

NOTES ON NEW FORMOSAN FOREST FUNGI⁽³⁾III. The Genus *Calostoma* DesvZUEI-CHING CHEN⁽¹⁾ and KAI-YÜN YEH⁽²⁾

Abstract: Descriptive notes on two newly discovered forest soil fungi belonging to the genus *Calostoma* Desv. are given. *Calostoma junghuhnii* (Schl. & Müll.) Mass. and *C. cinnabarium* Desv. were collected in the northern part of Taiwan in September 1974. The validity of *Mitremyces formosana* Saw., is also discussed in this paper.

INTRODUCTION

Dring (1973) recognized Calostomataceae, as having a single genus *Calostoma*, and belonging to the Tulostomatales, Gasteromycetes. The genus *Calostoma* (synonym: *Mitremyces* Nees) of which some 10 species are known, is characterized by having an epigeal, globose fruit-body which is borne on a well-developed stipe. The peridium complex of the fruit-body consists of four clearly defined layers: the outermost is gelatinous or spiny; the second is pigmented; the third is very horny, and the innermost is membranous and remains attached to the outer layers only at the top, around the star-shaped apical pore and so hangs loosely inside the horny layer. The stipe is a continuation of the outer and horny layers. Gleba is pale, of claylike texture with an annularly thickened capillitium which disintegrates at maturity. Basidial islands are formed from a primary infertile basidium surrounded by secondary fertile basidia. The secondary basidia are pleurosporous. Basidiospores are large and often extravagantly ornamented either with a reticulum or long spines.

The distribution of the genus is reported from the Americas, Australia, Southern Asia, Indonesia, and Japan. From Taiwan, Sawada (1933) reported the new species, *Mitremyces formosana* Saw. This is the only known species of *Calostoma* reported from Taiwan prior to 1974, when the junior author collected several fruitbodies of *Calostoma* from the northeastern mountain area of Taipei. The specimens collected belonged to two distinct groups in the genus *Calostoma* and have been identified by the senior author as *Calostoma junghuhnii* (Schl. & Müll.) Mass. and *C. cinnabarium* (Desv.) Mass.

DESCRIPTIONS

14. *Calostoma cinnabarium* Desv., Jr. de Bot. 2: 94, 1809. Pl. 1: A-D, Pl. 2: figs. 1-5.

Scleroderma calostoma Pers., in Desv., Jr. de Bot. 2: 15, 1809.

Lycoperdon heterogeneus Bosc, Mag. Ges. Nat. Fr. 5: 87, 1811.

Mitremyces heterogeneus Nees, Syst. der Pilze und Schwämme 136, 1817.

- (1) 陳瑞青 Associate Professor, Department of Botany, National Taiwan University, Taipei, Taiwan, 107, Republic of China.
 (2) 葉國暉 Senior student of the same department.
 (3) This work was supported by the National Science Council, Republic of China.

Cyropodium coccineum Hitchcock, Amer. Jr. Sci. 9: 56, 1825.

Mitremyces cinnabarinum Schw. einitz, Syn. Fung. Amer. Bor. in Amer. Phil. Soc. 255. no. 2244, 1831.

Mitremyces lutescens Ell. & Ev., Fung. Columb. 799, N. A. F. 727; Rav. Fung. Car. 1: 76.

Fruitbodies solitary or gregarious. Exoperidium, nape-yellow, colonial-buff, to maize-yellow, inside vermilion (salmon-orange to flamescarlet), breaking at base like a calyptra, and also breaking into irregular lobes at the apex, sometimes with squamous patches, up to 1-1.5 mm diam., covering the whole head. Endoperidium, ochraceous, ochraceous-tawny, sometimes with a vermilion tint, subglobose, 1.3-1.6 × 1.2-1.4 cm.; ostiolum vermilion, teeth 5-7. Footstalk or stem-like base comprised of many strings extending from the basal surface of the endoperidium, 1.0-1.6 (-2.5) cm long, 0.8-1.5 cm wide. Spore-sac, very pale ochre, (naphthalene-yellow, light-buff, to cream color), very thin, membranous, free on inside of the endoperidium but connected with the ostiolum at its top. Spore mass straw-yellow to cream color. Spores, elliptic-oblong, minutely verrucose or punctate, pale ochre-yellow. Melzer's reaction negative, 12-20 × 7-9 μ .

Hyphal system dimitic, generative hyphae thin-walled, hyaline, smooth, frequently branched, branches mostly dichotomous or fork-shaped, infrequently nodose-septate, distributed in peridium, 2-5 μ diam., or in gleba, 5-6 μ diam. Skeletal hyphae, fiber-like, thick-walled, rarely branched or moderately branched, few, with indistinct clamp-connections, 6-10 μ diam., wall up to 4.5 μ thick, distributed in peridium and spore-sac, vermilion portion of exoperidium consisting of brownish or yellow colored substances incrustated on the surface of the hyphal wall.

Distribution: Eastern U.S.A. Mexico, South America, Mainland China, and Taiwan.

Specimen examined: *TAIPEI*: San-chiau-lun, Sept. 12, 1974, *Z. C. Chen* 2291. (NTU).

Habitat: On the ground of the banks of a stream in a woods, growing in a rather shady moist site, single or gregarious. Fruitlet appearing in the early fall.

15. *Calostoma junghuhnii* (Schl. & Müll.) Mass., Ann. Bot. 2(5): 25-45, 1888. Pl. 1: E-H; Pl. 2. Figs. 6-9.

Mitremyces junghuhnii Schlechtendal & K. Müller, Bot. Ztg. 401, 1844.

