PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 11, Part 4, pp. 443-449 (1982)

A KEY TO THE SPECIES OF GELASINOSPORA

J. A. VON ARX

Centraalbureau voor Schimmelcultures, Baarn, Netherlands

The species described in *Gelasinospora* and in the synonymous genus *Anixiella* are keyed out and listed alphabetically. Three species described as *Anixiella* are transferred to *Gelasinospora*.

Recently some isolates of the ascomycete genus *Gelasinospora* Dowding were received for study. Their identification was time-consuming because no recent treatment of the genus is available. The strains present in the CBS collection therefore were examined and compared with the few other described species. In this paper a key is given to the accepted species which are listed alphabetically.

The generic name *Gelasinospora* has been introduced by Dowding (*1933*) for two Ascomycetes with dark, ostiolate ascomata, cylindrical, unitunicate asci and 1-celled, dark ascospores with a pitted wall. Two further species, one with a reticulate ascospore wall, have been added by Cain (*1950*). Moreau and Moreau (*1951*) introduced some older specific epithets. Cailleux (*1971*) included *Anixiella* Saito & Minoura ex Cain (*1961*) in *Gelasinospora* char. emend., which had been described for a similar but non-ostiolate fungus. He described 11 new, partly ostiolate, partly non-ostiolate species. Based on the structure of the ascospore wall, Cailleux distinguished four sections.

The name *Anixiella* again has been used for non-ostiolate counterparts of *Gelasinospora* by Horie and Udagawa (*1974*), Furuya and Udagawa (*1977*) and Udagawa (*1980*). They and other Japanese authors added some more species to both genera. The genus *Anixiella*, however, should not be separated from *Gelasinospora*, as is shown also by von Arx (*1973*). Some species described in *Anixiella* are closer to some ostiolate species than to other non-ostiolate ones. In some strains of *G. fallaciosa* the ascomata are ostiolate, in others non-ostiolate. In the type strains of *G. seminuda* and *G. novoguineensis*, most of the ascomata are non-ostiolate, but regularly ostiolate ascomata are also present.

The genus has been characterized by Cailleux (*1971*) as follows:

GELASINOSPORA Dowding. *In* Canad. J. Res., Sect. C, **9**: 294. *1933*.
type: *G. tetrasperma* Dowding
= *Anixiella* Saito & Minoura ex Cain. *In* Canad. J. Bot. **39**: 1667. *1961*.
type: *A. reticulispora* Saito & Minoura (nom. inval.) = *Thielavia reticulata* C. Booth & Ebben = *A. reticulata* (C. Booth & Ebben) Cain = *G. reticulata* (C. Booth & Ebben) Cailleux

Ascomata superficial or (partly) immersed, pyriform and ostiolate or spherical and non-ostiolate, dark; ascomata wall membranaceous, composed of pigmented, isodiametric or slightly flattened, distinct cells; asci cylindrical, clavate or subspherical, with a persistent or evanescent

wall, usually with a disc-like, thickened, non-amyloid apex; ascospores ellipsoidal or nearly spherical, 1-celled, dark, with a foveolate (pitted) wall or covered with reticulate or irregular markings, occasionally nearly smooth, with 1,2 or more germ pores, without gelatinous sheaths or appendages; paraphyses at maturity usually absent; anamorph absent or *Chrysonilia*-like.

