



## RESEARCH ARTICLE

# *Ophioglossum rubellum* (Ophioglossaceae): a new distributional record for the State of Maharashtra, India

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## Abstract

Maharashtra, located in western India, is recognized for its rich biodiversity due to its unique biogeographical position. The diverse flora, including both cryptogams and phanerogams, reflects a healthy and balanced ecosystem. *Ophioglossum* L. is a widely distributed genus within the eusporangiate pteridophytic family Ophioglossaceae. During floristic surveys conducted in open grasslands near forest floors and water bodies, the authors recorded a brownish-green population of *Ophioglossum* characterized by ovate-circular trophophylls, an apex that is acute to obtuse, and 2-3 trophophylls per rhizomorph, lying flat on the ground. Detailed micro-observations and taxonomic descriptions of the collected specimen confirm it as *Ophioglossum rubellum* Welw. ex A. Braun. This report documents the first occurrence of *Ophioglossum rubellum* in Maharashtra, thereby extending the known distribution of this species to the state.

**Keywords:** *Ophioglossum*; Eusporangiate; Rhizomorph; Trophophylls; New Record; Maharashtra

## 1. Introduction

Maharashtra, situated in western India, is renowned for its high biodiversity, attributable to its unique biogeographical context. *Ophioglossum* L. is among the most widely distributed genera within the eusporangiate pteridophytic family Ophioglossaceae. Numerous researchers have examined the diversity and distribution of *Ophioglossum* and related genera across various biogeographical regions of India (Roux, 2001; Goswami et al., 2012, 2020; Patil et al., 2014, 2020, 2021; Rajput et al., 2021; Shiwankar et al., 2024). *Ophioglossum* L. is recognised as a cosmopolitan and species-rich genus, with India serving as one of the primary centres for its germplasm diversity. This prominence positions India as an important region for global research on the genus (Khandelwal, 1987; Goswami et al., 2012 and 2020; Patel et al., 2019; Lakshmanan, 2022; Kachhiyapatel et al., 2018).

The genus *Ophioglossum* L. received attention from botanists and many other biologists because it was found to have the highest number of chromosomes among the plant groups (Ninan, 1958; Goswami, 2012). Earlier, fern exploration was conducted at different sites in the Bhandara district of eastern Maharashtra, India (Bhuskute, 1999). The present team revisited various forest floors of Bhandara district of eastern Maharashtra and wetlands frequently between June and October from 2019 to 2024. During the field study, the authors observed a brownish-green to reddish population of *Ophioglossum* L. This population had ovate-circular leaves with an acute-obtuse apex, 2-3 trophophylls per rhizomorph, lay flat on the ground. They were found in open grassland near forest floors and water bodies. Sample individuals from this population were collected for further study. The specimens were subjected to morphological and other taxonomic investigations. The process, along with recorded micro-observations and taxonomic description, revealed that the species is *Ophioglossum rubellum* Welw. ex A. Braun (Roux, 2001; Patil et al., 2021). This species is reported for the first time from Maharashtra as an extended distribution after Gujarat.

