Camarops spathulata: the teleomorph in agar culture

B. E. Callan & J. D. Rogers

Department of Plant Pathology, Washington State University, Pullman, WA, 99164-6430 USA

Callan, B.E. & J.D. Rogers (1989). *Camarops spathulata:* the teleomorph in agar culture. SYDOWIA 41: 74–78.

Several tropical collections of *Camarops spathulata* (Ascomycetes, Boliniaceae) are described. Pure cultures obtained from a stroma collected in French Guiana produced the teleomorph. No anamorph was observed. The generic disposition of this fungus is also discussed.

The teleomorph of *Camarops spathulata* (Berk. & Br.) Nannf. (Boliniaceae, Ascomycetes) was produced in pure agar cultures initiated from ascospores obtained from stromata collected in French Guiana. Teleomorphic stromata from nature and from culture and cultural characteristics are described below.

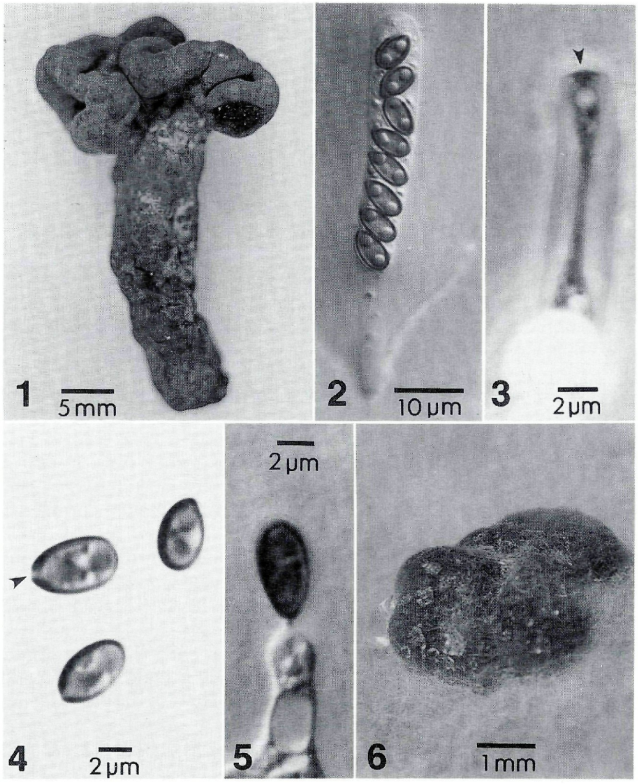
Camarops spathulata (Berk. & Br.) Nannf., Svensk. Bot. Tidskr. 66: 369. 1972.

Stromata from nature (Fig. 1) clavate to spathulate, stipitate, with distinct fertile portion irregularly lobed and overhanging the stalk or eccentric and cap-like. – Fertile portions 1–3 cm tall x 1.5–3.5 cm diam x 0.8–1.2 cm thick with cylindrical stipes 1.5–2.5 cm tall x 1–1.5 cm diam. – Immature stromata pulvinate, smooth, with exterior sulphur yellow to rust brown. – Mature stromata at first deep rust brown, smooth and velvety, with age cracking into square plates on upper surfaces. – Perithecial ostioles minute, dark, punctate. – Upper stromatal surfaces frequently darkened with patches of dried perithecial exudate and ascospores. – Interior of stromata dark reddish brown, the center of the fertile portion either hollow or filled with loose, tan to pinkish mycelium, stipe solid and concolorous.

Perithecia polystichous, embedded up to 4–5 mm below surface, globose to subglobose, ca. 1 mm diam., some with greatly elongated necks. – Asci (Fig. 2) eight-spored, cylindrical, short-stipitate, with spore-bearing portions (25–)29–38 x 4–5.5(–7) µm, stipes (10–)15–25 x 2–3(–4) µm, with apex not bluing in Melzer's iodine reagent, but appearing to have a small, discoid to funnel-shaped apparatus when examined by phase microscopy (Fig. 3). –

Ascospores brown, unicellular, ellipsoid to broadly ovoid, smooth, 5.5–6(–8) x 3–3.5 µm, with a germ pore at the more pointed end (Fig. 4).

Ascospores streaked on 2% Difco water agar germinating from germ pore after 48–60 h (Fig. 5). – Colonies on 2% Difco



Camarops spathulata

Figs. 1, 3–6. AR 3205. – Fig. 2. AR 3243. – Fig. 1. Stroma (nature). – Fig. 2. Ascus (nature). – Fig. 3. Ascus apex at arrow (culture). – Fig. 4. Ascospores (culture), pore at arrow. – Fig. 5. Germinating ascospore (culture). – Fig. 6. Stroma on oatmeal agar. – Figs. 2,4 – Differential interference contrast microscopy; Fig. 3 – Darkfield phase contrast microscopy; Fig. 4 – Brightfield microscopy.

oatmeal agar incubated at ca. 20 °C in alternating 12 h periods of darkness and fluorescent light covering Petri dish in ca. 4–5 wk, at first hyaline and submerged, then developing a thin white superficial layer that eventually turns yellow, with underlying hyphae darkening to deep rust brown. Reverse more or less unstained until colonies start to dry, then darkening to gray. No conidiogenous structures observed.

