Check List 8(3): 531-533, 2012

ISSN 1809-127X (available at www.checklist.org.br)

Check List
Journal of species lists and distribution

Notes on Geographic Distribution

Broomeia congregata Berk., 1844 (Agaricales: Broomeiaceae): New distribution record for San Luis, Argentina

Mónica A. Lugo [1,2*], Esteban M. Crespo [1], Kentaro Hosaka [3] and Laura S. Domínguez [4]

1 Instituto Multidisciplinario de Investigaciones Biológicas (IMIBIO-CONICET). FQByF-UNSL, Diversidad Vegetal I. Ejército de los Andes 950, 5700. San Luis, Argentina.
2 Universidad Nacional de San Luis, FQByF, Diversidad Vegetal I. Ejército de los Andes 950, 5700. San Luis, Argentina.
3 National Museum of Nature and Science (TNS), Department of Botany. Tsukuba-shi, Ibaraki 305-0005, Japan.
4 Universidad Nacional de Córdoba, IMBIV (CONICET-UNC), CC 495. 5000. Córdoba, Argentina.
* Corresponding author. *E-mail: lugo@unsl.edu.ar*

Abstract: *Broomeia congregata* Berk. is a gasteroid fungus with a predominant African distribution. However, it has been documented twice, in 1912 and 1973, as occurring in Catamarca Province (Argentina, South America). Nearly forty years later, a new finding is reported for San Luis Province, Argentina. The report includes new morphological information based on scanning electron microscopy (SEM). In addition, some phenological, biogeographical and ecological implications concerning *B. congregata* are discussed.

Broomeia congregata Berk. was firstly described by Berkeley (1844) from South Africa. Later *B. congregata*, and *B. ellipsospora* Höhn. were cited for Kenya, Namibia, Mozambique, and South Africa, which initially led to the conclusion that *Broomeia* is an endemic genus from southern Africa (Höhnel 1905; Pole Evans and Bottomley 1919; Sharp and Piearce 1999). However, this genus was later reported for the first time in the Americas, with *B. congregata* (= *B. congregata* var. *argentinensis* Speg.) from South America and *B. guadalupensis* Lév. from the Caribbean, in the Island of Guadalupe (Léveillé 1848; Wright and Gamundi 1973; Coetzee 2007). More recently, its distribution was extended to Asia, from Yemen in the Arabian Peninsula (Kreisel and Al-Fatami 2008). In Argentina, there were two sporadic findings of *B. congregata*, one in 1912 and another in 1973, both in the Province of Catamarca (Spegazzini 1912; Wright and Gamundi 1973; Dios *et al*. 2011).

Broomeia congregata has been placed in the gasteroid family Broomeiaceae (Agaricales, Basidiomycota) and characterized by having a compound basidiome with numerous tightly packed spore sacs, each with its own endoperidium and all sunk in a common stroma and covered by a common exoperidium that degrades at maturity (Murray 1883; Mycobank 2011). Microscopically, globose, subglobose to ellipsoidal spores of variable size with a reticulated surface consisting of a lattice in a "honeycomb" mesh of pentagonal to hexagonal cells (with columnar appearance under light microscopy) occur in this species. In addition, its spores also have pores at the spore wall, visible only by scanning electron microscopy (SEM) (Wright and Gamundi 1973; Kreisel and Al-Fatimi 2008).

Recently, specimens of *B. congregata* were found in Bajo de Véliz, Santa Rosa de Conlara Department, San Luis (Argentina), and were studied by both, light and scanning electron microscopy. SEM images of spores were taken with a Zeiss LEO 1450VP at LABMEM-CCT CONICET-UNSL SEM.

The specimens were mature and had an anise scent, each basidiome contained 30 to 40 spore sacs, of 0.5 – 0.7 (1.3) cm in diameter (Figure 1A); exoperidium was lacking; endoperidium light brown with a fimbriate pore. Basidiospores globose, subglobose to ellipsoidal, many slightly angular, up to 6.4 – 9.6 x 5.6 – 8 µm (including ornamentation), reticulated; ornamentation less than 0.5 µm of height; meshes are pentagonal or hexagonal of variable diameter (0.5 to 1.8 µm); within the mesh in the spore wall, there are usually 1 to 6 pores, but might be absent or more (up to 11) within the same spore and pores differ in diameter, apiculus not seen (Figure 1B, C). Capillitium unbranched, brownish, 3.2 – 7.2 µm in diameter, solid or with a very narrow lumen; thread walls tortuous.

