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ORIGINAL ARTICLE



# *Galzinia oberwinkleri* sp. nov.: one of the three known very rare *Galzinia* species with bifurcate basidiospores

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**Abstract**
A new species of *Galzinia* (Basidiomycota, Corticiaceae s. str.) with bifurcate basidiospores is described. *Galzinia oberwinkleri* was found on the roots of a young orchid in a mountain rain forest in Ecuador. It is characterized by very tiny resupinate, mucous-gelatinous, and watery basidiomata with very large basidia and basidiospores that are bifurcate. A key for corticioid species with bifurcate basidiospores and illustrations of their microanatomy are presented.

**Keywords** Corticioid fungi · Corticiaceae s. str. · Bifurcate basidiospores · Microanatomy · *Galzinia* · *Elaphocephala*

## Introduction

The genus *Galzinia* Bourdot (Basidiomycota, Corticiaceae s. str.) comprises species with very thin basidiomata, up to ca. 150 μm, which are ceraceous, gelatinous, or even watery. In Bourdot and Galzin (1928), the generic type *Galzinia pedicellata* Bourdot was described as having an ephemeral lifestyle on very rotten wood, being seen only in very wet conditions, and vanishing in dry conditions. Basidia of *Galzinia* often show a probasidium-like swelling at the base, a long and slender basidial body, and an enlarged apex with four sterigmata. *Galzinia* was classified in "Corticinés" by Bourdot and Galzin (1928) and in Thelephoraceae by Rogers (1944) which cover almost all corticioid basidiomycetes with a smooth hymenium. Later, Parmasto (1968) filed *Galzinia* under the Sistotremoideae all showing very thin and tiny basidiomata having globose, urniform, or utriform basidia. Eriksson and Ryvarden (1975) argued that *Galzinia* is not well-defined but shared the opinion of Parmasto (1968) linking *Galzinia* to *Sistotrema*. Hibbett and Binder (2002) clearly showed by inferring nuclear large-subunit rDNA that *Galzinia incrustans* (v. Höhn. and Litsch) Parm. was placed into a clade next to *Vuilleminia comedens* (Nees) Maire. Larsson (2007) assigned *Galzinia* to Corticiaceae s. str. and remarked that *G. incrustans* was sequenced but did not include it into his outstanding molecular analysis of corticioid basidiomycetes. From the hitherto 12 described *Galzinia* species, only two have basidiospores which were described as forked, bifurcate, or horseshoe-like twin spores: *Galzinia geminispora* L.S. Olive and *Galzinia forcipata* Pouzar. Like most of the *Galzinia* species, they have been found on very rotten dead wood in wet conditions. Both show the typical urniform basidia with probasidia-like structures. Here, we describe a third species with bifurcate basidiospores collected from a mountain rainforest in Ecuador.

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## Materials and methods

Fresh material was mounted in tap water and investigated with a Zeiss Axioskop 40. For dried material, an Olympus BX-51 was used. Material was mounted in 5% potassium hydroxide (KOH) and stained with 3% phloxine. Melzer's reagent was used for checking amyloidity of the spore walls. Twenty spores were measured. For line drawings and measurements, a drawing grid as employed by Oberwinkler (e.g., 1977, 2012) was used at × 1000

magnification. Documentation of the fresh material was made with a Nikon Coolpix 4500. DNA isolation and PCR were tried several times with protocols described by Ordynets et al. (2015). Herbarium specimens used for further comparison were as follows: *G. forcipata* PRM 829238 (holotype), PRM 829239 (paratype), *G. geminispora* TENN F-043267 (holotype), *Elaphocepala iocularis* Pouz. PRM 829236 (holotype), and PRM 829240 (paratype).

## Results

### Morphology

***Galzinia oberwinkleri*** E. Langer and G. Langer sp. nov.
Etymology: in honor of Prof. Dr. Franz Oberwinkler
Mycobank no.: MB 827599
Microanatomy, Figs. 1 and 2, basidioma Fig. 3.

