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# An updated review on diversity and distribution of taxa of *Oedogonium* Link in India

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## Abstract

The genus *Oedogonium* includes freshwater algae with a global distribution of more than 500 species. They often are associated with other plants or exist as a free-floating mass. The filaments of *Oedogonium* are characteristically unbranched and only one cell thick. The objective of the current study is to create an updated review of the diversity and distribution of the *Oedogonium* species native to India. Research papers published after the year 2000 are the foundation of the review.

**Key words:** Taxon; homothallic; diversity; macrandrous; ecosystem.

## Introduction

India is one of the mega biodiversity countries and is rich in algal flora with 7310 algal species based on BSI ENVIS data. Phycology studies and research started in India during the 1900s and explored many algae from diverse habitats. Seven distinct phylogenetic lineages arose independently during the geological period and they evolved at different rates based on molecular clocks (Yasmeen and Kamalakar, 2019). India's diverse ecosystems provide varied climatic and geographical conditions, hence each of these regions has its unique algal flora adapted to local environmental conditions. The distribution varies ranging from freshwater bodies to marine environments and even terrestrial habitats. Rich algal flora is generally reported from places with high nutrient content and favourable environmental conditions (Dalkıran *et al.*, 2021). Algae are also grown in anthropogenic environments such as agricultural fields, sewage treatment plants and aquaculture ponds, where they can have both positive and negative impacts (Al-Jabri *et al.*, 2021).

Macroscopic filamentous algae, including Chlorophyta, may form mats on the water surface as free-floating thalli and in the benthos-thalli attached to submerged substrata such as stones or macrophytes, in lakes and rivers. These algae play an important role in the functioning of aquatic ecosystems. *Oedogonium* Link ex Hirn species belong to Chlorophyta, include 534 species (Mahato, 1999) and are classified as filamentous green algae. These species are cosmopolitan in freshwater ecosystems and prefer stagnant waters, such as small ponds, pools, roadside ditches, marshes, oxbows, lakes, reservoirs, and rivers (Mrozińska-Weeb, 1976; Pikosz and Messyasz, 2015). Occurrence of *Oedogonium* species in any particular location depends on biotic and abiotic factors especially temperature, light intensity and type of habitats. (Marta and Beata, 2016). However, most *Oedogonium* taxa were found in small water bodies (Szymańska *et al.*, 2015). *Oedogonium* species may grow throughout the year, but maximum reproductive development in the lowlands was observed in June and less in August (Mrozińska-Webb, 1976). Young thalli are attached to macrophytes by a basal holdfast and as mature organisms, may form mats on the surface of water. *Oedogonium* is reported as more competitive than pelagic phytoplankton (Carrick and Lowe, 1989) due to their ability to form dense mats having large absorbing surfaces (John, 2003). The optimum range of pH and temperature for thallus growth is identified as

5–6 and 17–35°C respectively. Some species of *Oedogonium* were collected from locations showing a wide range of pH (Gonzalves, 1981).

*Oedogonium* filaments are unbranched, usually attached and without bristles. Cells are cylindrical, sometimes slightly broader at the anterior end, characterized by one or more ring like caps immediately below the cross wall. Cells contain a parietal, netlike chloroplast and several pyrenoids. Zoospores produced singly have a distinctive apical ring of many flagella. Sexual reproduction is oogamous: large swollen female oogonia, box-like antheridia or some species with dwarf male plants grow on or close to the oogonia; zygote is thick-walled and sometimes distinctively ornamented. *Oedogonium* is one among the algae with a great capacity to spread horizontally and is valued as more efficient in photosynthesis (Khanum, 1982).

Phycologists have employed diverse features as yardsticks for classifying the genus *Oedogonium*. The species of *Oedogonium* can be sorted out based on sexual differentiation. Depending upon the nature of antheridia-producing thalli, *Oedogonium* species have been distinguished as macrandrous and nannandrous. The distinct types of oogonium apertures/pores are considered stable taxonomic traits for the genus *Oedogonium*. (Xiong *et al.*, 2022).

