

Geastrum calycoriaceum



Fungal Planet 1080 – 29 June 2020

Geastrum calycicoriaceum Freitas-Neto, J.O. Sousa, Ovrebo, M.P. Martín & Baseia, *sp. nov.*

Etymology. From Latin *calyx* (cup) and *coriaceum* (leather). In reference to the coriaceous surface of mycelial layer, peeling-off to form a cup under basidiomata.

Classification — *Geastraceae*, *Geastrales*, *Agaricomycetes*.

Unexpanded basidiomata epigeous, golden brown (5D7, Kernerup & Wanscher 1978) to brown (5E4; 5F4), subglobose to obpyriform, 11.5–15 × 12–20 mm, surface coriaceous, with little triangular processes when young, velutinous to papery with age, slightly encrusted with debris. *Subiculum* white (4A1). *Expanded basidiomata* saccate, 10–23 mm high (including peristome) × 11–32 mm wide. *Exoperidium* splitting into 5–9 triangular rays, revolute or sometimes involute, rolling up under basidiomata, non-hygroscopic. *Mycelial layer* honey yellow (5D6) to brown (5F5), non-persistent, ephemeral, peeling-off forming a cup under basidiomata, surface coriaceous, not encrusted. *Fibrous layer* greyish yellow (4B3) to white orange (5A2), coriaceous. *Pseudoparenchymatous layer* reddish (8E8) when fresh, brownish orange (5C4) to dark brown (6F4) when dried, rimose, persistent or peeling-off in irregular patches, with an inconspicuous collar. *Endoperidial* body greyish brown (6D3) to brownish orange (6C3), subglobose to pyriform, 5–18 × 9–21 mm, sessile, surface glabrous, non-pruinose. *Apophysis* absent. *Peristome* fimbriate, distinctly delimited by greyish brown (6E3) line, mammiform, lighter than endoperidium, < 2 mm high. *Gleba* greyish brown (6F3). *Basidiospores* brownish, globose to subglobose, 3.3–4.1 × 3.25–4.03 µm ($x = 3.62 \pm 0.2 \times 3.55 \pm 0.2$ µm, $Q_m = 1.02$, $n = 30$), ornamentation conspicuous under LM. *Warts* cylindrical (0.3–0.5 µm high), sometimes with some confluent tips. *Apiculous* reduced. *Basidia* yellowish, oval, lageniform to clavate, thick walls (0.4–1.1 µm), 10.0–25.9 × 3.8–11.8 µm, 2–5 sterigmata. *Eucapillitium* pale brown hyphae, 2.8–6.4 µm diam, surface encrusted, covered by warts, thin walls (0.4–1.1 µm) and lumen evident. *Mycelial layer* composed of yellowish to hyaline, some sinuous and inflated hyphae, 1.9–3.3 µm diam, surface non-encrusted, some branched, thin-walled (0.3–0.75 µm) and lumen evident. *Fibrous layer* composed of yellowish to hyaline hyphae, 2.9–5 µm diam, surface non-encrusted, non-branched, thin-walled (0.5–1 µm) and lumen evident. *Pseudoparenchymatous layer* composed of yellowish, subglobose, oval to elongated cells, 21.2–69.8 × 10.1–47.9 µm, thick-walled (0.9–1.5 µm). *Rhizomorphs* composed of hyaline, thin hyphae, surface covered by acicular crystals, 3.8–11.6 × 1.1–1.9 µm, in an irregular arrangement.

Colour illustrations. Brazil, Rio Grande do Norte Baía Formosa, Reserva Particular do Patrimônio Natural (RPPN) Mata da Estrela, area of Atlantic Rainforest where the type species was collected; expanded basidiomata *in situ* (UFRN-Fungos 3002, paratype); basidiospores under SEM; eucapillitium under SEM; crystals of the rhizomorphs. Scale bars = 5 mm (basidiomata *in situ*), 2 µm (basidiospores under SEM), 5 µm (eucapillitium under SEM and crystals of the rhizomorphs under LM).

Ecology & Distribution — The specimens were found in the Atlantic Rainforest of the state Rio Grande do Norte, Brazil, and the Lowland Tropical Moist Forest of Panama Province, Panama. Growing on wood and leaf litter, with forest cover and gregarious habit. The distribution of *G. calycicoriaceum* is restricted to Latin America, specifically Brazil, Panama and Peru.

Typus. BRAZIL, Rio Grande do Norte, Baía Formosa, Reserva Particular do Patrimônio Natural (RPPN) Mata da Estrela, S6°24'33" W34°59'25", on leaf litter, 26 June 2009, B.D.B. Silva et al. (holotype UFRN Fungos-1215; ITS and LSU sequences GenBank KJ127031 and JQ683663, MycoBank MB834940).

Additional materials examined. PANAMA, Panama Province, Gatun Lake, Buena Vista Peninsula, near Barro Colorado Island, N9°11'00" W79°49'34", on wood, 16 Aug. 1999, C.L. Ovrebo 3757 (paratype UFRN-Fungos 3002; ITS and LSU sequences GenBank MT183521 and MT183522). — PERU, Cuzco, Santa Maria, no date, L. Papinutii, G. Roló & J.C. Zamora (paratype MA-Fungi 83787; ITS and LSU sequences GenBank KF988449 and KF988584).

Notes — *Geastrum calycicoriaceum* is characterised mainly by its ephemeral yellowish mycelial layer with coriaceous surface, peeling-off forming a cup under basidiomata and persistent rhizomorph with acicular crystals, also by distinct delimited peristome and basidiospores with 3.2–4.1 µm diam and small warts (up to 0.5 µm high). Our phylogenetic analyses (concatenate ITS and LSU) grouped *G. calycicoriaceum* in the *Mycelisotroma* section, *Velutina* subsection. This subsection comprises, until now, the species *Geastrum velutinum*, which has some features in common with *G. calycicoriaceum*: both have a yellowish mycelial layer, delimited and fimbriate peristome and presence of subiculum. However, *G. velutinum* has lighter colours in peridium layers (yellowish pseudoparenchymatous layer when fresh and pale brown endoperidium) than *G. calycicoriaceum*; moreover, *G. velutinum* lacks an ephemeral, coriaceous mycelial layer (Dissing & Lange 1962). *Geastrum javanicum* is another species which could be grouped in subsect. *Velutina* based on its morphological features. Presently there are no molecular data from the type to support *G. javanicum* as morphologically similar to *G. calycicoriaceum*, and it is distinct based on its smaller basidiospores (2.5–3.5 µm diam), conical peristome and felted endoperidium surface (Ponce de Leon 1968). *Geastrum argentinum* is another species morphologically close to *G. calycicoriaceum*. However, it has a non-delimited peristome, and larger basidiospores (4.8–5.6 µm diam) (Zamora et al. 2013).

Supplementary material

FP1080 The tree was obtained after a Bayesian analysis (ITS nrDNA) in MrBayes v. 3.2.7a (Ronquist et al. 2012) using the settings indicated in Accioly et al. (2019), protocol deposited in protocols.io (<https://doi.org/10.17504/protocols.io.wpdfdi6>).

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