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Morphological and ecological characterization of *Phycopeltis aurendinacea* (Montagne) De Toni **(Ulvophyceae, Trentepohliales) in Southern Western Ghats: A brief study**

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Abstract

The paper illustrates the morphological and ecological characterization of epiphyllous alga, *Phycopeltis aurendinacea* (Montagne) De Toni, which belongs to the family Ulvophyceae of the order Trentepohliales. It was investigated during south-west, north-east monsoon and summer seasons from the semi-urban and rural areas of Pathanamthitta District, Kerala, India, an important biodiversity zone of Southern Western Ghats. *Phycopeltis aurendinacea* was present in the twenty five families of plants studied except the Malvaceae. Morphology of the alga was examined by means of light Microscopy (LM) and Scanning Electron Microscopy (SEM). The morphological and ecological characterization of the species in two different ecosystems of semi urban and rural area indicates that there are certain variations within species.

Key words: Epiphyllous, *Phycopeltis aurendinacea*, Phyllosphere, Trentepohliales

Introduction

Phycopeltis is a trentepohlian green algae and it is more widely present in tropical regions (Printz, 1939; Chapman, 1984; Thompson and Wujek ,1997) than temperate regions (Printz,1964; Sarma ,1986; Lopez- Bautista *et al*., 2002). *Phycopeltis* spp. was not diversified in the region where more anthropogenic influences occurs (Lopez- Bautista *et al*., 2002). Printz (1939) reported twelve species of *Phycopeltis* from tropical region. A number of morphological characters are known to be taxonomically significant in identifying the *Phycopeltis*. Moreover, many of these characters are influenced by environmental and climatic factors. Assessment of these characters creates difficulties in identifying *Phycopeltis* spp. (Rindi *et al*., 2004). Molecular data are also limited for the family Trentepohliaceae (Lopez-Bautista *et al*., 2002; Lopez-Bautista *et al*., 2003). The studies of *Phycopeltis* species are still limited in Southern Western Ghats, India. In Kerala also, diversity and ecology of *Phycopeltis* is still unaccounted and unidentified. The purpose of the investigation was to examine the morphological and ecological characterization of *Phycopeltis aurendinacea* (Montagne) De Toni in Southern Western Ghats, Pathanamthitta District, Kerala, India.

Materials and methods

Samples of leaves from twenty six families of plants were collected from five different sites (each were of about 1-2 acre land) belonging to semi-urban and rural areas of Pathanamthitta District (9.2601^0N, 76.9643^0E) in Kerala. *Phycopeltis* spp. was collected between June 2016 to April 2017 during three different seasons of South-west, North-east monsoon and Summer seasons. Microscopic features were observed using the Olympus LX 400 Trinocular microscope and photographs were taken by using BioLinkz Cmos Cam (3.0m pixels) attached to the microscope. SEM analyses were carried out in the laboratory of the Sophisticated Test and Instrumentation Centre (STIC), Cochin University of Science and Technology, Kerala, India.

Major characterization and classification of alga was based on the database of Guiry and Guiry (2016). In addition to that, systematic keys of Printz (1939) and Thompson and Wujek (1997) were also used. Those voucher specimens of twigs leaves with algae were deposited in Catholicate College Herbarium (CATH) and the permanent slides of *P.aurendinacea* (CAPH-121) were also kept in the Phycotechnology Herbarium (CAPH), Catholicate College, Pathanamthitta, Kerala, India.

Results and Discussion

Currently six species of *Phycopeltis* were observed from the phyllosphere of Pathanamthitta District, Kerala. Among these, *P.arundinacea* shows wide distribution except in the members of the family Malvaceae.

***Phycopeltis aurendinacea* (Montagne) De Toni**

Morphological description

Morphologically, *P. aurendinacea* was identified by small light orange red patches of microscopic or macroscopic with 3-6 mm in diameter. Generally the species appeared as a circular disc formed by the adhesion of radiating dichotomous filaments from the centre of the thallus (Fig.1 a-e). The germlines of the species was circular, microscopic disc and incompletely separated into 4-5 lobes. Thalli of alga with more or less lobed margin were frequently observed (Fig. 3.f-g).Vegetative cells were 19.5- 22.5 µm long and 7.9 –9.5 µm wide, (Table 1).Sporangiate laterals were the common reproductive structure observed at the intercalary position of the thallus (Fig.2.e). Mature Sporangiate laterals were observed in the central part of the thallus. Generally, gametangia are oval or globular and not frequently observed. But in the present investigation, oval gametangia were observed (Fig.2.d). Similar observations were made by Thompson and Wujek, 1997; Zhu *et al.,* 2015. *P.aurendinacea* was the largest species among the genus *Phycopeltis* by their disc size and cell length. Similar observations were made by Thompson and Wujek (1997).

