendroideus* is distinctive in the production of dark greenish peridial hyphae with dendroid appendages.

Gymnostellatospora frigida closely resembles the type species *G. japonica* in having brownish ascomata, similar peridial morphology, simple, coarsely asperulate appendages, and ellipsoidal, ridged ascospores. Neither

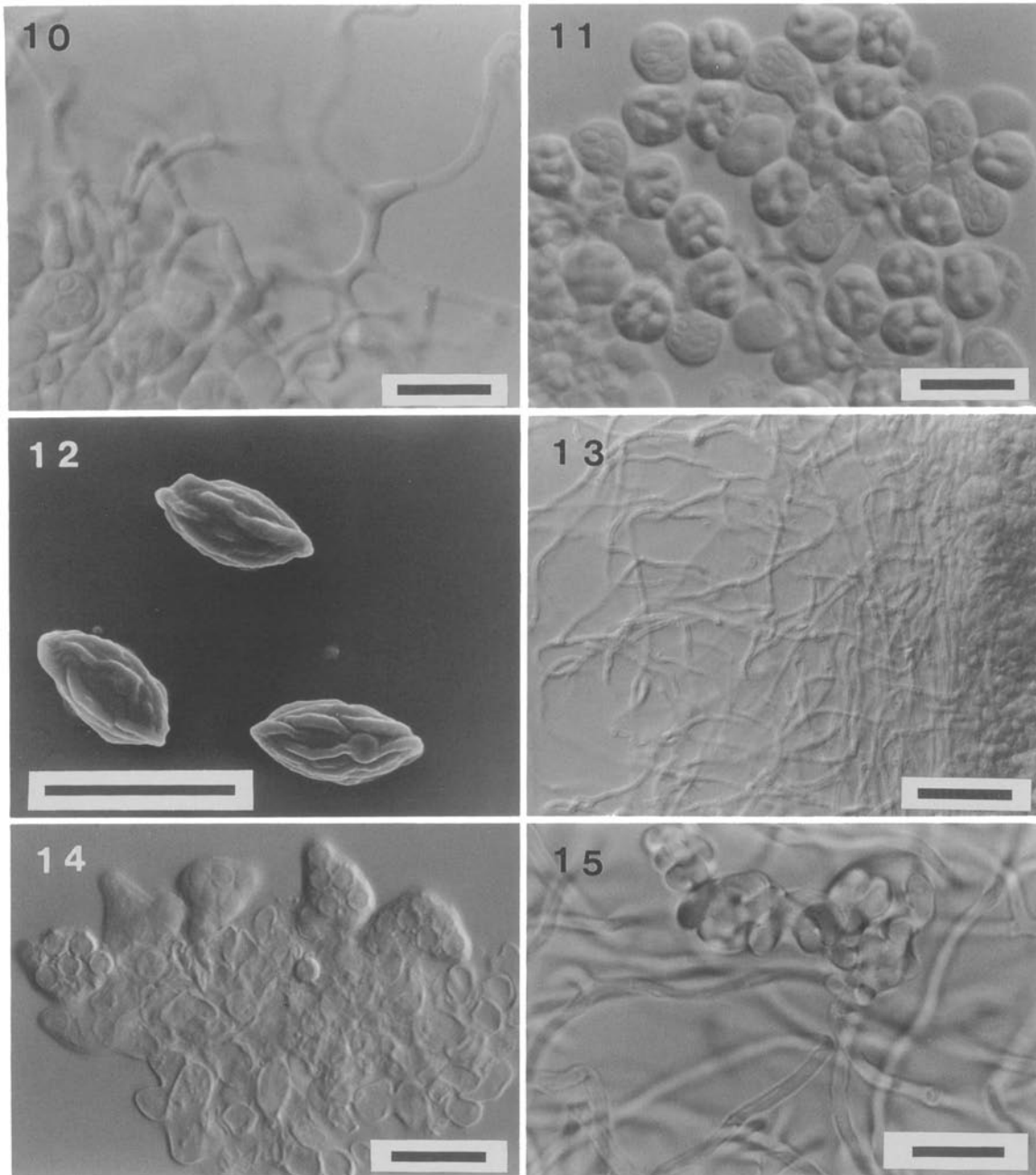
species forms conidia. The ascospores of *G. frigida* are somewhat larger (viz. 3–4 \times 1.5–2 μm ascospores in *G. japonica*) and striate by low, somewhat irregular ridges. This fungus is markedly psychrophilic, with the better growth and ascomatal formation at 15°C than at 25°C, while *G. japonica* is mesophilic.