KEY TO THE SPECIES

1. Ascospores with pits, extending into it as conical spines (endodentate) 2
1 Ascospores without such spines 7
2. Ascospores 18-28 × 13-20 μm 3
2. Ascospores larger 5
3. Ascomata ostiolate, ascospores 20-28 × 12-16 μm 4
3. Ascomata non-ostiolate, ascospores 18-28 × 15-21 μm, with 1 or 2 germ pores . . *G. endodonta*
4. Asci 8-spored. . . . . *G. calospora*
4. Asci 4-spored. . . . . *G. tetrasperma*
5. Ascomata non-ostiolate, less than 250 μm diam., ascospores 30-42 × 25-30 μm . . . *G. saitoi*
5. Ascomata ostiolate or non-ostiolate, 300-600 μm diam. 6
6. Ascospores 27-32 × 18-21 μm, with slightly attenuated ends. . . . . *G. seminuda*
6. Ascospores 32-38 × 22-27 μm, with rounded ends . . . . . *G. santi-florii*
7. Ascospores verrucose or covered with nonreticulate markings 8
7. Ascospores pitted, reticulate or nearly smooth. 11
8. Ascospores 16-20 μm broad, with 2 germ pores; ascomata ostiolate 9
8. Ascospores broader 10
9. Ascospores 22-26 × 16-20 μm, with rounded ends . . . . . *G. varians (G. brasiliensis)*
9. Ascospores 28-34 × 16-20 μm, with attenuated ends . . . . . *G. amorphoporcata*
10. Ascospores 31-39 × 26-32 μm, with 2 germ pores; ascomata usually non-ostiolate . *G. fallaciosa*
10 Ascospores 37-47 × 27-35 μm, ascomata ostiolate . . . . . *G. pseudoreticulata*
11. Ascospores reticulate or with 2.5-5 μm wide pits. 12
11. Ascospores with 0.7-1.5 μm wide pits or nearly smooth 18
12. Ascomata non-ostiolate; ascospores spherical or broadly ellipsoidal 13
12. Ascomata ostiolate, ascospores ellipsoidal or elongate 16
13. Ascospores 36-45 μm diam., spherical . . . . . *G. sphaerospora*
13. Ascospores smaller. 14
14. Ascospores 23-30 × 17-20 μm . . . . . *G. reticulata*
14. Ascospores broader 15
15. Ascospores 25-31 × 22-28 μm . . . . . *G. indica*
15. Ascospores 30-35 × 27-33 μm . . . . . *G. stellata*
16. Ascospores 25-35 × 14-20 μm, asci long cylindrical. . . . . *G. retispora*
16. Ascospores 30-42 × 20-27 μm 17
17. Ascospore pits 2-3.5 μm wide, ascomata non-ostiolate or with a recurved beak *G. novoguineensis*
17. Ascospore pits 4-6 μm wide, ascomata ostiolate, conical, often tomentose . . . . *G. mirabilis*
18. Ascomata spherical, non-ostiolate or with a small beak; asci evanescent 19
18. Ascomata conical or pyriform, with a distinct beak, asci persistent. 22
19. Ascospores 30-39 × 26-32 μm . . . . . *G. fallaciosa*
19. Ascospores larger 20
20. Ascospores 39-47 × 29-34 μm, ascomata with a short beak . . . . . *G. inversa*
20. Ascospores larger, ascomata usually non ostiolate 21
21. Ascospores 40-50 × 32-42 μm, with 6-8 germ pores . . . . . *G. micropertusa*
21. Ascospores 43-55 × 38-47 μm, with a single germ pore . . . . . *G. macrospora*
22. Ascospores 20-28 × 12-16 μm . . . . . see this key no 4
22. Ascospores larger 23
23. Ascospores up to 42 μm long 24

23. Ascospores up to 56 µm long 29
24. Ascospores 27-32 × 16-18 µm . . . . . *G. pseudocalospora*
24. Ascospores broader 25
25. Ascospores 27-35 × 22-27 µm, with a rather thick, light outer wall . . . . . *G. cerealis*
25. Ascospores larger 26
26. Ascospores 32-43 × 25-31 µm, with a single germ pore and distinct pits . . . . . *G. longispora*
26. Ascospores with 2-6 germ pores 27
27. Ascospores with slightly attenuated ends, 34-42 × 25-31 µm . . . . . *G. kobi*
27. Ascospores with broadly rounded ends 28
28. Ascospores 34-38 × 24-28 µm, with distinct pits . . . . . *G. goundaensis*
28. Ascospores 35-43 × 25-33 µm, with indistinct pits . . . . . *G. heterospora*
29. Ascospores with slightly attenuated ends, 38-52 × 25-32 µm, pits often not sharply delimited *G. foveaconica*
29. Ascospores with rounded ends 30
30. Ascospores 43-50 × 34-40 µm, with distinct pits . . . . . *G. multiforis*
30. Ascospores 37-56 × 28-36 µm, indistinctly pitted . . . . . *G. himalayensis*

LIST OF ACCEPTED SPECIES

1. *G. amorphoporcata* Udagawa. *In* Trans. mycol. Soc. Japan **21:** 19. 1980.

This species will have to be compared with *G. brasiliensis* Ram and *Emblemospora ditrema* Jeng & Krug. *G. varians* also is similar.

2. *G. calospora* (Mouton) C. & M. Moreau. *In* Rev. Mycol. 14, Suppl. colon. **2:** 50. 1949.
= *Rosellinia calospora* Mouton. *In* Bull. Soc. R. bot. Belg. **36:** 12. 1879.
= *Gelasinospora adjuncta* Cain. *In* Can. J. Res., Sect. C, **28:** 568. 1950.
= *Gelasinospora autosteira* Alexopoulos & Sun. *In* Mycologia **42:** 723. 1950.