In the protologue, Berkeley (1844) enumered more than 150 spore sacs per stroma, while materials studied from Catamarca (Wright and Gamundi 1973), was referred with 10 to 40 gastrocarps, as occurred in the specimens from San Luis. San Luis specimens, however, had a higher number of pores (up to 11) within the mesh (Figure 1C) than the ones described by Wright and Gamundi (1973), and Kreisel and Al-Fatimi (2008) from Yemen material.

Broomeia ellipsospora Höhn. differs from *B. congregata* by having a smaller and thiner stroma, grey to brown endoperidium and smooth to rough elliptical basidiospores. In adddition, *B. ellipsospora* has been found on sand and sandy soil from South Africa, Namibia and Mozambique without establishing any association with plants (Höhnel 1905; Bottomley 1948; Dissing and Lange 1962; Coetzee 2007).

Another Neotropical taxon, *B. guadalupensis* Lév., remains in an uncertain taxonomic position because of doubts about its identity. In the protologue, *B. guadalupensis* (Léveillé 1848) was described with cup-shaped volva, a partial exoperidium surrounding each gastrocarp of stroma, with cartilaginous consistency,

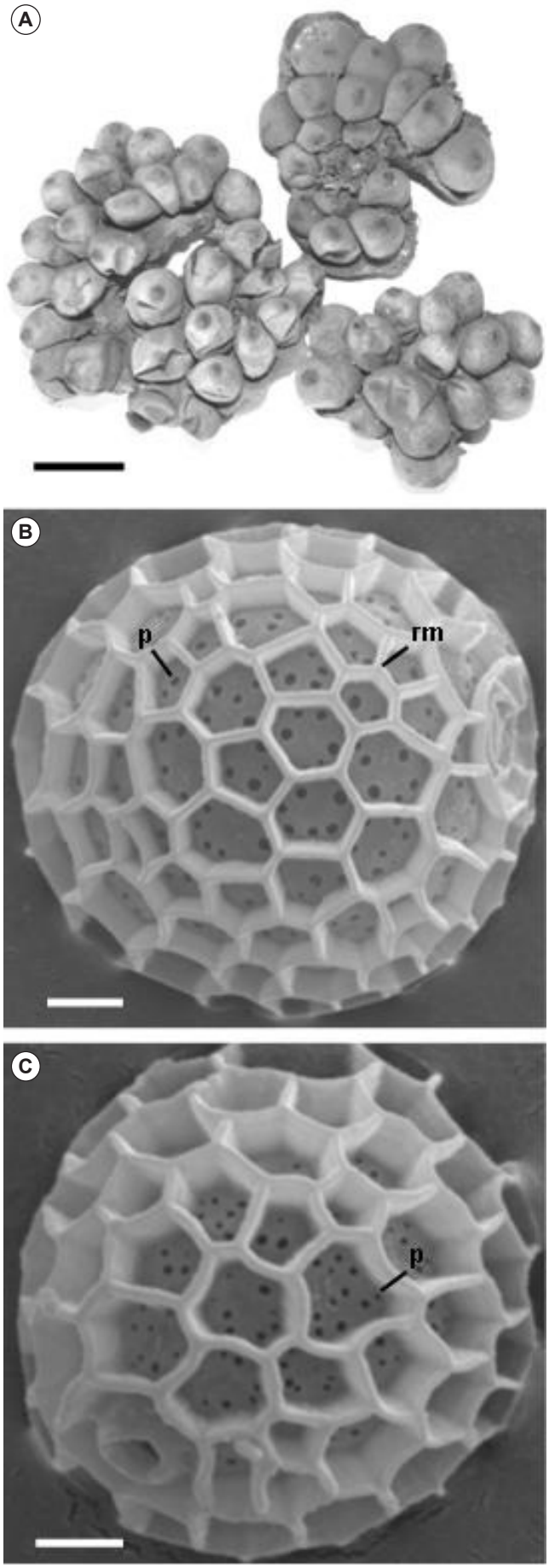

Figure 1. *Broomeia congregata*. A, general view of basidiome. B and C, details of the spores under SEM. B, aspect of the reticulate mesh (rm) of the exosporium and cells with pores (p); C, detail of cells of exosporium with numerous pores (p). Scales: A= 1 cm; B, C= 1 µm.

lobed at the margin and yellowish. Further, *Diplocystis,* another genus of Broomiaceae (Zeller 1948), was founded considering a resupinate or patellate stroma and individual veil (Berkely and Curtis 1869), each gastrocarp possesess its own exoperidium. Thus, some authors have speculated that *B. guadalupensis* might be considered a *Diplocystis* species (Coetzee 2007), particularly as *D. wrightii*, both entities were collected in Guadalupe (Coker and Couch 1928; Bottomley 1948).

