Gymnomyces dominguezii sp. nov. from Spain

B. MORENO-ARROYO¹, J. GÓMEZ² AND F. D. CALONGE³

¹ Depto. de Biología Vegetal y Ecología, Facultad de Ciencias, Universidad de Córdoba, Avda. San Alberto Magno, s/n. 14004 Córdoba, Spain

² Asociación Micológica de las Sierras Subbéticas, Mesones, 4. 14800 Priego, Córdoba, Spain

³ Real Jardín Botánico, CSIC, Plaza de Murillo, 2. 28014 Madrid, Spain

Gymnomyces dominguezii, a gasteroid fungus belonging to the Russulales, is described and illustrated as a new species. Its main taxonomic characters are discussed and compared with other species in the genus and those in *Martellia* and *Zelleromyces*.

Gymnomyces was proposed by Masee & Rodway (1898) and defined as follows: *Peridium* haud distinctum vel nullum. *Gleba* carnosa, ad basin fertilis, extus intusque lacunosa, cellulis cavis ubique subaequalis; septa haud scissilia. *Basidia* plerunque 2-spora. *Sporae* globosae, hyalinae, echinulatae vel verrucosae.

Gymnomyces pallidus Masee & Rodway and *G. seminudus* Masee & Rodway were included in the genus, the first being chosen as the type. Eleven species have been added by Singer & Smith (1960), Smith (1962), Beaton, Pegler & Young (1984), Zhang & Yu (1990) and Llistosella & Vidal (1995).

On the question of the generic concept, we agree, in part, with the different opinions expressed by several authors (Pegler & Young, 1979; Beaton *et al.*, 1984; Thiers, 1984; Miller, 1988; Zhang & Yu, 1990), pointing out the difficulties in separating *Gymnomyces* from *Zelleromyces* and *Martellia*. The chosen characters vary considerably, even within the same basidiome, which leads to artificial classifications. Amongst the proposed systematics we have chosen that given by Beaton *et al.* (1984).

MATERIAL AND METHODS

Microscopic observations were carried out using a Nikon Labophot, and 3% KOH and Melzer's reagent. Ultramicroscopic studies were carried out as usual; samples from dried basidiomes were directly stuck onto an adhesive layer on a clean coverslip, then coated with gold and observed using a Jeol JSM-T330A SEM. The material studied is preserved in the herbaria of the senior author (BM) and the Madrid Botanic Garden (MA-Fungus).

DESCRIPTION

Gymnomyces dominguezii Moreno-Arroyo, J. Gómez & Calonge, sp. nov. (Figs 1–6)

Etyim.: *dominguezii*, dedicated to Prof. E. Dominguez, from the University of Córdoba, Spain.

Basidiomata hypogaea, angiocarpa, subglobosa, lobulata, 0.9–2 cm

lata, substipitata. *Peridium* initio cremeum dein rufobrunneum. *Gleba* pallide crenea dein rufobrunnea, ex loculis minutis composita. *Columella* praesens. *Sporae* globosae vel subglobosae, 8–10 µm diam, statismosporicae, hyalinae dein pallide brunneae, amyloideae, verrucis vel reticulato partiali instructae. *Basidia* 25–40 × 10–15 µm, clavata, 1–2–3–4-sporigera. *Cystidia* nulla. *Basidiolae* numerosae 20–50 × 10–15 µm, clavatae. *Trama* hymenophoralis heteromera cum hyphis filamentosis et sphaerocystis numerosis 9–15 µm diam. *Subhymenium* pseudoparenchymaticum.

Holotypus in Hortus Botanicus Matritensis, MA-Fungus 38572 et B. M. 412. Córdoba, Carretera de los Villares, subter *Quercus ilex* subsp. *ballota*, *Cistus crispus* et *Pistacia lentiscus*, aggregatus, 4-II-1996, coll. B. Moreno et J. Gómez.

Basidiomata hypogeous, angiocarpous, subglobose, lobed, 0.9–2 cm diam., substipitate (Figs 1, 2). *Peridium* at first pale cream to ochraceous, drying reddish brown (Figs 1, 2). *Gleba* pale cream, ochraceous later, composed of cavities showing a labyrinthic structure. *Columella* heteromorous well-developed; sterile base present, rudimentary (Figs 1, 2). *Spores* globose, 8–10 µm diam., including ornamentation, statismosporic, at first hyaline then pale brown; myxosporium strongly amyloid, ornamented with a few free irregular warts and a partial reticulum (Figs 3, 4). *Basidia* 25–40 × 10–15 µm clavate, hyaline, changing to reddish brown in KOH (Fig. 5), 1–2–3–4-spored; *sterigmata* 6–10(–14) µm long. *Cystidia* absent. *Basidiolae* very abundant, 20–50 × 10–15 µm, clavate. *Hymenophoral trama* 30–40 µm thick, heteromorous with hyphae and abundant sphaerocysts 9–15 µm diam. (Fig. 6). *Subhymenium* pseudoparenchymatous.