Arachnotheca glomerata (Müller et Pacha-Aue) von Arx, *Persoonia* 6: 376. 1971. Figs. 13–18
 ≡ *Arachniotus glomeratus* Müller et Pacha-Aue, *Nova Hedwigia* 15: 554. 1968.

Colonies in OA growing rather rapidly, attaining a diam of 30–32 mm in 14 days at 25°C, velvety to somewhat floccose, more or less zonate, consisting of a thin basal felt, producing abundant ascomata on the felt, overgrown by a loose aerial hyphae and scattered conidia, White to Yellowish White or Yellowish Grey (M. 4A2-B2); exudate small, clear; odor indistinct; reverse Greyish Orange (M. 5B3). Colonies on PYE growing rapidly, attaining a diam of 40–42 mm in 14 days at 25°C, velvety, zonate, consisting of a thin basal felt, White to Yellowish White (M. 1A2), with surface developing abundant aerial hyphae; ascomata tardily produced on the felt and not affecting the colony appearance; conidiogenesis inconspicuous; odor earthy; reverse Violet Brown to Dark Magenta (M. 10F6,7–13F3) or Chestnut to Brown Vinaceous (R). with margins Light Orange to Brownish Grey (M. 5A5–11C2) or Salmon to Pale Purplish Grey (R). Colonies on YpSs agar growing rapidly, attaining a diam of 40–43 mm in 14 days at 25°C, floccose, consisting of a thin basal felt, in surface appearance essentially as on OA, White to Orange White (M. 5A2) or somewhat Rosy Buff (R); odor earthy; reverse Pale Yellow (M. 4A3).

Ascomata superficial, discrete or often confluent, globose to subglobose, (150–)200–400 μm in diam, white to straw-colored, becoming gray in age, sometimes as small clusters of asci with few peridial hyphae, maturing rapidly within 21 days; peridial hyphae at first undifferentiated, hyaline, delicate, thin-walled, smooth or irregularly roughened, septate, 1–3 μm in diam, branched and anastomosed, forming an incomplete network in age; appendages lacking. Asci 8-spored, singly borne, hyaline to pale yellow, ovoid to pyriform or broadly clavate, 7–13 \times 5–8 μm , evanescent. Ascospores hyaline to pale yellow or straw-colored, globose to subglobose, (2–)2.5–3 μm in diam, with surface punctate-reticulate, enveloped with a hyaline, irregular, wing-like epispore up to 2 μm long.

Vegetative mycelium consisting of hyaline, branched, smooth-walled or sometimes roughened, septate, 1–2.5 μm diam hyphae; racquet hyphae present, swollen up to 5–6 μm in diam near the septum; ascomatal initials consisting of elongate lateral branches from aerial hypha, around which the ascogonium is spirally twisted. Anamorph: arthroconidia and aleurioconidia. Arthroconidia borne in an intercalary or terminal position on lateral branches of hyphae, separated from each other by empty parts of the hyphae or by two adjacent septa, hyaline, cylindrical, sometimes curved or T-shaped, often twisted, 5–18(–22.5) \times 1.5–2.5 μm , thin- and smooth-walled,



Figs. 10–15. *Gymnostellatospora frigida* and *Arachnotheca glomerata* (BF 49347).