Stromata initiated in culture after 2–3 wk, irregularly pulvinate, superficial, 0.2–0.5 cm. diam., yellowish white when small, darkening to dull rust brown at maturity (Fig. 6). Surface velvety, perithecial ostioles faintly visible, becoming more prominent, minutely papillate and darker than surrounding tissue as colony dries. Interior and exterior concolorous.

Perithecia developing after 5–6 wk, maturing after 7–8 wk. Perithecial arrangement and dimensions as well as those of asci and ascospores averaging the same as those from natural collections. Ascospores ejected forcibly from perithecia, forming dark clumps on Petri dish lid above stromata. Some asci discharging ascospores passively, the latter collecting as dark droplets at ostioles. Ascospores germinating in culture in 48–60 h.

Collections examined. – FRENCH GUIANA: Rossman AR 3243 BPI, on wood; Rossman AR 3205 BPI (Cultured); Samuels (coll. by R. Halling).

Several *Camarops* species have been previously cultured: *C. lutea* (Alb. & Schw. : Fr.) Nannf. (Petrini, 1986); *C. petersii* (Berk. & Curt.) Nannf. (Horn, 1984); *C. polyspermum* (Mont.) Miller [Chesters, 1960; Martin, 1969, as *Nummulariola polysperma* (Mont.) Martin; Mercuri, 1972]; and *C. tubulina* (Alb. & Schw.) Shear (Chesters, 1960). Of these, only cultures of *C. lutea* and *C. petersii* have produced the teleomorph. No anamorph has been associated with cultures or developing stromata of any *Camarops* species. Indeed, it appears that members of this genus lack anamorphs (Nannfeldt, 1972).

Camarops spathulata apparently differs from the other two species fruiting in culture in that ascospores are forcibly ejected from asci. Horn (1984) and Petrini (1986) did not record this phenomenon in cultures of *C. petersii* and *C. lutea*, respectively, but ascospore ejection has been described from naturally occurring stromata (Heagle & French, 1972; Granmo, 1975; Nuss et al., 1977). Nannfeldt (1972) believed that asci of *Camarops* species have lost the ability to forcibly eject ascospores.

The generic disposition of *Camarops spathulata* has been subject to differing taxonomic opinion. It was placed by Nannfeldt (1972) in *Camarops* and this generic position is supported herein. This species was initially described as *Xylaria spathulata* Berk. & Br. and was later transferred to *Sarcoxylon* Cooke by Petch (1924).

PETCH additionally considered *X. polysticha* PENZ. & SACC. and, according to DENNIS (1961), *X. xanthophaea* PENZ. & SACC. to be synonyms of *Sarcoxylon spathulatum* (BERK. & BR.) PETCH. Synonyms of *Camarops* include *Bolinia* SACCARDO (1882), *Solenoplea* STARBÄCK (1901), and *Peridoxylon* SHEAR (1923), as well as others discussed by SHEAR (1923, 1938) and NANNFELDT (1972). BOEDIJN (1959) erected the family Sarcostromellaceae which included *Sarcostromella* BOEDIJN and *Pseudoxylaria* BOEDIJN. He instated *X. polysticha* PENZ. & SACC. and *X. xanthophaea* PENZ. & SACC. into *Sarcostromella* as *S. polysticha* (PENZ. & SACC.) BOEDIJN. DENNIS (1961) considered *Sarcostromella* to be a synonym of *Peridoxylon* and made the new combination *P. spathulatum* (BERK. & BR.) DENNIS. VON ARX & MÜLLER (1954) had earlier placed *Peridoxylon* into synonymy with *Sarcoxylon,* a move rejected by DENNIS (1961) and ROGERS (1981).

