EXISTENCE AND NEW DISTRIBUTIONAL RECORDS OF CENTRITRACTUS AND OPHIOCYTUM (XANTHOPHYCEAE) FROM THE FRESHWATER BODIES OF SHIVAMOGGA DISTRICT, KARNATAKA

SAVITHRA N AND S G MALAMMANAVAR

The distribution and occurrence of Xanthophyceae are inadequately encountered in India and as well as in Karnataka. The identification of members of this class especially of Centritractus and Ophiocytum has been done earlier merely on generic level. The present study (September 2018 – March 2021) confirms the existence of six taxa belonging to the class Xanthophyceae of which 5 taxa belong to the genus Ophiocytum and one taxon represents the genus Centritractus. Further, the systematic account, description, geographical coordinates with collection sites were enumerated in detail.

Keywords: Centritractus, Distribution, Karnataka, Ophiocytum, Ponds of Shivamogga, Xanthophyceae

Xanthophyceae is the photosynthetic group of yellow-green algae usually found in pervasive habitats of fresh and marine water. A few members have been reported to grow on mud, walls or tree trunks. Also, found in the acidic water and bog pools with less population of other microbes (Mallick et al. 2005). Most of the members of this class are coccoid or filamentous, but some are siphonous and free floating in nature. Due to the similar morphological plasticity, these members are sometimes misapplied as members of Chlorophyceae. Diadinoxanthin is the primary pigment and violaxanthin, lutein, neoxanthin, flavoxanthin, and flavacin are the supplementary pigments. The products of metabolism are oil, lipid and lucosin.

A total of 686 taxa of Xanthophyceae have been reported worldwide under 24 families of 6 orders. Among them, only 17 taxa of 15 families are cited from various states of India (Guiry and Guiry 2021). Members of Xanthophyceae have been inadequately studied in India (Mallick et al. 2005). Centritractus (Centritractaceae) and Ophiocytum (Ophiocytaceae) are fairly exciting genera of xanthophyceae and poorly known for their taxonomical annotations. Also these genera exhibits limited distribution and diversity in the suitable environments (Mallick et al. 2005, Guiry et al. 2021).

Nageli (1849) has legitimated Ophiocytum and proposed O. apiculatum and O. majus under this genus. Respectively, 31 taxa have been cited in wide range of habitats from various countries and 18 taxa are flagged taxonomically with valid binomials (Guiry and Guiry 2021). Likewise, Lemmermann (1900) has recognized Centritractus as distinct genus and proposed C. belonophorus as type species of this genus. Currently, 10 taxa are recognized under this genus (Guiry and Guiry 2021).

Kamat (1968), Suxena et al. (1973), Patel and Soni (1975), Sarma, and Khan, (1980), Shah et al. (1992), Mallick et al. (2005) and Gupta, (2012) have made the remarkable contributions for Centritractus and Ophiocytum of Xanthophyceae from the various habitats of India. Mallick et al. (2005) documented existence of Ophiocytum (5 taxa) and Centritractus (1 taxa) from the different desmid habitats of West Bengal, India. Srivastava and Misra (2007) evidenced the growth of Vaucheria geminata in the freshwater bodies of North Eastern Uttar
Pradesh. The Xanthophyceae members *Monocilia simplex* and *Tribonema bombycinum* were reported from the lakes in and around Kolhapur City, Maharashtra by Leela et al. (2010). Sudipta Kumar Das and Onkar Nath Maurya (2015) made floristic survey of Algae in Vikramasila Gangetic Dolphin Sanctuary, Bihar and reported the occurrence of *Ophiocytium cochleare*. Sushmita Boyra et al. (2017) collected *Ophiocytium capitatum* from the water bodies of Sen Pokhar of Nonihat, Dumka District, Jharkhand.