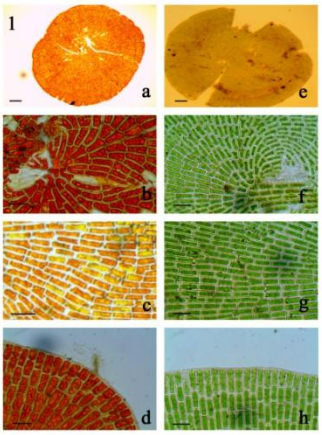

Fig.1 Microphotographs of *Phycopeltis aurendinacea*

Table 1. Morphological variations of *Phycopeltis aurendinacea* from semi urban and rural area

	Characteristics of *P.aurendinacea*				
Sl.No	**Locality**	**Length (µm)**	**Width(µm)**	**Disc colour**	**Habitat**
1	Natural forest-Rural area- Thannithodu	21.8	8.0	Light green	Epiphyllous
2	Natural forest- Rural area- Ranni	22.6	9.5	Light green	Epiphyllous
3	Natural forest- Rural area-Konni	22.8	8.2	Light green	Epiphyllous
4	Natural forest- Rural area-Konni	19.4	7.5	Light green	Epiphyllous
5	Semi urban-Adoor	20.1	7.9	Orange red	Epiphyllous
6	Semi urban-Adoor	20.4	8.8	Orange red	Epiphyllous
7	Semi urban-Kaipattor	19.6	8.27	Orange red	Epiphyllous
8	Semi urban-Kaipattoor	20.8	7.8	Orange red	Epiphyllous

Ecological evaluation

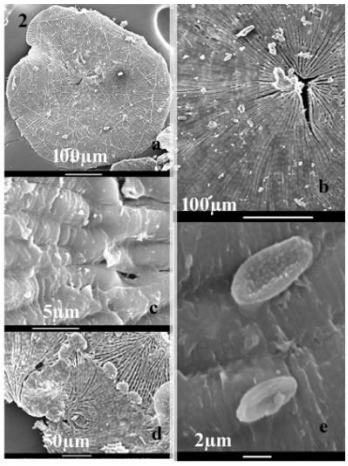

Fig. 2 SEM of *Phycopeltis aurendinacea*

P.aurendinacea was found in all the study sites in south-west, north-east and summer seasons. They were collected from both urban and forest areas during all seasons. The forest colonizing *P.aurendinacea* forms a biofilm over the leaf surface (Fig.3.a-b). Nevertheless, in the urban areas diversity and distribution of algae was limited .It may be due to changes in the environmental constraints undergoing human modification (Tilman and Lehman, 2001). Usually the alga was found on the adaxial side of the leaves of the studied plants. The alga was widely present in the members of the twenty five families such as Euphorbiaceae, Melastomaceae, Lythraceae, Menispermaceae, Polygalaceae, Clusiaceae, Sterculiaceae, Moraceae, Sapotaceae, Fabaceae, Apocynaceae, Rhamnaceae, Sapindaceae, Anacardiaceae, Combretaceae, Guttiferae, Meliaceae, Rubiaceae, Loganiaceae, Aristolochiaceae, Myristicaceae, Acanthaceae, Zingiberaceae, Palmae and Annonaceae. Interestingly it was found that, the alga were exclusively absent in the members of the family Malvaceae. It may due to their special morphological and biochemical features such as star shaped hairs, mucilage, alkaloids, anthraquinone derivatives,glycosides, terpenoids, steroids, and flavanoids, (Richa *et al*., 2014)

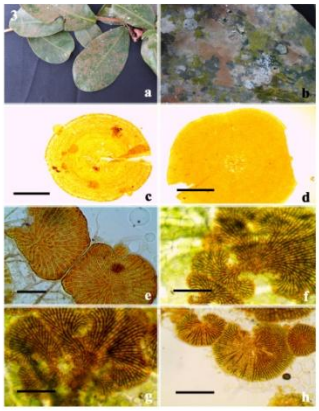

Fig.3. a-b: Host plants; c-h: Growth pattern of *Phycopeltis aurendinacea*

The alga never made parasitic mode of life with any of the host plants. Similar observations made by Thompson and Wujek (1997), Lopez-Bautista *et al*., (2002). According to Thompson & Wujek (1997) the genus is identified from fruits, twigs and also from non-living substrata in the areas of high humidity. During the present study, the alga was collected from the leaves only. Alga also exhibit in different colors according to their habitat. In the shade region, particularly in the natural forest it appeared as light green in colour. But in the urban areas it was orange red (Fig.1.a-h). Similar observations were made by Thompson and Wujek (1997).

Length and width of the algal cells varies in different ecological areas of Pathanamthitta District (Table 1). It might be due to change in the environmental factors (Rindi *et al*., 2004). They mainly prefer moist environment for their flourished growth and grows in an irregular pattern (Fig. 3.f-h). Similar observations were made by Rindi *et al*., (2004).

Western Ghats of South India represents one of the biodiversity hotspots of the world. It is also a place with high degree of all the three levels of - α, β and γ - biodiversities. Diversity and ecology of the diverse kinds of epiphyllous algal flora in the Western Ghats at its different altitudes and precipitation regimes is not yet properly carried out. The present investigation will generate a new knowledge regarding the epiphyllous algal wealth of the whole Western Ghats of South India.

Conclusion

The study indicates that Southern Western Ghats is a good source of epiphyllous algae. The morphological and ecological characterization of *Phycopeltis aurendinacea* in two different ecosystems of semi urban and rural areas of Pathanamthitta District, Kerala, an important biodiversity zone of Southern Western Ghats indicates that there are certain variations within species. The species was widely present in all the studied plants except the members of Malvaceae.

Acknowledgements

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