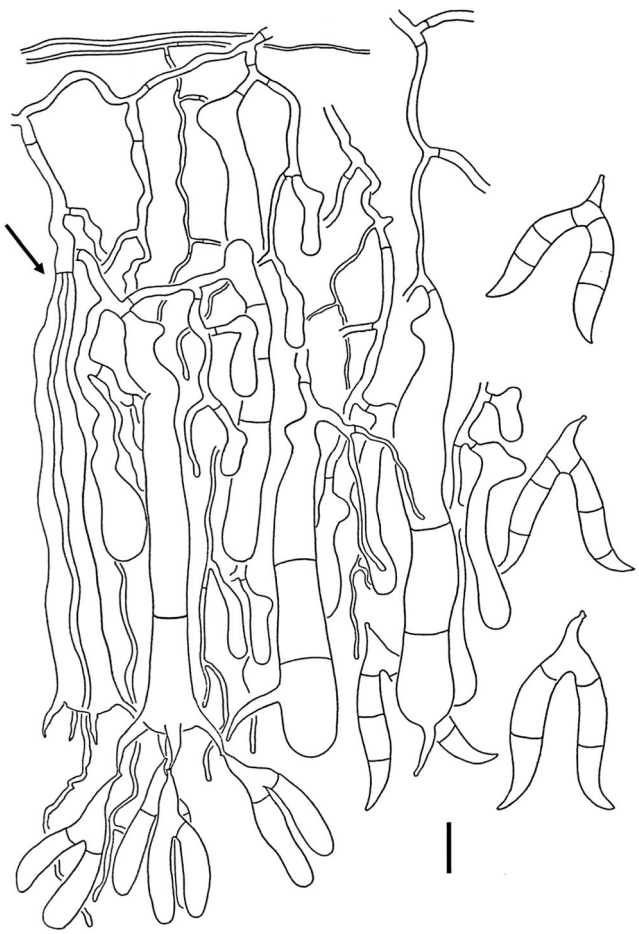

**Fig. 1** *Galzinia oberwinkleri* (EC 50, holotype); cross section of basidioma with basidia, bifurcate spores, and basidial repetition (arrow); bar = 10 μm

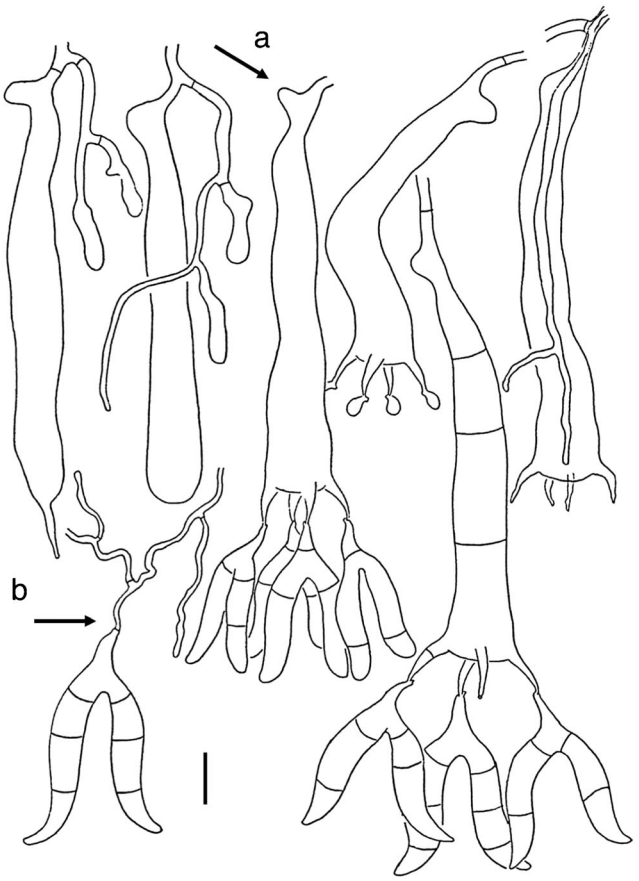


**Fig. 2** *Galzinia oberwinkleri* (EC 50, holotype); basidia, spores, and probasidia-like structure (arrow a), germinating bifurcate basidiospore (arrow b); bar = 10 μm

**Holotype (EC 50 in herbarium KAS):** Ecuador, province Zamorra, Loja, Estacion Scientifica San Francisco, 2010 m alt., coordinates 3° 58′ 28.9″S 79° 04′ 31.3″W, on roots of young epiphytic orchid attached to very decayed and wet wood in a mountain rainforest with *Graffenrieda* spp. (Melastomataceae), Lauraceae, Ericaceae, and Bromeliaceae, leg. Ewald Langer, 6th June 2004.