The occurrence of different taxa of the *Ophiocytium* and *Centritractus* was found during floristic survey of microalgae from the ponds of Shivamogga district, Karnataka, India. In Karnataka, *Vaucheria madhuensis*, *Botryococcus braunii* are the taxa recorded evidently at species level (Gupta and Das, 2018, Padmakumar and Tharavathy, 2020). Jayagoudar et al. (2020) have evidenced the occurrence of 3 taxa of Xanthophyceae in the paddy fields of Belgavi district. But they have not authenticated the taxa name under this class. Also, Ramachandra et al. (2018) stated the occurrence of *Ophiocytium* at genus level from the wetlands of Jakkur Lake, Bangalore. Further, the identity of these genera under this class especially of *Centritractus* and *Ophiocytium* has not been recorded at species level from Karnataka. Hence, this study was aimed to detail the occurrence, identifying features and localities of genera *Centritractus* and *Ophiocytium* in the fresh water bodies of Shivamogga district, Karnataka.

**MATERIALS AND METHOD**

The district of Shivamogga is geographically positioned in the western parts of Karnataka with the coordinates of 13° 27' to14° 39' N. and 74° 38' to 76° 34' E. The temperature of summer ranges from 20 °C to 36 °C and winter experiences 25 °C to 37°C. Heavy rainfall is the distinctive feature of the Shivamogga region and receives an average annual rainfall of 1811mm. Gangavati, Kali, Tadadi, and Sharavathi, Bhadra, Varada, Thunga, Kumadvathi, Vedavathi, and Kushavathi are the major rivers running in this district for the source of water.

Ponds in Shivamogga district are mostly perennial; few are seasonal and are rich in phytoplankton diversity. The perennial ponds are used for the purpose of drinking, irrigation, fishing, washing and bathing. In the present study seven perennial ponds were surveyed periodically from September 2018-March 2021 to record the occurrence of *Centritractus* and *Ophiocytium*. But, only Mattur pond (Shivamogga) and Goutur pond (Hosanagara) were cited with the presence of both genera (Fig.1 & Plate - 1: 1 - 4). The GPS coordinates; habits and habitats were recorded and photographed. The samples were collected using plankton net and sealed in the clean

![Figure 1: Map of Study area](image-url)
container. The firmly attached and filamentous forms of algae samples were collected with help of a scalpel, by hand, or by scraping with the help of the knife. The collection was carried out early morning and late evening. The samples were preserved in 4% formalin and deposited in Department of Applied Botany, Kuvempu University. The live forms as well as preserved forms of the algal samples were examined under a compound light microscope to witness the colour, shape, length, width, filamentous form, surface nature, size (using ocular micrometre), cell wall arrangements in layers, chloroplast shape and numbers.

Also, the taxa of both genera have been authenticated using standard resources furnished by West (1904), Prescott (1954, 1962) Mallick et al. (2005) and the author citation and nomenclature doubts were diagnosed with online resource (https://www.algaebase.org/).

RESULTS AND DISCUSSION

The present study demonstrated the existence of the genera Centritractus of Centritractaceae and Ophiocytium of Ophiocytiaceae, which encompasses five taxa belong to Ophiocytium and one taxon of Centritractus in the study area. All the six taxa were not recorded or not cited by the earlier workers such as Gupta and Das (2018), Ramachandra et al. (2018), Padmakumar and Tharavathy (2020), Jayagoudar et al. (2020) investigated from the various fresh water habitats of Karnataka. Centritractus belanophorus, Ophiocytium arbuscula, Ophiocytium cuspidatum var. longispinum, Ophiocytium cochleare, Ophiocyticum majus and Ophiocytium parvulum are reported for the first time from the freshwater bodies of Karnataka and treated as new additions to the algal flora of Karnataka.

Both of them are planktonic or epiphytic on filamentous fresh water algae, cells in Ophiocyticum are unicellular to colonial. The curved or spirally contorted natures of the filament with capitate or apiculate or attenuated apex are the ideal characterization to distinguish this genus from others. Correspondingly, Genus Centritractus is identified and classified based on the form of the cell wall, cell morphology and presence and importance of apical spines as well as cell dimensions (Prescott 1962).

Further, the systematic account, description, geographical coordinates with collection sites are enumerated below in detail.


   Cells elongate, cylindrical, straight with long, thin spines at each pole, cells
uninucleate, several chromatophores makes plate like bodies, cell 6 µm in diameter, 108 µm long, spines about as long as the cell (110 µm).

Collection site & Date: Mattur pond, Shivamogga District & 27/03/2021
Coordinates of the collection location: 13° 52' 37.2" N & 75° 34' 37.2" E

Distribution in India: Bihar, Jharkhand, Kerala & West Bengal.