Some phenological and ecological considerations can be made concerning *B. congregata* based on data from herbarium material. *Broomeia congregata* was collected in November 1909 (Spegazzini 1912) and January 1972 (Wright and Gamundi 1973) in Catamarca and November 2005 in San Luis. Therefore, it can be inferred that *B. congregata* has a summer fruiting period corresponding to the wet season of West Central Argentina, although it is known that the fruiting bodies of some gasteroid fungi, e.g. *Geastrum* and *Lycoperdon*, can remain undamaged for long periods under suitable conditions (Domínguez personal communication). Hosaka *et al.* (2006) mentioned: "Zeller (1948) described Broomeiaceae in Lycoperdales, but it is unclear whether this family is more closely related to Geastrales than to other homobasidiomycetes". Surprisingly, preliminary data based on the sequences of ITS region and other genes, including three additional nuclear markers (nuclear ribosomal large subunit DNA, RPB2, and EF-1α) and two mitochondrial markers (small subunit of ribosomal DNA and ATP6) indicated that the genus belongs to Polyporales (Hosaka 2011). There are, however, no obvious morphological similarities between *Broomeia* and other genera in Polyporales, but the lignicolous habit is arguably the common ecological character of the order, and the species was found growing under tree genera belonging to the same plant family.

In addition, *B. congregata* has been cultured successfully from basidiome context on malt extract agar, potato glucose agar and carrot agar media (usually used for Polyporales), although mycelia tend to grow very slowly reaching 5.5 - 6 cm in diameter at 18 days of culture and having a negative Melzer's reaction in mycelia and chlamydospores (Wright and Gamundi 1973). Likewise, as many species of Polyporales, *B. congregata* forms chlamydospores in culture (Wright and Gamundi 1973) very similar to the ones formed by some species of *Tomophagus* (*i. e. T. colossus*).

Broomeia congregata collected in Bajo de Véliz was found under a member of the Fabaceae (*Prosopis* sp.), as well as the material described by Wright and Gamundi (1973) from Catamarca, while the African specimens were found under *Acacia s. l.*, another genus of Fabaceae. At this moment, however, the possibility of ectomycorrhizal status of *Broomeia* cannot be discarded. It is known that Fabaceae can establish ectomycorrhizal and/or arbuscular mycorrhizal symbioses (Wang and Qiu 2006; Sprent and James 2007; McGuire *et al.* 2008). In Africa, *Acacia s. l.* are ectomycorrhizal associated with gasteroid and telephoroid Basidiomycota (Diédhiou *et al*. 2005; Sprent and James 2007). In Argentina, species of *Acacia s. l.* and *Prosopis* were reported as being arbuscular mycorrhizal (Fracchia *et al.* 2009) in Córdoba Province; however, other

species of these genera are cited as ectomycorrhizal in South America (Frioni *et al*. 1999). Thus, in Argentina, ectomycorrhizal fungi, potentially including *B. congregata,* could establish ectomycorrhizae with *Prosopis* at different developmental stages than those studied by Fracchia *et al*. (2009), considering that this type of association may be transient over the life cycle of the host.

This work extends the distribution of *B. congregata* to San Luis Province (Argentina) *ca.* forty years after its last finding in Argentina and provides data that allow us to reject the hypothesis of *Broomeia* as an endemic genus of Africa. We provide more information about spore wall ornamentation with SEM. Further study is necessary to clarify their ecological characters (saprobe, lignicolous or ectomycorrhizal), co-specificity across all known distribution ranges, and phylogenetic position.

Family Broomeiaceae

Broomeia congregata Berk., 1844

Known geographic distribution. Africa: Kenya, Tanzania, Congo, Namibia, Mozambique, South Africa, and Zimbabwe. Middle East: Yemen. South America: Argentina (Catamarca Province).

New state records. Argentina: San Luis Province.

Examined material. ARGENTINA: **San Luis** - Departamento Santa Rosa de Conlara, Parque provincial Bajo de Véliz, 5-XI-2005 (R. Paez et E. Crespo): in "monte", under *Prosopis* sp. [LSD 2378 (CORD)].

Acknowledgments: This work was supported by PROICO 2-0203 (FQBYF-UNSL). M.L. is a researcher of Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET, Argentina). The authors are very grateful to M.E. González Mazza and T.L. Sasser for English proofreading of the preliminary version of the manuscript. Special thanks to L. Peterson for critical review of the paper.

Literature Cited

Berkeley, M.J. 1844. Decades of Fungi. *London Journal of Botany* 3: 185-194.

Berkely, M.J. and M.A. Curtis. 1869. Fungi Cubenses II. *Journal of Linnean Society of London* 10: 341.

Bottomley, A.M. 1948. Gasteromycetes of South Africa. *Bothalia* 4 (3): 1-473.