10–12. *G. frigida*. 10. Appendages. 11. Asci. 12. Ascospores (SEM). 13–15. *A. glomerata*. 13. A part of ascus. 14. Ascus. 15. Ascomatal initial. Scale bars: 10, 11 = 10 μm ; 12 = 5 μm ; 13 = 20 μm ; 14, 15 = 10 μm .

mostly truncated at both ends with conspicuous frills, sometimes rounded at one end. Aleurioconidia hyaline, ovoid, 3.5–6.5 \times 3–5 μm , truncated at the base, more or less thick-walled and smooth.

Keratinolytic.

At 37°C, growth is extremely reduced.

Material examined: a culture isolated from cultivated soil, Hikigawa-cho, Nishimuro-gun, Wakayama-ken, Japan, 26 November 1993, BF 49347.

The genus *Arachnotheca* was proposed by von Arx (1971) for *Arachniotus glomeratus*, which is character-

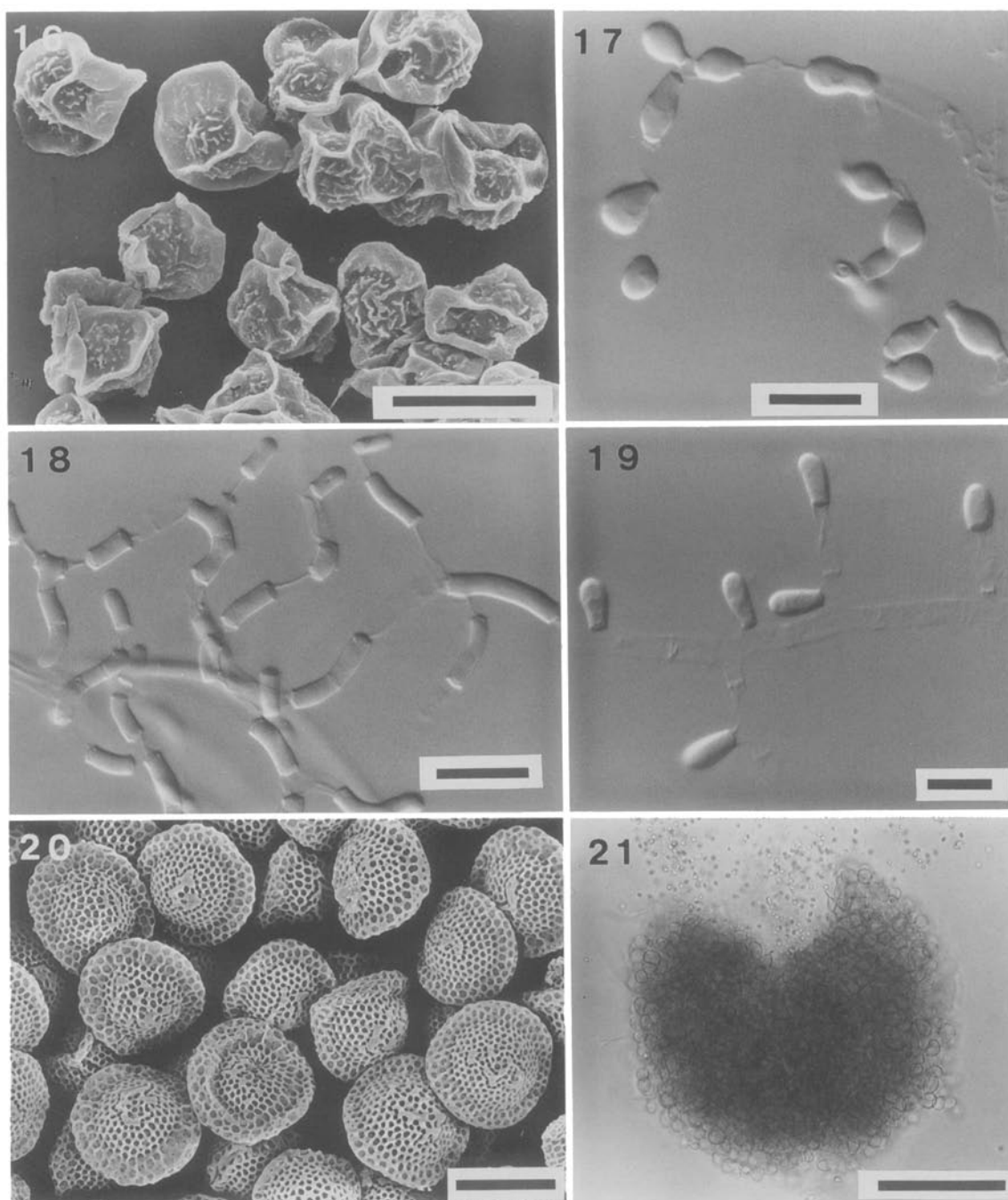
ized by the formation of grayish ascomata with a telaperidium, globose ascospores with an irregularly furrowed episporium and arthroconidia. Subsequently von Arx (1974, 1981) transferred two species to the genus, *A. albicans* (Apinis) von Arx and *A. vriesii* (Apinis) Samson apud von Arx, but both were rejected from the genus in recent papers on the Onygenales (Currah, 1985; Guarro et al., 1991). The genus *Amaurascopsis* (the type species: *A. perforatus*) was proposed by Guarro et al. (1992) and also characterized by the formation of ascospores with a loose pitted episporium (sheath).

