

# NEW REPORT OF CYANOBACTERIAL ASSOCIATION ON THE ROOTS OF EPIPHYTIC ORCHID, *DENDROBIUM CRUMENATUM* SW.

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**ABSTRACT:** The present study is the new report of cyanobacterial association on the aerial and substrate roots of epiphytic orchid, *Dendrobium crumenatum*. Six cyanobacterial species were identified from the aerial and substrate roots of epiphytic orchid, which are belonging to the 3 families (Oscillatoriaceae 1; Nostocaceae 4; Rivulariaceae 1). Descriptions of the cyanobacterial species and their microphotographs are provided.

**Keywords:** Cyanobacteria, Epiphytic orchid, *Dendrobium crumenatum*

## 1. INTRODUCTION

The genus *Dendrobium* is the second largest group in Orchidaceae with 900 species (Dressler, 1993). Cyanobacterial association were found on the aerial and substrate roots of *Dendrobium crumenatum*. Cyanobacterial identification is greatly supported by their characteristic colour, which may vary from green, blue-green or olive green to various shades of red to purple or even as black. Cyanobacteria-orchid association is greatly influenced by the conditions of plant growth and environmental factors such as humidity, temperature, etc.

Cyanobacteria have the ability to form symbioses with a wide range of taxonomically different hosts such as bryophytes, pteridophytes, gymnosperms and even in angiosperms. It colonizes different tissues and organs in the host. Identification of the symbiont is often difficult because, 1) the morphological and physiological behaviour might change in the symbiotic conditions compared to isolated cultures, 2) when culturing a symbiotic organism, selection cannot be excluded, or in the extreme, it might not be cultivable (Rasmussen and Nilsson, 2003).

Very little is known about the cyanobacteria-orchid association and their species level

taxonomic identification. The present study was aimed to report a new record of cyanobacterial association on the aerial and substrate roots of the epiphytic orchid, *Dendrobium crumenatum*.

## 2. MATERIALS AND METHODS

Cyanobacteria were collected from the aerial and substrate roots of the epiphytic orchid *Dendrobium crumenatum*. Visible cyanobacterial mass was observed on the aerial and substrate roots (Fig. a) and they were collected by using scalpels and needles.

Microscopic analysis was done in the live condition for the identification of cyanobacteria. Microphotographs were taken using Leica DM 1000 LED Compound microscope and field photographs were taken by using Sony Cybershot DSC-HX7V. Cyanobacterial identification was done with the taxonomic publications.

## 3. RESULTS

### Taxonomic enumeration

1. *Oscillatoria acuta* Bruhl et Biswas, orth. Mut. Geitler (Fig. d)

Trichome solitary, not constricted at the cross walls, 3.911 µm - 4.226 µm broad, filaments

straight; cell contents bluish-green, granulated, tip of the trichome bent, end cell conical or somewhat pointed at both sides.

Occurred as greenish mat on the aerial roots of *Dendrobium crumenatum*

Specimen examined: CU 139332.

**2. *Nostoc spongiaeforme*** Agardh ex Born.et Flah. **var. *varians*** Rao, C.B. (Fig. b)

Trichome loosely arranged; yellowish, 2.67  $\mu\text{m}$  broad, 4.55  $\mu\text{m}$  long; cells barrel shaped; heterocyst cylindrical with rounded and broader than trichomes, 4.520  $\mu\text{m}$  - 5.482  $\mu\text{m}$  broad and 7.521  $\mu\text{m}$  - 9.181  $\mu\text{m}$  long.

Occurred as greenish mat on the aerial roots of *Dendrobium crumenatum*

Specimen examined: CU 139332.

**3. *Nostoc calcicola*** Brebisson ex Born. et Flah. (Fig. c)

Thallus mucilaginous, slightly diffluent, blue-green, filaments entangled, trichome 1.9  $\mu\text{m}$  - 2.3  $\mu\text{m}$  broad, 1.970  $\mu\text{m}$  long; cells subspherical.

Occurred as brownish mat on the substrate roots of *Dendrobium crumenatum*

Specimen examined: CU 139329.