Unicellular, cell body elongated, cylindroids, slightly curved, several plate like chloroplasts without pyrenoids, mother cell thin walled, daughter cells attached at the tip of the mother cell arranged in corymbose manner with rounded apices, cells 5 µm in diameter, 36 µm long.

Collection site & Date: Mattur Pond, Shivamogga District & 27/03/2021
Coordinates of the collection Location: 13° 52' 37.2" N & 75° 34' 37.2" E

Distribution in India: Gujarat, Rajasthan & West Bengal.


Cells free floating, cylindrical, straight, each pole bearing spines, cells 6 µm in diameter, 12 µm long, numerous disc shaped chloroplasts, oil droplets present, spines longer than the cell.

Collection site & Date: Goutur Pond, Shivamogga District &17/01/2020
Coordinates of the collection Location: 13° 59' 0.42"N & 75° 14' 57.84" E

Distribution in India: Assam, Maharastra, Rajasthan, & West Bengal.


Cells free floating, cylindrical, curved or spirally twisted, cells 6 µm wide, 230 µm in length, with a truncate, expanded bulb like portion at one side and a stripe, sharp spine at another side, spine up to 11 µm in length.

Collection site & Date: Mattur Pond, Shivamogga District & 27/03/2021
Coordinates of the collection Location: 13° 52' 37.2" N & 75° 34' 37.2" E

Distribution in India: Gujarat, Rajasthan & West Bengal.


Free floating, cylindrical, spiralled cells, 7 µm wide, up to 600 µm long, chloroplast disc shaped, rounded tip at one end, with a minute spine at another end.

Collection site & Date: Mattur Pond, Shivamogga District & 27/03/2021
Coordinates of the collection Location: 13° 52' 37.2" N & 75° 34' 37.2" E

Distribution in India: Uttar Pradesh.

New distributional records of *Centritractus* and *Ophiocytium*


Cells free floating, cylindrical, long, curved or contorted, truncate at both ends; tip of the cells rounded, without spines, 6 µm in diameter, up to 57 µm long.

**Collection site & Date:** Mattur Pond, Shivamogga District & 27/03/2021

Coordinates of the collection Location: 13° 52' 37.2" N & 75° 34' 37.2" E

**Distribution in India:** Bihar, Gujarat, Rajasthan, & West Bengal.

**CONCLUSION**

The present study highlighted the occurrence of Xanthophyceae members from the ponds of Shivamogga District, Karnataka. Also, current endeavour enumerates the data towards the earlier author citation, characters of the each taxon, collection location with coordinates and distribution in India. The taxa *Centritractus belanophorus*, *Ophiocytium arbuscula*, *Ophiocytium cuspidatum* var. *longispinum*, *Ophiocytium cochlare*, *Ophiocyticum majus* and *Ophiocytium parvulum* are reported for the first time from the freshwater algal bodies of Karnataka and signified the wide range of algal distribution in the southern part of India. The finding of the present study is greater than the earlier records in different decades. Also the outcomes would be the framework for the future researchers to enlighten their research in different aspects of science.

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**REFERENCES**


Braun A 1855 *Algarum unicellularium* genera *nova et minus cognita praemissis observationibus de algis unicellularibus in genere.* Kessinger Publishing Company, USA.


Patel RJ and Soni MJ 1975 On genera *Ophiocytium* and *Vaucheria* from Gujarat, India. *The Botanique* 6(4) 185-190

Prasanta Mallick, Chattarjee Sudip and Jai Prakash Keshri 2005 The Genus *Ophiocyticum* Naegeli And *Centritractus* Lemmermann (Heterococcales; Xanthophyta) In West Bengal, India. *J. Econ. Taxon. Bot.* 29(1) 54-58


Prescott GW 1962 *Algae of the Western Great Lakes Area, with an illustrated key to the genera of desmids and freshwater diatoms*. Cranbrook Institute of Science, United States.


Sudipta Kumar Das and Onkar Nath Maurya 2017 Floristic survey of Algae in Vikramasila Gangetic Dolphin Sanctuary, Bihar (India). *Nelumbo* 57 124-134.