The acceptance of *G. tetrasperma* as a separate species for strains with 4-spored asci is a matter of opinion. The ascospores usually are pitted, but may be also nearly smooth. The fungus then can be recognised by the absence of a gelatinous sheath and by the spiny inner wall. The ascospores usually have two germ pores.

3. *G. cerealis* Dowding. *In* Can. J. Res., Sect. C, **9:** 295. 1933.

The species is characterized by the undulate, light-coloured outer wall of the ascospores and therefore was classified by Cailleux (*1971*) in a separate section. The ascospores have two apical germ pores.

4. *G. endodonta* (Malloch & Cain) v. Arx. *In* Proc. Ned. Akad. Wet., Sect. C, **76:** 290. 1973.
= *Anixiella endodonta* Malloch & Cain. *In* Can. J. Bot. **49:** 870. 1971.

The fungus is known from two strains, isolated from Australian soil. It is characterized by rather small, non-ostiolate ascomata. The ascospores may have one or two germ pores.

5. *G. fallaciosa* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 623. 1971.

This species may be ostiolate or non-ostiolate. The ascospores have rather large and irregular pits and two germ pores.

6. *G. foveoconica* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.

This species has ascospores with 6-8 distinct germ pores arranged in two subapical rings. In the type strain the ascospore pits are rather diffuse.

In CBS 493.78 the pits are more distinct. In this strain the ascospores are not ejaculated, but become free in a dark, slimy droplet.

7. *G. goundaensis* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.

8. *G. heterospora* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.

9. *G. himalayensis* Horie & Udagawa. *In* Trans. mycol. Soc. Japan **15:** 201. 1971.
This species could not be studied. It would have to be compared with *G. foveoconica.*

10. *G. indica* (Rai & al.) v. Arx. *In* Proc. Ned. Akad. Wet. C, **76:** 291. 1973.
= *Anixiella indica* Rai & al. *In* Can. J. Bot. **45:** 479. 1967.
The species has been redescribed and depicted by Udagawa (1980). *G. stellata* Cailleux may be identical.

11. *G. inversa* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.

12. *G. kobi* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 621. 1971.
This species is rather close to *G. longispora*, but can be distinguished by the conical ascomata and by the formation of an anamorph with orange conidiogenous structures, similar to the *Chrysonilia* (*Monilia*) anamorph of *Neurospora sitophila* Shear & B. O. Dodge. This anamorph was not mentioned by Cailleux (*1971*). It usually is only imperfectly developed. The conidia are only partly separated from each other and do not form powdery masses.

13. *G. longispora* Udagawa. *In* Trans. mycol. Soc. Japan **8:** 50. 1967.

14. *G. macrospora* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.

15. **Gelasinospora micropertusa** (Horie & Udagawa) v. Arx, *comb. nov*
= *Anixiella micropertusa* Horie & Udagawa. *In* Trans. mycol. Soc. Japan **15:** 197. 1974 (basionym).
The species can be distinguished from *G. macrospora* only by slightly smaller ascospores and may be conspecific. In both, the ascomata are non-ostiolate.

16. *G. mirabilis* Furuya & Udagawa. *In* Trans. mycol. Soc. Japan **17:** 313. 1976.

17. *G. multiforis* Cailleux *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.

18. *G. novoguineensis* Takada. *In* Bull. nat. Sci. Mus., Tokyo **16:** 529. 1973.
In this species the ascomata may be ostiolate or non-ostiolate; both occur in the same culture.

19. *G. pseudocalospora* Udagawa. *In* Bull. nat. Sci. Mus., Tokyo **16:** 517. 1973.

20. *G. pseudoreticulata* Matsushima. *In* Microf. Solom. Isl. Papua New Guinea p. 73. 1971.
= *Gelasinospora variabilis* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 622. 1971.
The synonymy of *G. variabilis* with *G. pseudoreticulata* was established by Furuya and Udagawa (*1977*) when describing the close species *G. varians.*

21. *G. reticulata* (C. Booth & Ebben) Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 534. 1971.
= *Thielavia reticulata* C. Booth & Ebben. *In* Trans. Br. mycol. Soc. **44:** 214. 1961.
= *Anixiella reticulata* (C. Booth & Ebben) Cain. *In* Can. J. Bot. **39:** 1667. 1961.

= *Anixiella reticulospora* Saito & Minoura. *In* J. Ferment. Technol. Osaka **26:** 4. 1948 (without Latin diagnosis).