**4. *Nostoc carneum*** Ag.ex Born.et Flah. (Fig. e)

Thallus reddish brown, trichome 3.999  $\mu\text{m}$ -4.171  $\mu\text{m}$  broad, 6.559  $\mu\text{m}$ -7.647  $\mu\text{m}$  long; cells cylindrical, constricted at the cross walls; heterocyst oblong, 5.514  $\mu\text{m}$ -6.919  $\mu\text{m}$  broad, 5.820  $\mu\text{m}$ -7.063  $\mu\text{m}$  long.

Occurred as brownish mat on the aerial roots of *Dendrobium crumenatum*

Specimen examined: CU 139329.

**5. *Anabaena variabilis*** Kutzing ex Born. et Flah. (Fig. f)

Thallus dark green, constricted at the cross walls; cells barrel-shaped, 4.426  $\mu\text{m}$  broad, 6.122  $\mu\text{m}$

long; heterocysts slightly larger than cells, 7.450  $\mu\text{m}$  long and 5.357  $\mu\text{m}$  broad.

Occurred as brownish mat on the substrate roots of *Dendrobium crumenatum*

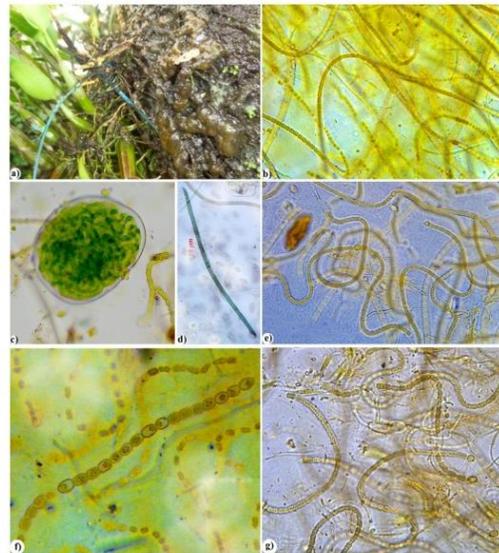
Specimen examined: CU 139331.

**6. *Rivularia hansgirgi*** Schmidle (Fig. g)

Thallus expanded, flat, blackish brown, trichome long, 2.796  $\mu\text{m}$ -3.551  $\mu\text{m}$  broad, 3.688  $\mu\text{m}$ -5.003  $\mu\text{m}$  long; cells rectangular; heterocyst basal, 5.556  $\mu\text{m}$  broad, 6.800  $\mu\text{m}$  long.

Occurred as brownish mat on the substrate roots of *Dendrobium crumenatum*

Specimen examined: CU 139331.



**Fig. a)** Occurrence of cyanobacterial mass on the aerial and substrate roots of *Dendrobium crumenatum*; **b)** *Nostoc spongiaeforme* var. *varians*; **c)** *Nostoc calcicola*; **d)** *Oscillatoria acuta*; **e)** *Nostoc carneum*; **f)** *Anabaena variabilis*; **g)** *Rivularia hansgirgi*

#### 4. DISCUSSION

The present study dealt with the species level taxonomic identification of orchid associated cyanobacteria. A total of six cyanobacterial species belonging to 3 families were identified. *Oscillatoria acuta*, *Nostoc carneum* and *Nostoc spongiaeforme* var. *varians* were found at the aerial roots; *Anabaena variabilis*, *Nostoc calcicola*

and *Rivularia hansgirgi* were found at the substrate roots of *Dendrobium crumenatum*.

Cyanobacterial associations have been found on the roots of certain epiphytic orchids (Tsavkelova *et al.* 2001; Tsavkelova *et al.* 2003 a; Tsavkelova *et al.* 2003 b; Ram and Shamina, 2014). Cyanobacterial mat can be observed on the epiphytic roots of orchid when there is persistent moisture avail in the environment. The aerial and substrate root surface of *Dendrobium crumenatum* is covered with brownish, dark blue-green or blackish mass of organisms.

The growth appearance of epiphytic, endosymbiotic and endolithic cyanobacteria is determined by the host or substrate inter-relationship. Cyanobacterial species identified from the epiphytic orchids confirms that these organisms are having a strong symbiotic association with orchids. It is assumed that prolonged drought may result in a decline in the nitrogen fixation capacity of cyanobacteria-orchid associations.

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