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First report of teleomorphic stage of *Normandina pulchella* from India

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ABSTRACT

The paper reports the fertile stage of *Normandina pulchella* (Borr.) Nyl. from the state of Kerala. Previously it was known in a sterile condition from Tamil Nadu state. A taxonomic note regarding *Normandina pulchella* and its teleomorph [*Lauderlindsaya borrieri* (Tul.) J.C. David & D. Hawksw.] is provided along with detailed description of the species.

Keywords: Anamorph, Kerala, lichen, taxonomy, teleomorph, Western Ghats

INTRODUCTION

Normandina pulchella (Borr.) Nyl. is an ombrophytic and hygrophytic small cosmopolitan lichen, which is widely distributed in the Northern and Southern hemispheres (except Antarctica), in localities with suboceanic conditions (Almborn, 1966; Culberson and Hale, 1966; Degelius, 1935; Figueiras, 1986; Filson and Rogers, 1979; Galloway, 1985; Mares *et al.*, 1993; Oxner, 1956; Pluntke, 1984; Purvis *et al.*, 1992; Shaw, 1984; Swinscow and Krog, 1988; Xavier Filho and Toledo Rizzini, 1976; Yoshimura, 1974). This species is one of the most striking examples of hyperepiphytism, growing both on rocks or bark and on the thallus of other epiphytes, chiefly liverworts, mosses and even other lichens (Tretiach and Nimis, 1988). The genus was recently confirmed in *Verrucariaceae* by Muggia *et al.* (2010).

MATERIALS AND METHODS

Macroscopical examination was carried out using a dissecting microscope (OLYMPUS SZ2-ILST) and microscopical studies of handmade sections were made using a CX21iLeDFS1 microscope. Measurements of ascospores refer to material examined in tap water. Ascospore size of a large number of spores was measured for the specimen, and are indicated as (minimum-)low mean-high mean(-maximum), followed by the number of measurements (*n*). The specimen is deposited in herbarium of Kerala Forest Research Institute (KFRI). The detailed taxonomic description of *N. pulchella* is provided in the ongoing account.

TAXONOMIC DESCRIPTION

Normandina pulchella (Borr.) Nyl., *Ann. Sci. Nat. Bot. Sér.* 4 (15): 382 (1861)

(Fig. 1: A-C)

Thallus squamulose, scattered or partly becoming contiguous forming dense colonies in irregular patches, of small cochleate to rounded squamules. Squamules plane to concave, concentrically ridged, with sharply raised and inrolled entire margins, undivided or with distinct marginal lobes, 1-2 mm wide, 30-70 μ m thick, sometimes becoming leprose. Upper surface glaucous, pale gray to greenish gray, with greenish soredia on the surface and along the margin. Soredia farinose to granular, 20-50 μ m in diameter. Upper

cortex pseudoparenchymatous and up to 10 μ m thick, or evanescent; medulla indistinct. Photobiont layer distinct, 35-60 μ m thick, composed of hyphae with mostly globose or ellipsoid cells arranged in a net like structure surrounding groups of algal cells. Lower surface ecorticate, tomentose, pale.

Ascomata perithecioid, solitary, immersed in the host thallus, protruding through the underside of host squamules; black, matt, with a distinct apical ostiole, entire, globose at the base, becoming conical at the apex, 200-320 \times (150-) 180-230(-300) μ m diam.; peridium *textura angularis* with fairly elongated cells composed of 10-15 cell layers, 30-40 μ m thick, the outer cells having densely pigmented walls, the inner layers \pm colorless, centrum I+ red-brown. Hamathecium lacking interascal filaments, periphyses well developed at the ostiole, septate, branched or unbranched. Asci 8-spored, clavate to broadly clavate, short stalked, with delicate walls, I-; 16-20 \times 80-100 μ m. Ascospores hyaline, elongate-ellipsoid, with pointed ends, (5-)7-trans-septate, smooth-walled, (22-)25-35(-38) \times (5-)6-9(-10) μ m (*n*=25);