A full description and good illustrations of this species have been given by Cain (*1961*).

22. *Gelasinospora retispora* Cain. *In* Can. J. Res., Sect. C, **28:** 573. 1950.

= *G. reticulispora* (Greis & Greis-Dengler) C. & M. Moreau. *In* La Mycothèque Lab. Crypt. Mus. nat. Paris **3,** suppl. **1:** 48. 1951.

= *Rosellinia reticulispora* Greis & Greis-Dengler. *In* Jb. wiss. Bot. **89:** 341. 1941 (without Latin diagnosis).

23. **G. saitoi** (Udagawa) v. Arx, *comb. nov.*

= *Anixiella saitoi* Udagawa. *In* Bull. nat. Sci. Mus., Tokyo **16:** 511. 1973 (basionym).

This species is close to *G. santi-florii*, both agree in shape, size and structure of the ascospores (30–40 × 22–28 µm, ellipsoidal, wall with inwardly extending spines). *G. santi-florii*, however, has ostiolate ascomata, whereas those of *G. saitoi* are non-ostiolate.

24. *G. santi-florii* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 621. 1971.

25. *G. seminuda* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 621. 1971.

26. **G. sphaerospora** (Horie & Udagawa) v. Arx, *comb. nov.*

= *Anixiella sphaerospora* Horie & Udagawa. *In* Trans. mycol. Soc. Japan **15:** 197. 1974 (basionym).

This species differs from all others by the spherical, irregularly reticulate ascospores. No specimens could be studied.

27. *G. stellata* Cailleux. *In* Bull. trimest. Soc. mycol. Fr. **87:** 623. 1971.

28. *G. tetrasperma* Dowding. *In* Can. J. Res., sect. C, **9:** 294. 1933.

= *Gelasinospora calospora* f. *tetrasperma* (Dowding) C. & M. Moreau. *In* La Mycothèce. Lab. Crypt. Mus. natn. Paris 3, suppl. **1:** 41. 1951.

29. *G. varians* Furuya & Udagawa. *In* Trans. mycol. Soc. Japan. **17:** 314. 1977.

According to the description, *G. brasiliensis* Ram. *In* Broteria, n.s., **37:** 18. 1968 is similar, but has narrower, 17–30 × 12–17 µm ascospores. The description of this species, however, is incomplete and no specimens were available for study.

EXCLUDED SPECIES

Anixiella monospora Malloch & Cain. *In* Can. J. Bot. **49:** 872. *1971* = *Monosporascus monosporus* (Malloch & Cain) Hawksworth & Ciccarone *in* Mycopathologia **66:** isl. *1978.*

Anixiella sublineata Furuya & Udagawa *in* Trans. mycol. Soc. Japan **17:** 317. *1977* = *Neurospora sublineata* (Furuya & Udagawa) v. Arx, because its ascospores are broadly fusiform, longitudinally striate, and have a germ pore at each end (von Arx, *1981*).

RELATED GENERA

The genus *Gelasinospora* is close to *Neurospora* Shear & Dodge. The only distinguishing character is the structure of the ascospores, which in the latter genus are broadly fusiform, longitudinally striate, with distinct apical germ pores. The genus *Diplogelasinospora* Cain (*1961*) differs from *Gelasinospora* by the 2-celled ascospores and the formation of an arthric anamorph of the form genus *Arthrographis* Cochet ex Sigler & Carmichael. This anamorph is related to the *Chrysonilia* (*Monilia*) anamorph of *Neurospora*, and a similar anamorph with orange conidiogenous structures has been observed in cultures of *Gelasinospora kobi* and (immature) in some more species.

The genus *Arniella* Jeng & Krug (*1977*) has 1-celled, dark, pitted ascospores with two germ pores. It differs from *Gelasinospora* by hairy (setose) ascomata and gelatinous appendages of the ascospore. The genus *Emblemospora* Jeng & Krug (*1976*) was distinguished from *Gelasinospora* by an ascospore wall covered with markings and falls within the limits of *Gelasinospora* sensu Cailleux. The type species, *E. monotrema* Jeng & Krug has 28–31 × 17–20 μm ascospores with a dark wall with numerous hyaline fissures and grooved rings at both ends surrounding the germ pores. *E. ditrema* Jeng & Krug, the second species, has ascospores without apical rings, and *G. amorphoporcata* Udagawa may be close.

Poroconiochaeta Udagawa & Furuya (*1979*) also is characterized by 1-celled, dark, pitted ascospores. They are, however, oblate and have a germ slit; characters which indicate a relationship to *Coniochaeta* (Sacc.) Massee (Coniochaetaceae) (von Arx, *1981*).