**Fig. 3** *Galzinia oberwinkleri* (EC 50, holotype); basidioma (arrow); bar = 0.5 cm

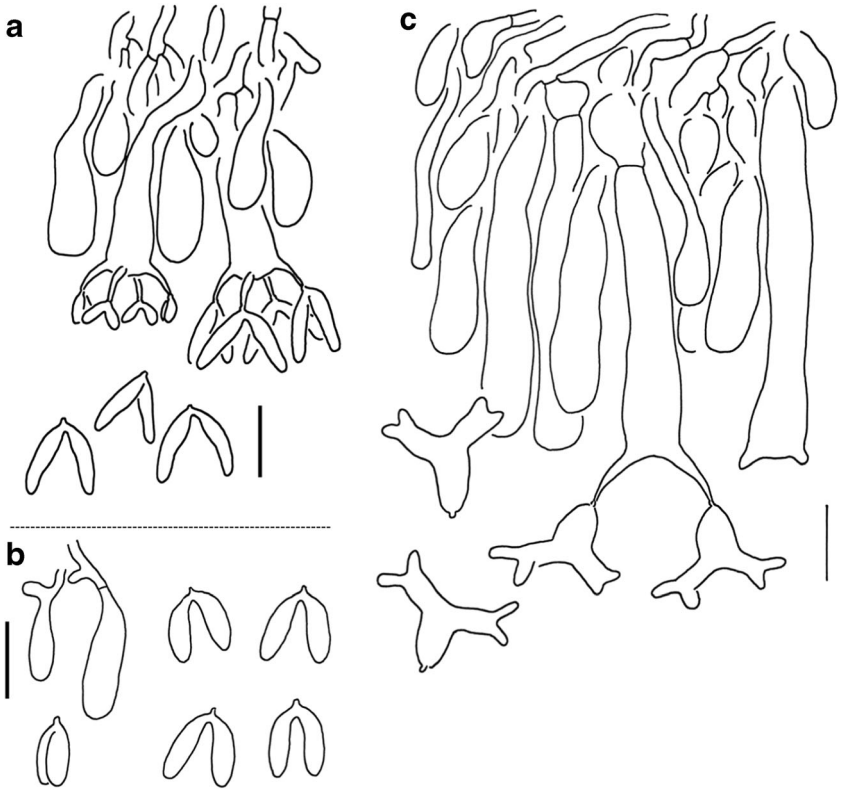


**Fig. 4** **a** *Galzinia forcipata* (PRM829238, holotype); hymenium with basidia and bifurcate basidiospores; bar = 10 μm. **b** *Galzinia geminispora* (TENN-F-043267, holotype); young basidia and basidiospores; bar = 10 μm. **c** *Elaphocepala iocularis* Pouz. (PRM 829236, holotype); hymenium with basidia and antler-like basidiospores, bar = 10 μm

*Basidioma* resupinate, mucous-gelatinous, looking watery, surface smooth, up to 150 μm thick, and 0.5 cm wide. Hyphae thin-walled, without clamps. Basal hyphae 0.5–1.5 μm in diameter, very loosely interwoven, towards basidial bases up to 3 μm in diameter. Young basidia developing somewhat pleural from a probasidia-like structure in the subhymenium which remains as a lateral expansion on the base of mature basidia. Basidia basally 5–7 μm in diameter, apically 10–13 μm, up to 70–85 μm long, with up to 3 transversal secondary septa. *Sterigmata* hornlike 10–12 μm long, mostly 4 when developed on the apex of the basidium, but sometimes also only one sterigma when developed laterally. Basidial repetition by hypha growing inside empty basidia. *Basidiospores* bifurcate, developed from a single apiculus, each half 35–45 × 5–7 μm, inamyloid, not dextrinoid. The horn-like twin parts of the bifurcate basidiospores splitting up 11–17 μm from the apiculus. Distal ends of the twin parts round when young, becoming horn-like when mature. Most of the mature spores with 1–3 septa. Spores germinating with a hypha from the apiculus (arrow Fig. 2b).