However, *Amaurascopsis perforatus* Guarro, Gené et de Vroey is readily distinguished from this species in having orange to brownish orange ascomata, light yellow to light orange, large ascospores ($3.5-4.5(-5) \times 3.5-4.5 \mu\text{m}$) and a *Chrysosporium* anamorph.

Aphanoascus saturnoideus Cano et Guarro, Mycol. Res. **94**: 370. 1990. Figs. 19, 20

Colonies on OA growing rather rapidly, attaining a diam of 35–38 mm in 21 days at 25°C, floccose, plane,

with submerged vegetative mycelium and sparse aerial hyphae, at first White, becoming Greenish Grey to Greyish Orange (M. 30B2–6B3) or Vinaceous Buff (R); ascomata abundantly produced at the center and scattered in the marginal areas, Pale Red to Brownish Grey (M. 7A3–7D2); conidiogenesis sparse, inconspicuous; exudate clear; reverse Greyish Orange (M. 5B3) or Buff (R). Colonies on PYE growing rather rapidly as on OA, velvety, more or less zonate, consisting of a thin basal felt, Yellowish White to Pale Green (M. 2A2–30A3); ascomata not



Figs. 16–21. *Arachnotheca glomerata*, *Aphanoascus saturnoideus* (BF 46857) and *Leucothecium emdenii* (BF 31778). 16–18. *A. glomerata*. 16. Ascospores (SEM). 17, 18. Conidia. 19, 20. *A. saturnoideus*. 19. Conidia. 20. Ascospores (SEM). 21. *L. emdenii*. Ascomata. Scale bars: 16=5 μm ; 17–19=10 μm ; 20=5 μm ; 21=100 μm .

produced; conidiogenesis abundant throughout the colony; exudate lacking; odor earthy; reverse Light Brown (M. 7D6) or Fulvous Umber (R).