Holotype: MA-Fungi 38572. B.M. 412. Córdoba, Carretera de los Villares, under *Quercus ilex* subsp. *ballota*, *Cistus crispus* and *Pistacia lentiscus*, Feb. 1996, aggregate forming colonies, leg. B. Moreno and J. Gómez.

Figs 1–4. *Gymnomyces dominguezii* (holotype, MA-Fungi 38572). Figs 1–2. Basidiomata, complete and in section, showing cavities of the gleba, rudimentary sterile base and columella (arrows). Bar = 1 cm. Figs 3–4. Basidiospores (SEM).

DISCUSSION

Few species of *Gymnomyces* already described show a clear taxonomic delimitation. Comparison of *G. dominguezii* with them, however, shows several differences when taking into

consideration characters such as spore and basidium morphology as the main features (Table 1).

Table 1 shows that only four species have subreticulate spores, *G. alveolatus* Singer & A. H. Sm., *G. parksii* Singer & A. H. Sm. (Singer & Smith, 1960), *G. eildonensis* G. W. Beaton,

Figs 5–6. *Gymnomycetes dominguezii* (holotype, MA-Fungi 38572). Bars = 12 μ m. Fig. 5. Basidium after treatment in KOH. Fig. 6. Nest of sphaerocysts.

Table 1. Morphological features of spores and basidia in *Gymnomycetes*

	Spores	Basidia (no of spores)	References
<i>G. pallidus</i>	8–9.5 $\times$ 8–9 μ m, spiny	30–38 $\times$ 12–14 μ m (2-3-4)	Beaton <i>et al.</i> (1984)
<i>G. seminudus</i>	9.5–13.5 $\times$ 8.5–11.5 μ m, spiny	28–40 $\times$ 8–11 μ m (1-2)	Beaton <i>et al.</i> (1984)
<i>G. eildonensis</i>	7–9 $\times$ 6.5–8 μ m, subreticulate	30–42 $\times$ 8.5–12 μ m (4)	Beaton <i>et al.</i> (1984)
<i>G. roseomaculatus</i>	14–17 $\times$ 12–16 μ m, spiny	30–35 $\times$ 12–14 μ m (2)	Singer & Smith (1960)
<i>G. cinnamomeus</i>	9–12 μ m diam., spiny	38–55 $\times$ 10–13 μ m (4)	Singer & Smith (1960)
<i>G. alveolatus</i>	9–12 μ m diam., subreticulate	26–33 $\times$ 9–11 μ m (2)	Singer & Smith (1960)
<i>G. socialis</i>	9–14 $\times$ 9–11 μ m, spiny	24–28 $\times$ 11–14 μ m (2-4)	Singer & Smith (1960)
<i>G. compactus</i>	10–14 $\times$ 9–12 μ m, spiny	26–33 $\times$ 9–12 μ m (4)	Singer & Smith (1960)
<i>G. ferruginascens</i>	11–14.5 $\times$ 9–12 μ m, spiny	35–60 $\times$ 11–14 μ m (2-4)	Singer & Smith (1960)
<i>G. parksi</i>	8–11 $\times$ 7–9 μ m, subreticulate	33–34 $\times$ 9–11 μ m (2-4)	Singer & Smith (1960)
<i>G. xanthosporus</i>	10–15 $\times$ 10–14 μ m, spiny	30–45 $\times$ 12–16 μ m (2)	Smith (1962)
<i>G. latijfer</i>	12–14 μ m, spiny	30–45 $\times$ 7–10 μ m (2)	Zhang & Yu (1990)
<i>G. ihcis</i>	9–11 (–13) μ m, spiny	33–51 $\times$ 10–15 μ m (1-2)	Llistosella & Vidal (1995)
<i>G. dominguezii</i>	8–10 μ m diam., subreticulate	25–40 $\times$ 10–15 μ m (1-2-3-4)	Present study

Pegler & T. W. K. Young (Beaton *et al.*, 1984) and *G. dominguezii* but in the first three their basidia do not change in KOH and they lack a developed columella. Only in *G. alveolatus* can a rudimentary columella be appreciated, in contrast to the well-developed one in *G. socialis* Singer & A. H. Sm. and *G. ihcis* Vidal & Llistosella (Singer & Smith, 1960; Llistosella & Vidal, 1995). In *G. cinnamomeus* Singer & A. H. Sm. the basidia change in KOH (Singer & Smith, 1960). *Gymnomycetes dominguezii* has a well-developed columella and the basidia are reddish brown in KOH. The rest of the species

are differentiated by having spinose spores. Thus, we consider that *G. dominguezii* combines a series of unique features, not observed in any other taxa within this genus.