## Diversity and distribution

Eighteen taxa of *Oedogonium* Link ex Hirn reported from the Raigad district of Maharashtra while studying the filamentous green algae (Samruddha and Iyer, 2016). Collections of *O. boscii* var. *notabile*, *O. crispum* var. *pithophorae*, *O. inconspicuum*, *O. richterianum* from Khalapur, *O. brevicingulatum*, *O. plagiostomum* from Shelu, *O. cardiacum* var. *minus* from Nagothane, *O. crassum* var. s*ubtumidum* from Maldunge, *O. discretum* var. *calliandrum* from Khandeshwar and Navi Mumbai, *O. loricatum*, *O. pusillum* var. *minus*, *O. tapeinosporum*, *O. tapeinosporum f. indicum* from Karjat, *O. nanum* from Chipale, *O. tapeinosporum f. fowlingense* from Lowjee, *O. transeaui* from Kelavali, *O. vaucherii* from Karjat and Lowjee and *O. virceburgense* from Dolavali and Karjat of Raigad district accounts for various taxa studied.

Five macrandrous homothallic sp., *O. subvaucherii from Kuliyan and Mansar*, *O. pseudofragile* from Thanda Pani, *O. upsaliense* from Sheesh Mahal and Poonch, *O. visayense* from Kuliyan, Kathua, Samba and Majalta, *O. amplius* from Kuliyan and Three macrandrous heterothallic forms *O. capillare* from Surinsar and Ram Nagar, *O. angustistomum* from Pragwal wetlands and *O. magnusii* from Jawahar Nagar, Kathua, Thandapani of Jammu were collected, identified and reported (Jitendra and Anand, 2016).

Kargupta and Keshri (2006) reported seventeen macrandrous taxa including eleven heterothallic and six homothallic sp. of *Oedogonium* Link for the first time from West Bengal. Species comprises *O. areolatum*, *O. crispum* var. hawaiense, *O. crispum* var. *pithophorae*, *O. lageniforme* var. *ellipsoideum*, *O. figuratum*, *O. fragile*, *O. intermedium*, *O. khannae*, *O. lautumniarum*, *O. leiriense*, *O. paucocostatum*, *O. pringsheimii* var. *nordstedtii*, *O. pseudocostatosporum* Kargupta *et* Keshri, *O. sphaerico-inconspicuum*, *O. tapeinosporum* var. *fowlingense*, *O. vaucherii*, *O. welwitschii* and *O. leiriense*. *O. crispum* var. *pithophorae* is the first record since its original description from Bangladesh and *O. pseudocostatosporum* Kargupta *et* Keshri is a newly introduced taxon.

Nine taxa of *Oedogonium* Link ex Hirn were found to grow epiphytically on hydrophyte leaves and stems in lentic freshwaters: *O. bharuchae* from Chinsurah, *O. cardiacum* var. *pulchellum* from Madhusudanpur, *O. crispum* var. *pyriforme* from Somra Bazar, *O. gunnii* from Guptipara, *O. khannae* var *minus* from Khamargachi, *O. nanum* from Balarambati, *O. pratense* from Khanyan, *O. rivulare*, and O. Vaucheri from Diara of Hooghly district, West Bengal, and studied taxonomic and limnological features (Halder, 2018).

Diverse chlorophycean taxa belonging to various orders i.e., Oedogoniales, Zygnematales, Cladophorales, Chlorococcales, Ulotrichales, etc. with a wide range of thallus structures were collected and identified using image processing techniques (Kumar and Annadurai, 2021). *O. australe* showed higher

percentage of dry matter averaged 6.25%, sugar (22.5) and carbon content (23.7).

Kargupta and Kumari (2016) described a species *O. incrassatum* collected from Darbhanga district, during the survey of Oedogoniales from freshwater bodies of North Bihar. This is the first record of the species from India.