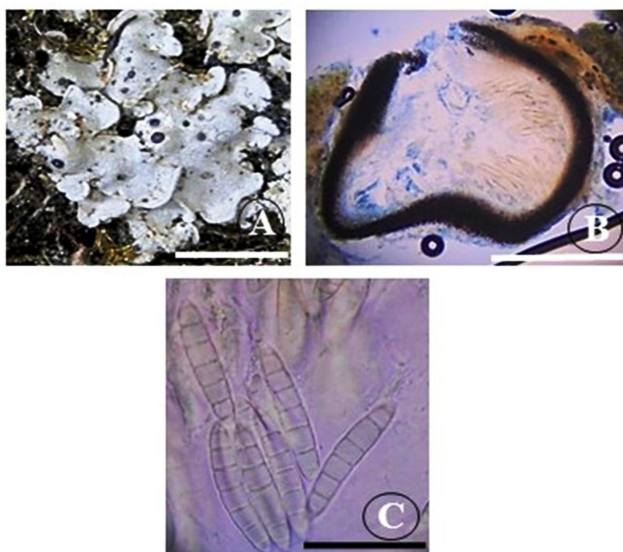


Fig. 1. *Normandina pulchella* (A-C). A) Fertile specimen of *Normandina pulchella*; B) Section through perithecia, C) Mature ascospores. Scale bars: A = 5 mm, B = 50 μ m, C = 25 μ m.

ascospores tend to remain clustered together after discharge. Conidiomata absent.

Ecology and distribution: The species is so far, distributed in Kerala and Tamil Nadu states and grows in association with *Heterodermia incana* (Stirt.) D.D. Awasthi, *H. pseudospeciosa* (Kurok.) W.L. Culb., *H. togashii* (Kurok.) D.D. Awasthi, *Hypotrachyna formosana* (Zahlbr.) Hale, *Opegrapha foreaui* (C. Moreau & M. Moreau) Hafellner & R. Sant. and *Parmeliella triptophylla* (Ach.) Müll. Arg. between elevations of 875-2200 m.

Specimens examined: (as *Normandina pulchella*): India, Kerala, Palghat district, Siruvani, Dam site, alt. ca. 875 m, s.d., Stephen 23133 (KFRI); Palakkad district, Silent Valley National Park, Anginda, alt. 2200 m, s.d., Stephen 83v (KFRI). [as *Lauderlindsaya borrieri* (Tul.) J.C. David & D. Hawksw.]: Kerala, Palakkad district, Silent Valley National Park, Anginda, alt. 2200 m, s.d., Stephen 70i (KFRI).

DISCUSSION

Ever since the discovery of *Lauderlindsaya* (Tul.) J.C. David & D. Hawksw., its fruiting bodies were in dispute. Aptroot (1991) revitalized the view that they represent the rare fertile form of *Normandina* Nyl., as was stated by Swinscow (1963). In fact, Borrer (1829) was the first to describe this lichen with its perithecia, calling it *Verrucaria pulchella*. However, the species was lectotypified on a specimen from Borrer that lacked perithecia (Henssen 1976) even though Borrer's illustrations showed the lichen both in its sterile and fertile form. This was the cause of the lasting ambiguity. In 1855, Nylander redescribed the lichen as a new genus, *Normandina*, along with the description of the perithecia (Nylander, 1855). He claimed that the ascocarps "are typical of the species" (David and Hawksworth, 1989).

Recently Muggia *et al.* (2010) obtained the sequences from the perithecia present on the lichen thallus of *N. pulchella* and from its squamules, and confirmed that fertile and sterile specimens do not represent a parasite and its host, and thus rejects the hypothesis of *Lauderlindsaya borrieri* being a lichenicolous fungus (David and Hawksworth, 1989; McCune, 1997; Hafellner *et al.*, 2002) and mentioned that the genus *Normandina* is monophyletic in *Verrucariaceae*, and *Lauderlindsaya* is not separated from *Normandina*, and represents the fertile form of *Normandina*. The name *Lauderlindsaya* has been designated as a younger synonym of *Normandina*, by Aptroot (1991) and Hoffmann and DePriest (2000).

Lauderlindsaya borrieri so far, known from Europe (Hafellner, 1997) and North America (Hafellner *et al.*, 2002), is reported for the first time from Asia. *Normandina pulchella* in its sterile condition so far reported from Tamil Nadu state of India by Upreti *et al.* (2008). It shows extended distribution to the state of Kerala.

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