M. beyrichii Schl. & Müll., l.c.

Fruitbodies solitary, 1.3-1.7 × 1.0-1.5 cm, stipe 1.2-2.0 × 0.8-1.5 cm. Exoperidium, dark brown to mars-brown, soon breaking up into irregular warts and disappearing following the expansion of the head, only a small amount of the remnant attached to the base. Endoperidium, cinnamon-brown to russet, subglobose, glabrous, with a very well developed ostiolum on the top. Ostiolum prominent, very thick, erect, triangular in shape in cross section, teeth 5-6, stem-like base originating from the base of endoperidium, comprised of many rhizoidal extensions, concolorous with the head. Spore-sac pale, membranous, free only in upper part, attached on the mouth of peridium, marguerite-yellow. Spores white, marguerite-yellow to naphthalene-yellow in mass, globose, surface coarsely tuberculate, appearing like the flower of a dandelion with a thick outer-wall, 3-4.5 μ in thickness surrounding the inside globose spores, 9-13 μ diam. Total spore size ranging from 15-22 μ (the majority 16-19 μ). Melzer's reaction negative.

Hyphal system dimitic, generative hyphae thin-walled, smooth or rarely incrustated, frequently branched, usually fork-shaped, nodose-septate but very scarcely dis-

tributed, 1-3.5 μ diam. for the hyphae in the gelatinous matrix of the endoperidium, or exoperidium, 4-6 μ in spore-sac and gleba. Skeletal hyphae, fiber-like, distributed in peridium. 9-15 μ diam., wall thickness up to 6 μ , lumen very narrow up to 2 μ diam.

Distribution: Sikkim, Java, Sumatra and Taiwan.

TAIPEI: San-chiau-lun, Sept. 12, 1974, Z. C. Chen 2292. (N. T. U.)

Habitat: On the ground in hardwood forests.

UNCERTAIN SPECIES

Mitremyces formosana Sawada, Desc. Catal. Form. Fungi 6: 68, 1935.

The holotype which was deposited in the mycological herbarium of Plant Pathology Laboratory, College of Agriculture, National Taiwan University, was lost after World War II. The author carefully checked through Sawada's collection and could not find this specimen or any other collection with the above name. His description suggests that this species is similar to *Calostoma junghuhnii*. *Mitremyces formosana* Saw. had a globose fruitbody, 1.2×1.0-1.1 cm, avellaneous, surface of endoperidium scattered with scales of exoperidium. Ostiolum prominent, very thick about 0.3-0.5 mm in thickness in cross-section, coral-red, teeth 6. Spore-sac thin-papery, massicot-yellow. Spores globose with tuberculate surface, hyaline or slightly yellowish in color, 11-15 μ diam., one guttulate. Stem or footlike structure not seen. The specimen was collected from a pine forest at 7,000 ft. altitude in Taiwan. Sawada recognized the similarity of his species with *Mitremyces junghunii* but separated his new species from it because it lacked a stem. Koboyasi (1962) considered *M. formosana* to be a form of *C. junghuhnii* with very short rooting stem.

LITERATURE CITED

- Boedijn, K. B., 1938. The genus *Calostoma* in the Netherland Indies. in Bull. Jard. Bot. Buitenzorg, 16(3): 64-75.
- Burnap, E., 1897. Notes on the genus *Calostoma*. in Bot. Gaz., 23: 180-196.
- Dring, D. M., 1873. Gasteromycetes in The Fungi, an advanced treatise, Vol. IV B, 451-478. Ed by Ainsworth, Sparrow, and Sussman. Academic Press.
- Imazeki, R., & T. Hongo., 1957. Coloured Illustrations of Fungi of Japan. Hoikusha, Osaka, Japan 181 pp.
- Kobayasi, Yosio., 1962. The *Calostoma* of Eastern Asia, in Acta Phytotax Geobot. 20: 252-257.
- Masses, G., 1888. A Monograph of the Genus *Calostoma* Desv. (*Mitremyces*, Nees). in Ann. Bot. 2(5): 25-45.
- Ridgway, R., 1912. Color Standards and Color Nomenclature. Washington, D. C.
- Sawada, K., 1933. Descriptive Catalogue of the Formosan Fungi VI: 68.

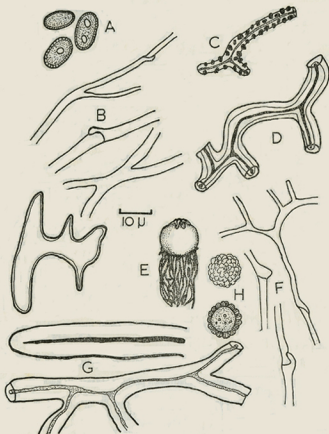


Plate I. A-D: *Calostoma cinnabarinum*; A: spores, B: generative hyphae, C: pigmented hyphae in teeth, D: thick-walled fiber-hyphae. E-H: *Calostoma fungukunii*; E: fruitbody 1.0x, F: generative hyphae, G: thick-walled fiber-hyphae, H: spores.

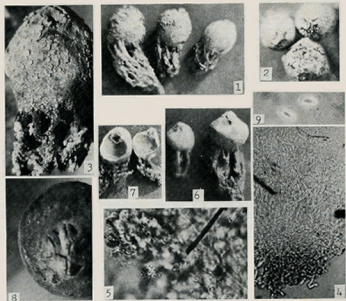


Plate II. Figs. 1-5. *Calostoma junghuhnii*. 1: side view of fruitbodies (1 \times), 2: surface view of ostiolum and teeth (1 \times), 3: side view of a fruitbody (2.5 \times), 4: cross-section of endoperidium (100 \times), 5: basidiospores (400 \times); Figs. 6-9. *Calostoma cinnabarium*. 6: side view of fruitbodies (1 \times), 7: longitudinal section of a fruitbody (1 \times), 8: surface view of ostiolum and teeth (3.5 \times), 9: basidiospores (400 \times).