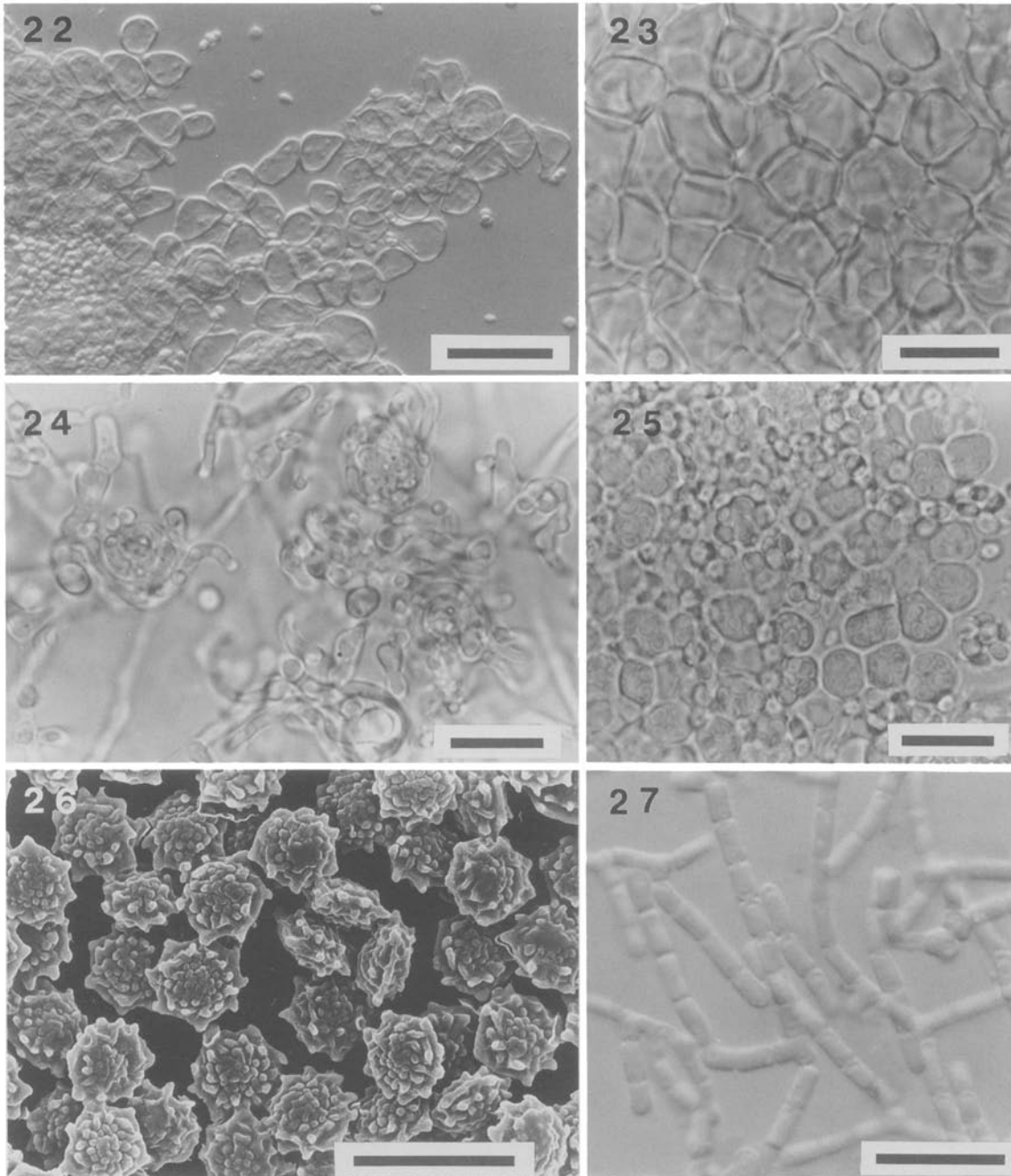
Ascomata superficial, scattered or often confluent, non-ostiolate, light brown, globose to subglobose, 350–500 μm in diam, glabrous but covered by aerial hyphae, maturing within 21–28 days; peridium 10–16 μm thick, yellowish brown, of *textura angularis*, consisting of angular, 4–10 \times 3–6.5 μm cells. Asci singly borne, subglobose to ovoid or pyriform, 12–16 \times 10–12 μm , evanescent. Ascospores brown, oblate, 5.5–8 \times 3.5–5 μm in-

cluding rim, provided with a more or less sinuous equatorial rim up to 1.5 μm , finely pitted.

Vegetative mycelium consisting of hyaline, branched, septate, smooth-walled, 2–7 μm wide hyphae; racquet hyphae present. Anamorph: alternate arthroconidia and aleurioconidia, cylindrical, 6–10(–20) \times 3–6 μm , or clavate to obovoid, (4–)5–12 \times 3–4 μm . Keratinolytic.

At 37°C, growth is somewhat reduced.

Specimen examined: a culture isolated from cultivated soil, Hikigawa-cho, Nishimuro-gun, Wakayama-ken,



Figs. 22–27. *Leucothecium emdenii*.