A controversial and difficult question is that related to the delimitation of *Gymnomycetes*, *Martellia* and *Zelleromyces*. Zhang & Yu (1990), have discussed this subject and consider spore ornamentation as a good character to separate *Zelleromyces*, whose basidiospores have a regular to irregular reticulum, from *Martellia* and *Gymnomycetes*, with spinose ornamentation. From our own experience, however, this

character is not always so easy to distinguish, since warts and partial reticulum may be associated on the spores from a single basidiome or even on the same spore, as in the case of *G. eildonensis* (Beaton *et al.*, 1984). If we consider the other features, e.g. laticiferous hyphae and columella, the problem is similar, with characters of only relative usefulness. For Beaton *et al.* (1984) *Gymnomyces* lacks laticiferous elements and columella, but Singer & Smith (1960) described *G. socialis* and *G. alveolatus* with a columella, in parallel to *G. illicis* (Llistosella & Vidal, 1995). *Gymnomyces dominguezii* also shows a clear columella. Regarding laticiferous hyphae, Zhang & Yu (1990) indicate that in *Gymnomyces* this type of hypha may be present or absent. Sphaerocysts are, in our opinion, the more stable character, and may form nests, as in *Gymnomyces* and *Zelleromyces*, or appear scattered, as in *Martellia*. We believe that the present chaotic situation concerning the delimitation of the three genera could be clarified by applying molecular biology techniques, such as DNA sequencing.

In respect to *Gymnomyces* in Spain, only *G. illicis* has been recorded (Llistosella & Vidal, 1995). Calonge, Gómez & Moreno (1994) recorded *G. ferruginascens* Singer & A. H. Sm. from Spain, but a reexamination of that material has shown it to be a new species of *Zelleromyces* currently being described (Moreno-Arroyo, Gómez & Calonge, unpublished).

The authors are grateful to Mr M. Jerez for valuable SEM assistance and to Mr J. C. Hernández for word processing.

(Accepted 14 April 1997)

F. D. C. acknowledges the financial support received from the DGES and CSIC, under research project no. PB 95-0129-C03-01.

REFERENCES

- Beaton, G., Pegler, D. N. & Young, T. W. K. (1984). Gasteroid Basidiomycota of Victoria State, Australia. *Kew Bulletin* **39**, 669–698.
- Calonge, F. D., Gómez, J. & Moreno, B. (1994). *Gymnomyces ferruginascens* Singer & A. H. Sm. (Gasteromycetes) en España. *Boletín de la Sociedad Micológica de Madrid* **19**, 305–306.
- Llistosella, J. & Vidal, J. M. (1995). Due nuove specie di Russulales gasteroidi della regione mediterranea. *Rivista di Micologia* **2**, 149–162.
- Massee, G. & Rodway, L. (1898). DCIX. Fungi Exotici. Tasmania. *Gymnomyces*. *Bulletin of Miscellaneous Information of the Royal Botanic Gardens, Kew*, nos **136–137**, 125.
- Miller, S. L. (1988). A systematic evaluation of basidiospore symmetry and tegumentation in hypogeous and gasteroid Russulales. *Canadian Journal of Botany* **66**, 2561–2573.
- Moreno-Arroyo, B., Gómez, J. & Calonge, F. D. (1998). *Zelleromyces meridionalis* (Russulales, Elasmomycetaceae), a new species from Spain. *Mycotaxon* (in preparation).
- Pegler, D. N. & Young, T. W. K. (1979). The gasteroid Russulales. *Transactions of the British Mycological Society* **72**, 353–388.
- Singer, R. & Smith, A. H. (1960). Studies on secotiaceous fungi. IX. The astrogastraceous series. *Memoirs of the Torrey Botanical Club* **21**, 1–112.
- Smith, A. H. (1962). Notes on astrogastraceous fungi. *Mycologia* **54**, 626–639.
- Thiers, H. D. (1984). The genus *Arcangeliella* Cav. in the Western United States. *Sydowia* **37**, 296–308.
- Zhang, B. C. & Yu, Y. N. (1990). Two new species of gasteroid Russulales from China, with notes on taxonomy of *Gymnomyces*, *Martellia* and *Zelleromyces*. *Mycological Research* **94**, 457–462.