**Distribution:** Only known from the type locality

**Remarks:** The consulted types of *G. geminispora* and *G. forcipata* including also *E. iocularis* are extremely difficult to analyze due to very thin basidiomata with strongly agglutinated hyphae in dried herbarium specimens.

**Key to corticioid species with bifurcate or antler-like lobed basidiospores**

- 1 Spores lobed and antler-like (Fig. 4c).....*E. iocularis.*
- 1′ Spores bifurcate, not antler-like.....2
- 2 Individual branches of basidiospores longer than 10 μm.....*G. oberwinkleri*
- 2′ Individual branches of basidiospores shorter than 10 μm.....3
- 3 Diameter of individual branches of basidiospores 2.5–3.7 μm.....*G. geminispora*
- 3′ Diameter of individual branches of basidiospores 1.3–2.0 μm.....*G. forcipata*

DNA isolation and PCR from the dried holotype of *G. oberwinkleri* were not successful after several attempts. The types of *G. geminispora* and *G. forcipata* have been reinvestigated. While the types of *G. forcipata* are in quite good condition (Fig. 4a) showing mature basidia and spores, in the holotype of *G. gemininpora* (Fig. 4b), it was not possible to find well-developed basidia.

## Discussion

There are only few corticioid fungi with furcate basidiospores having long appendages or lobes. Oberwinkler

**Table 1** Comparison of microanatomy of *Galzinia* species with bifurcate basidiospores in μm

| | Basidiospores (indiv. branch) | Basidia | Hyphae |
|---|---|---|---|
| *G. geminispora* | 7.2–9.9 × 2.5–3.7 | 19–68 × 2.7–6.3 | 1.6–7.7 |
| *G. forcipata* | 6–10 × 1.3–2 | (17) –27–54 × 1.5–6.5 | 1.2–1.5– (2) |
| *G. oberwinkleri* | 35–45 × 5–7 | 70–85 × 5–13 | 0.5–3 |

(1982) illustrated the marine basidiomycete *Digitatispora marina* Doguet (Atheliales Jül.) showing spores with bi- to trifurcate appendages. Doguet (1962, 1969) suggested that these appendages were aiding successful water dispersal. The two-sterigmate *Elaphocephala iocularis* (Atheliales) with basidiospores having big antler-like twin-lobes (compare Fig. 4c) has been collected a few times in Czech Republic (Pouzar 1983), in France (Boidin and Gilles 1990), in England (Roberts 1994b), and The Netherlands (Dam and Dam 2015). The first described bifurcate-spored *Galzinia* was *G. geminispora* which was collected twice by Olive (1954) in the southern Appalachians on very decayed wood and later by Jülich (1984) in Europe. *Galzinia forcipata*, described by Pouzar (1983), was collected several times but in the same locality at a riverside near Jenvany in Czech Republic within 2 weeks and later by Roberts (1994a) in England, Devon, as *G.* aff. *forcipata*. Interestingly, the type of *G. forcipata* was collected inside the basidioma of *E. iocularis* and supposed to be parasitic (Pouzar 1983). Also, *G. oberwinkleri* seems to be very rare as it is only known from a single specimen from the type locality in Ecuador. What all these species have in common is that they are living on a very decayed wood in moist to wet conditions supporting the water dispersal hypothesis formulated by Doguet (1962, 1969) for *Digitatispora marina*.