Ten species of genus *Oedogonium* having distinct morphological variations have been recorded from different water bodies of the Jammu region. Out of ten species, five spp. are nannandrous, three macrandrous homothallic and two macrandrous heterothallic: *O. idioandrosporam* var. *idioandrosporam* from Rajouri, *O. undulatum* from Bishnah, *O. flavescense* var. *flavescense* from Sunderbani and Rajouri, *O. irregulare* var *irregulare* from Akhnoor, *O. multisporum* var *unicellularis* from Mandal, *O. cryptoporum* var *szechwanense* from Miran Sahib, *O. pseudofragile* from Thanda pannii, *O. pusillum* var. *pusillum* from Garigarh, *O. pratense* var. *crassum* from Mandal and *O. magnusii* var. *major* from Thanda panii (Anand and Jitendra, 2006).

Keshri (2012) reported extensive growth of *Oedogonium* sp. in West Bengal because of its geographical location, climatic conditions, and the presence of many reservoirs.

*magnusii*, *O. microgonium*, *O. moniliformae*, *O. nanum*, *O. porrectum*, *O. smithii* were identified among 50 taxa collected from Khelna reservoir in Aurangabad district of Maharashtra (Sawdekar and Jadhav, 2017). *O. intermedium* var. *intermedium* from Dusane, *O. oviforme* var. *oviforme* from Nagzari dam, *O. robustum* from Nizampur, *O. macharastrense* from Kondaibari, *O. mysorense* from Dahewl, *O. oblongellum* var. *oblongellum* from Cahranmal, *O. terrestris* from Kondaibari, *O. hatei* from Wasdare, *O. kolhapurense* from Gangapur and Gokul Nala, *O. anomalum* from Vesarwadi, *O. glabrum* var *maharastrense* from Chincpada, *O. hindustanense* var. *minus* from Sukwel, *O. sociale* from Ukalapani, *O. orientale* from Ukalapani, *O. welwitschii* from Navagaon, *O. welwitschii* var. *welwitschii* from Borkekhadi, *O. repens* from Sukapur, *O. tapeinosporum* from Kudashe *and O. dentirecticulosporum* from Shrawani were recorded from the study of Oedogoniales of Sakri and Navapur Taluk of Dhule and Nandurbar district respectively (Jaiswal, 2017).

Sahool *et al.* (2014) described thirteen taxa of *Oedogonium* Link (Chlorophyceae) including a new species (*Oedogonium sagarense*) during a study of the algal biodiversity of rice fields of Sagar Island, The Sunderbans. They are: *Oedogonium autumnale* var. *subrupestre*, *O. chaetophorum*, *O. gunnii* var. *breviarticulatum*, *O. kozminskii* var. *targaonense*, *O. longatum*, *O. oblongellum* var. *minus*, *O. ouchitanum*, *O. polistandrium*, *O. rigidum* f. *africanum*, *O. spiripennatum*, *O. spurium* and *O. suborbiculare* var. *kamalapurense*.

Chaudhari *et al.* (2019) identified and reported thirteen species thirteen taxa of genus *Oedogonium* belongs to Chlorophyceae from North Maharashtra *viz. O. abbreviatum* var. a*bbreviatum* from Navapur, *O. bharuchae* from Hartala, *O. indicum* from Rangavali river of Navapur, *O. laeve* from Manjal, *O. obpyriformae* from Jamnya, *O. smithii* var. *narayanpurense* from Mangrul dam, *O. ellii*, *O. lautumniarum* f. *gracilis*, *O. lautumniarum* f. *lautumniarum*, *O. macrandrium* var. *hohenackerii*, *O. pseudopyriforme*, *O. rosenvingii* and *O. subintermedium* from Faizpur.

The nomenclatural status of *Oedogonium lemmermannii* var. *barellum* is investigated and resolved by Kargupta and Kumari (2022).

## Conclusion

*Oedogonium* grows in different types of ecosystems from reservoirs, lakes, and ponds to rivers and drainage ditches. Several species and varieties of the algae are reported, identified, and documented mainly from the North Indian regions. The diversity of algae in India is still not fully documented and demands more research to discover new species and a better understanding of their ecological functions. Conservation strategies and efforts are also important to protect algal wealth, one of the richest components of India's biodiversity.

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