We agree with NANNFELDT (1972) that *Peridoxylon* is to be considered a synonym of *Camarops* KARST. *Peridoxylon* was erected by SHEAR (1923) to accommodate *Hypoxylon petersii* BERK. & CURT. This species seems to have the cardinal characteristics of *Camarops:* small, dark-pigmented ascospores that are slightly flattened and bear a single germ pore at one, usually slightly narrowed end, or, as in *C. biporosa* (ROGERS & SAMUELS, 1987) a germ pore at each end of the spore; small asci with nonamyloid apices; polystichous perithecia; and stromata that are fairly soft when hydrated, becoming horny on drying. One feature that has led some workers to consider *C. spathulata* different from other *Camarops* species is its stipe. It is noteworthy that stromata of *C. petersii* can also have narrow connectives or stipes (HEAGLE & FRENCH, 1972). While it is true that most *Camarops* species are sessile, this feature seems insignificant in comparison with the characteristic morphologies of ascospores and asci, in addition to the stromatal composition and perithecial arrangement.

Anatomically, stromata and perithecia of *C. spathulata* seem much like those of *C. lutea* and *C. petersii.* The pseudotissue of the textura intricata beneath the perithecia of *C. spathulata* is looser (less compact) than comparable tissue in the other two species, but this does not seem very significant. It could be argued that the stipitate, almost xylarioid habit of the stroma and its tendency to become hollow at maturity are features that warrant its inclusion in *Peridoxylon* or another genus. We believe that the morphological characteristics of *C. spathulata* other than the upright stromatal habit along with the capacity to produce a teleomorph in culture, argue strongly for the inclusion of this fungus in *Camarops.* Additionally, the lack of an anamorph in this or any other *Camarops* in nature or in culture suggests strongly that *Camarops* is a well-conceived genus embracing more or less closely related species.

Acknowledgments

We thank G. J. SAMUELS, New York Botanical Garden, NY and A. Y. ROSSMAN, National Fungus Collection, Beltsville, MD, for their generous provision of specimens, and M. ADAMS, Washington State University and D. A. GLAWE, University of Illinois for photographic assistance and review of the manuscript, respectively. PPNS No. 0031, Washington State University, College of Agriculture and Home Economics Research Center, Project 1767, supported in part by National Science Foundation Grant BSR-8710005 to JDR.

Literature cited

BOEDIJN, K.B. (1959). On a new family of the Sphaeriales. – Persoonia 1: 15–19.

CHESTERS, C.G.C. (1960). *Camarops polyspermum* (MONT.) MILL.– Coventry Nat. Hist. Sci. Soc. pp 105–109.

DENNIS, R.W.G. (1961). Xylarioideae and Thamnomycetoideae of Congo. – Bull. Jard. Bot. État. 31: 109–154.

GRANMO, A. (1975). *Camarops microspora* (KARST.) SHEAR reported for the first time from Norway. – Friesia 11: 46–53.

HEAGLE, A.S. & D.W. FRENCH. (1972). *Peridoxylon petersii* on oak in Minnesota. – Mycologia 64: 1349–1351.

HORN, B.W. (1984). Fertile stromata of *Camarops petersii* in culture. – Mycologia 76: 956–959.

MARTIN, P. (1969). Studies in the Xylariaceae VI. *Daldinia, Nummulariola* and their allies. – J. S. African Bot. 35: 267–320.

MERCURI, O.A. (1972). *Camarops* (Ascomycetes) género nuevo para la Argentina. – Darwiniana 17: 548–551.

NANNFELDT, J.A. (1972). *Camarops* KARST. (Sphaeriales – Boliniaceae). – Svensk Bot. Tidskr. 66: 335–376.

NUSS, V.L., R. HILBER & M. VON H. MICHAELIS. (1977). *Camarops petersii* (BERK. & BR.) NANNF. – Erstnachweis für Europa – und weitere *Camarops*-Arten. – Z. Pilzk. 43: 217–236.

PETCH, T. (1924). Xylariaceae Zeylaniae. – Ann. R. Bot. Gard. Peradeniya 8: 119–170.

PETRINI, L.E. (1986). On *Camarops lutea* fruiting in culture. – Botanica Helvetica 96: 269–271.

ROGERS, J.D. (1981). *Sarcoxylon* and *Entonaema* (Xylariaceae). – Mycologia 73: 28–61.

ROGERS, J.D. & G.J. SAMUELS. (1987). *Camarops biporosa* sp. nov. from French Guiana. – Mycotaxon 28: 415–417.

SACCARDO, P.A. (1882). *Sylloge fungorum omnium hucusque cognitorum.* – Vol. I. Patavii.

SHEAR, C.L. (1923). Life histories and undescribed genera and species of fungi. – Mycologia 15: 120–131.

SHEAR, C.L. (1938). Mycological notes II. – Mycologia 30: 580–593.

STARBÄCK, K. (1901). Ascomyceten der ersten Regnellschen Expedition 2. – Bih. Kongl. Svenska Vetensk. Akad. 27:3–9.

VON ARX, J.A. & E. MÜLLER. (1954). Die Gattungen der amerosporen Pyrenomyceten. – Beitr. Kryptogamenfl. Schweiz 11: 1–434.