*Galzinia oberwinkleri* differs from the two other known bifurcate-spored *Galzinia* species by distinctly larger basidia and basidiospores. While *G. geminispora* and *G. forcipata* have bifurcate basidiospores with a length up to 10 μm for each individual spore branch, in *G. oberwinkleri,* they are up to 45 μm in length. Basidia are up to 85 μm in length while *G. geminispora* and *G. forcipata* only reach 68 μm and 54 μm respectively. The differences of *G. geminispora* and *G. forcipata* are minute providing only the diameter of the individual spore branches as delimiting character with up to 3.7 μm and 2 μm respectively (compare Figs. 4a, b and Table 1). The collection by Roberts (1994a) was intermediate and therefore named *G.* aff. *forcipata.* Basidial repetition is nicely illustrated by Eriksson and Ryvarden (1975) for *G. incrustans* and *G. pedicellata* and also present in *G. oberwinkleri*. *G. oberwinkleri* has secondary septa in both basidia and spores while Olive (1954, figs. 11 and 13) illustrated septate basidia for *G. geminispora*. Septate spores are also described from *Waitea circinata* Warcup and Talbot. While Warcup and Talbot (1962) discussed an affinity of *W. circinata* to *Thanatephorus* Donk because of the *Rhizoctonia*-state and sclerotia, Larsson (2007) proved its place in the Corticiaceae s. str. by molecular inference. The also sclerotia-forming *Marchandiomyces lignicola* Lawrey and Diederich was shown to be closely related to *G. incrustans* and *V. comedens* when comparing DNA from the small and large subunit repeat including ITS (DePriest et al. 2005). Because of the very cryptic appearance of the basidiomata of the here-discussed bifurcate spored *Galzinia* species, it is necessary to recollect fresh material to get successful DNA isolations for a molecular hypothesis. Meanwhile, the microanatomical illustrations of *G. oberwinkleri*, *G. geminispora, G. forcipata,* and *E. iocularis* may be kept in mind when hunting for unusual basidiomycetes.

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## References

Boidin J, Gilles G (1990) Corticiés s.l. intéresantes ou nouveaux pour la France (Basidiomycotina). Bull Soc myc France 106(4):135–167

Bourdot H, Galzin A (1928) I. Hyménomycètes de France - Héterobasidiés - Homobasidiés Gymnocarpes. Marcel Bry, Sceaux, 764 pp.

Dam N, Dam M (2015) The oddest of them all... Coolia 58(1): 37–40

DePriest PT, Sikaroodi M, Lawrey JD, Diederich P (2005) *Marchandiomyces lignicola* sp. nov. shows recent and repeated transition between a lignicolous and a lichenicolous habit. Mycol Res 109(1):57–70

Doguet G (1962) *Digitatispora marina,* n. g., n. sp., Basidiomycete marin. Comptes Rendus Acad. Sci. Compt. Rend. Acad. Sci., Paris 254: 4336–4338

Doguet G (1969) *Nia vibrissa* Moore et Meyers, Gasteromycete marin . II. Developement des carpophores et des basides. Bull Soc myc France 84:93–104

Eriksson J, Ryvarden L (1975) The Corticiaceae of North Europe. Vol 3., Fungiflora, Oslo, pp 549–886

Hibbett DS, Binder M (2002) Evolution of complex fruiting-body morphologies in homobasidiomycetes. Proc R Soc Lond B 269:1963–1969

Jülich W (1984) *Galzinia geminispora* Olive new to Europe. Persoonia 12:189–191

Larsson KH (2007) Re-thinking the classification of corticioid fungi. Mycol Res 111:1040–1063

Oberwinkler F (1977) Das neue System der Basidiomyceten. In: Frey Pflanzen. G. Fischer Verlag, Stuttgart, pp 59–105

Oberwinkler F (1982) The significance of the morphology of the basidium in the phylogeny of Basidiomycetes. In: Wells K, Wells EK (eds) Basidium and basidiocarp. Evolution, cytology, function, and development. Springer press, New York, pp 9–35

Oberwinkler F (2012) Evolutionary trends in Basidiomycota. Stapfia 96: 45–104

Olive LS (1954) Two species of *Galzinia* from the southern Appalachians. Mycologia 46(6):794–799

Ordynets A, Larsson KH, Langer E (2015) Two new *Trechispora* species from La Réunion Island. Mycol Prog 14:113. https://doi.org/10.1007/s11557-015-1133-0

Parmasto E (1968) Conspectus systematis corticearum. Tartu, **261 pp**.

Pouzar Z (1983) Taxonomic studies in resupinate fungi II. Ceska Mycol 37(4):206–211

Roberts P (1994a) New British records. 114 *Galzinia* aff. *forcipata*. Mycologist 8(2):53

Roberts P (1994b) Interesting and unusual corticoid fungi from Slapton, Devon II. Mycologist 8(3):115–118

Rogers DP (1944) The genera *Trechispora* and *Galzinia* (Thelephoraceae). Mycologia 36(1):70–103

Warcup JH, Talbot PHB (1962) Ecology and identity of mycelia isolated from soil. Trans Br Mycol Soc 45(4):495–518