Coetzee, J.C. 2007. The genus *Broomeia* (Gasteromycetes, Broomeiaceae) in a nutshell. *Mycorrhiza Newsletter* 7: 6-8.

Coker, W.C. and J.N. Couch. 1928. *The Gasteromycetes of the Eastern United States and Canada*. Chapel Hill: The University of North Carolina Press. 201 p.

Diédhiou, A.G., G. Guèye, M. Diabaté, Y. Prin, R. Duponnois, B. Dreyfus and A.M. Bâ. 2005. Contrasting responses to ectomycorrhizal inoculation in seedlings of six tropical African tree species. *Mycorrhiza* 16: 11-17.

Dios, M.M., E. Albertó and G. Moreno. 2011. Catálogo de hongos gasteroides (Basidiomycota) de Catamarca, Argentina. *Boletín Sociedad Argentina de Botánica* 46 (1-2):5-11.

Dissing, H. and M. Lange. 1962. Gasteromycetes of congo. *Bulletin du Jardin Botanique de L´Etat Bruxelles* 32(4): 325-516.

Frioni, L., H. Minasian and R. Volfovicz. 1999. Arbuscular mycorrhizae and ectomycorrhizae in native tree legumes in Uruguay. *Forest Ecology and Management* 115: 41-47.

Fracchia, S., A. Aranda, A. Gopar, V. Silvani, L. Fernández and A. Godeas. 2009. Mycorrhizal status of plant species in the Chaco Serrano Woodland from central Argentina. *Mycorrhiza*: 19: 205-214.

Höhnel, F. von. 1905. Mykologisches. *Österreichische botanische Zeitschrift* 55(3): 97-101.

Hosaka, K, S.T. Bates, R.E. Beever, M.A. Castellano, W. Colgan III, L.S. Domínguez, J. Geml, A.J. Giachini, S.R. Kenney, E.R. Nouhra, N.B. Simpson and J.M. Trappe. 2006. Gomphoid-phalloid phylogeny. Molecular phylogenetics of the gomphoid-phalloid fungi with an establishment of the new subclass Phallomycetidae and two new orders. *Mycologia* 98 (6): 949-959.

Hosaka, K. 2011. Systematics of an enigmatic Basidiomycete, *Broomeia*: its Phylogenetic and Biogeographic Implications. *Asian Mycological Congress, Incheon-Korea Symposium* 1-1. Abstract.

Kreisel, H. and M. Al-Fatimi. 2008. Further Basidiomycetes from Yemen. *Feddes Repertorium* 119: 463-483.

Léveillé, M.J.H. 1848. Fragments Mycologiques. *Annales des Sciences Naturelles, Botanique* 9 (S III): 119-144.

McGuire, K.L., T.W. Henkel, I. Granzow de la Cerda, G. Villa, F. Edmund and C. Andrew. 2008. Dual mycorrhizal colonization of forest-dominating tropical trees and the mycorrhizal status of non-dominant tree and liana species. *Mycorrhiza* 18: 217-222.

Murray, G. 1883. On the outer peridium of *Broomeia*. *Journal of the Linnean Society of London Botany* 20 (128): 311-313.

Mycobank. 2011. *Fungal Databases*. Nomenclature and Species Banks. Online Taxonomic Novelties Submission. Administered by the International Mycological Association. Electronic Database accessible at http://www.mycobank.org. Captured on 08 August 2011.

Pole Evans, I.B. and A.M. Bottomley. 1919. On the genera *Diplocystis* and *Broomeia*. *Transactions of the Royal Society of South Africa* 7 (1): 189-192.

Sharp, C. and G. Piearce. 1999. Some interesting gasteroid fungi from Zimbabwe. *Kew Bulletin* 54 (3): 739-746.

Spegazzini, C. 1912. Mycetes Argentinensis. Serie VI *Anales Museo Nacional de Buenos Aires* 23: 1-146.

Sprent, J.I. and E.K. James. 2007. Legume evolution: where do nodules and mycorrhizas fit in. *Plant Physiology* 144: 575-581.

Wang, B. and Y.L. Qiu. 2006. Phylogenetic distribution and evolution of mycorrhizas in land plants. *Mycorrhiza* 16: 299–363.

Wright, J. and I. Gamundi. 1973. Nuevo hallazgo de *Broomeia congregata* (Gasteromycetes). *Boletín de la Sociedad Argentina de Botánica* 15 (2-3): 187-196.

Zeller, S.M. 1948. Notes on certain Gasteromycetes, including two new orders. *Mycologia* 40 (6): 639-668.

Received: December 2011
Accepted: February 2012
Published online: June 2012
Editorial responsibility: Matias J. Cafaro