22. Margin of ascoma showing chlamydospore-like cells. 23. Ascomatal peridium. 24. Ascomatal initials. 25. Asci. 26. Ascospores (SEM). 27. Conidia. Scale bars: 22 = 20 μm ; 23–25 = 10 μm ; 26 = 5 μm ; 27 = 10 μm .

Japan, 26 November 1993, BF 46857.

The most reliable difference between this taxon and the closely related species *A. terreus* (Randhawa et Sandhu) Apinis is the size and morphology of the ascospores: those of *A. terreus* are $5\text{--}6 \times 2.5\text{--}3.5 \mu\text{m}$ including a rim and with flattened polar thickenings (Randhawa and Sandhu, 1964; Cano and Guarro, 1990). *Aphanoascus saturnoideus* was originally reported only from arable soil in Spain and garden soil in Chile, whereas *A. terreus* is ubiquitous, occurring in Australia, Egypt, Germany, India, Japan, Kenya, Mozambique, South Africa and Spain (Currah, 1985; Cano and Guarro, 1990; Yokoo et al., 1983; Ito and Nakagiri, 1995).

Leucothecium emdenii von Arx et Samson, *Persoonia* 7: 378. 1973. Figs. 21–27

Colonies on PCA growing very restrictedly, attaining a diam of 15–16 mm in 21 days at 25°C, velvety, plane, thin, with vegetative mycelium submerged, more or less zonate, Yellow (M. 3A6) or Pure Yellow (R), producing abundant ascomata; conidiogenesis inconspicuous and not influencing the colony appearance; reverse Yellow (M. 3A5). Colonies on OA growing very restrictedly as on PCA, largely submerged, producing scattered ascomata, Light Yellow (M. 3A5) in color; conidiogenesis limited; reverse Pastel Yellow (M. 3A4).

Ascomata superficial to immersed, scattered, non-ostiolate, yellow, globose to subglobose, 170–350 μm in diam, loosely covered with chlamydospore-like swollen cells measuring $5\text{--}12.5 \times 5\text{--}10 \mu\text{m}$, maturing within 35 days; peridium up to 15 μm thick, hyaline to yellowish, of *textura angularis*, consisting of two or three layers of hyaline, flattened, angular cells measuring $5\text{--}12 \times 4\text{--}8 \mu\text{m}$. Asci borne in short chains, 8-spored, subglobose to pyriform, $5\text{--}6.5 \times 4\text{--}5.5 \mu\text{m}$, evanescent. Ascospores hyaline, pale yellow in mass, discoid with a low equatorial rim, $2\text{--}3 \times 1.5\text{--}2 \mu\text{m}$, finely verrucose.

Vegetative mycelium consisting of hyaline, branched, smooth-walled, septate, 1–3 μm diam, often sinuous hyphae, sometimes swollen as an intercalary node. Ascomatal initials arising from aerial hypha as swollen lateral branches, which are subsequently covered by narrowed hyphal coils. Anamorph: *Arthrographis*, characterized by chains of arthroconidia; intercalary one hyaline, one-celled, cylindrical, $2\text{--}7.5\text{--}10 \times 1.2\text{--}2 \mu\text{m}$, truncated at both ends, smooth-walled; terminal one subglobose to pyriform, truncated at the base and rounded at the apex.

At 37°C, growth is nil.

Specimen examined: a culture isolated from pasture soil near the Cape of Soya, Wakkanai-shi, Hokkaido, Japan, 20 May 1991, BF 31778.

Ascomata of the Japanese isolate somewhat resemble those of *L. coprophilum* Valldosera et Guarro (Valldosera et al., 1991), which are encased in chlamydospore-like swollen cell masses. It differs from *L. coprophilum*, however, in some other features, e.g., ascospore size and morphology, arthroconidium size and temperature range for the growth. In *L. coprophilum*, the ascospores are smaller ($2\text{--}2.5 \times 1\text{--}1.5 \mu\text{m}$) and without an

equatorial rim.

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