STRAINS STUDIED

G. amorphoporcata:	CBS 626.80 = NHL 2814
G. calospora:	CBS 224.49, 225.49, 274.50 (type strain of *G. adjuncta*), 264.51 (type strain of *G. autosteira*), 265.51, 261.54, 198.55, 665.74, 444.78
G. cerealis:	CBS 177.33 (type strain), 256.52, 365.66, 553.66, 604.78
G. endodonta:	CBS 504.70 (type strain), 505.70
G. fallaciosa:	CBS 458.67, 574.72 (type strain), 575.72, 576.72
G. foveaconica:	CBS 557.72 (type strain), 493.78
G. goundaensis:	CBS 558.72 (type strain)
G. heterospora:	CBS 559.72 (type strain)
G. indica:	CBS 496.81 = NHL 2744
G. inversa:	CBS 554.72 (type strain)
G. kobi:	CBS 560.72 (type strain)
G. longispora:	CBS 458.67, 141.68 (type strain), 142.68
G. macrospora:	CBS 573.72 (type strain)
G. mirabilis:	CBS 667.77 = NHL 2758 (type strain)
G. multiforis:	CBS 555.72 (type strain)
G. novoguineensis:	CBS 647.80, 495.81 (type strain)
G. pseudocalospora:	CBS 439.74 = NHL 2667 (type strain), 413.78
G. pseudoreticulata:	CBS 556.72 (type strain of *G. variabilis*), CBS 497.81 = NHL 2695
G. reticulata:	CBS 435.61 (type strain), 331.68, 656.71, 451.81
G. retispora:	CBS 275.50 (type strain), 212.58, 868.68, 656.70, 673.74
G. saitoi:	CBS 435.74 (type strain)
G. santi-florii:	CBS 571.72 (type strain), 534.76
G. seminuda:	CBS 572.72 (type strain)

G. stellata:	CBS 561.72 (type strain)
G. tetrasperma:	CBS 178.33 (type strain), 575.68, 592.69, 880.69
G. varians:	CBS 561.72 (type strain)

REFERENCES

J. A. VON ARX, (1973). Ostiolate and non-ostiolate Pyrenomycetes. *In* Proc. K. Ned. Akad. Wet., Amsterd., C, **76:** 289-296.

—— (1981). The genera of fungi sporulating in pure culture, 3rd Ed., J. Cramer, Vaduz.

CAILLEUX, R. (1971). Recherches sur la mycoflore coprophile centrafricaine. Les genres *Sordaria, Gelasinospora, Bombardia. In* Bull. trimest. Soc. mycol. Fr. **87:** 461-626.

CAIN, R. F. (1950). Studies of coprophilous Ascomycetes. I. *Gelasinospora. In* Can. J. Res., Sect. C, **28:** 566-576.

- (1961). *Anixiella* and *Diplogelasinospora*, two genera with cleistothecia and pitted ascospores. *In* Can. J. Bot. **39:** 1667-1677.

DOWDING, E. S. (1933). *Gelasinospora*, a new genus of Pyrenomycetes with pitted spores. *In* Can. J. Res., Sect. C, **9:** 294-305.

FURUYA, K. & UDAGAWA, S. (1977). New species of *Gelasinospora* and *Anixiella. In* Trans. mycol. Soc. Japan **17:** 313-320.

HORIE, Y. & UDAGAWA, S. (1974). *Anixiella* and *Gelasinospora* from Himalayan soils. *In* Trans. mycol. Soc. Japan **15:** 196-205.

JENG, R. S. & KRUG, J. C. (1976). *Emblemospora*, a new genus of the Sordariaceae. *In* Can. J. Bot. **54:** 1971-1976.

—— & —— (1977). *Arniella*, a new genus of the Sordariaceae with pitted ascospores. *In* Mycologia **69:** 73-80.

MOREAU, C. & MOREAU, M. (1951). Le genre *Gelasinospora. In* La Mycothèque, Lab. Crypt. Mus. natn. Paris **3,** Suppl. 1: 46-49.

UDAGAWA, S. (1980). New or noteworthy Ascomycetes from Southeast Asian soil I. *In* Trans. mycol. Soc. Japan **21:** 17-34.

UDAGAWA, S. & FURUYA, K. (1979). *Poroconiochaeta*, a new genus of the Coniochaetaceae. *In* Trans. mycol. Soc. Japan **20:** 5-12.