## 2. Material and method

### 2.1. Collection of plant specimens

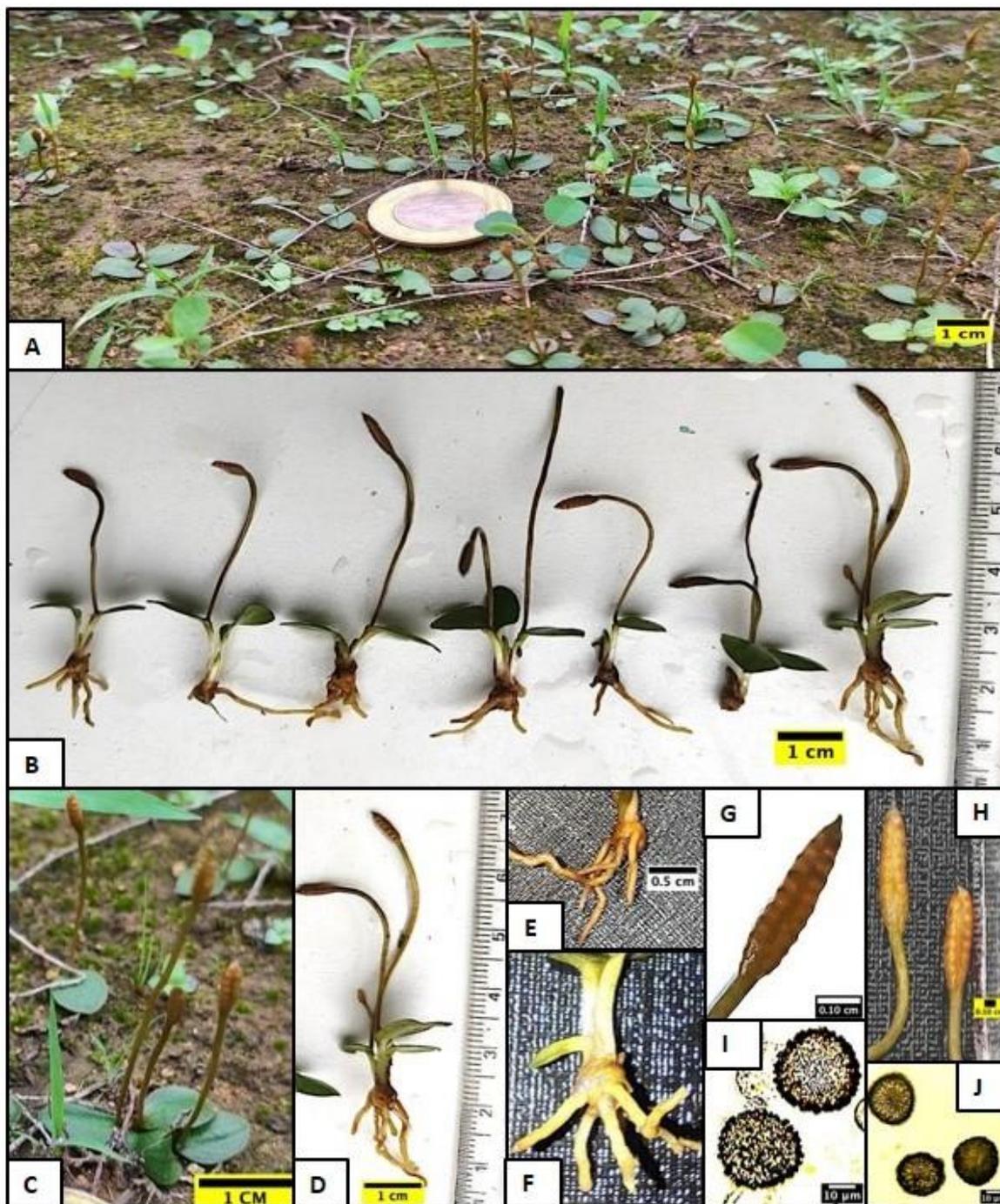
The individual specimens were collected from open grassland near forest floors and water bodies from the adjoining areas of Nawegaon-Nagzira Tiger Reserve (NNTR), Bhandara Dist.: 21°10'57"N-79°50'43"E, 21°11'02"N-79°51'08"E, alt. 300-350 m, and 21°010'01"N-80°07'14"E, alt. 250-300 m. Present investigations were made by studying the specimens *in-situ*, and observations were recorded for their habit, habitat, and ecological interactions as well as a pattern of distribution of the population. The population associated with *O. costatum*, *O. jaykrishnae* and *O. gramineum*. The species has been observed in a sporadic clumped distribution.

Individual specimens were subjected to morphological and other taxonomic characteristics, like size, shape, length of plants, fronds, and rhizome, and also looked for rhizoid length, number, colour, scales, venation pattern, fertile spike, shape, size, and length of spike, etc. Microscopic investigations were done to study spore morphology, shape, and size. Final floristic accounts were prepared based on observations and investigations (Figure 1). Plant specimen identification was confirmed using flora, books, monographs, and research publications.

## 3. Result and discussion

### 3.1. Systematic treatment

Perennial herb with deciduous aerial parts, (3.5)4 - 7(-8.5) cm in height; common stalk 0.6-1.5 cm, white, subterranean, trophophylls 0.4-1 × 1 cm, 3-4 (rarely more than 4) per rhizomorph, brownish-green, venation simple reticulate, ovate-circular, apex acute-obtuse, base truncate, margin entire, leaf base without sheathing, flat on ground forming 60°-90° angle to the fertile stalk; fertile segment 2.8-5.5 cm long, strobili 0.5-1 cm long,



**Figure 1.** A-G: *Ophioglossum rubellum* Welw. ex. A. Braun. (A) Natural vegetation in habitat, showing a number of trophophylls. (B) Range of variation within species. (C, D) Complete mature individual. (E, F) Enlarged rhizomorph. (G, H) Enlarged strobili. (I, J) Spores.

thick, apex acute-acuminate, sporangia 5-8, arranged in two alternate rows, green at young reddish-brownish at mature. Spores 25-35  $\mu\text{m}$  dia., trilete, exine reticulate; rhizomorph strictly subglobose 0.3-0.5 cm long, strictly subterranean, roots fibrous, 0.7-1.8 cm long.

### 3.2. Specimen examined

India: Maharashtra: Bhandara dt.: Usagaon (21°10'57"N-79°50'43"E) (21°11'02"N-79°51'08"E), alt. ~300 m., and Palasgaon, Sakoli (21°01'01"N - 80°07'14"E), alt. ~280 m; adjoining areas of Nawegaon-Nagzira Tiger Reserve (NNTR). About 400-500 individuals were counted, from two sites of around 500 sq.m. each. The collected individual process and recorded micro-observations, along with the taxonomic description, reveal that the collected

species is *Ophioglossum rubellum* Welw. ex. A. Braun. This is the first time that the species has been described as having a new distribution in Maharashtra state. The worldwide distribution of *O. rubellum* Welw. ex. A. Braun is known as an African element. Past records noted it only from the African continent (Burrows, 1990; Roux, 2001). However, recent studies from Gujarat have reported *O. rubellum* as a new record for India (Patil et al., 2021). *O. rubellum* shows strictly subglobose rhizomorph, a subterranean common stalk, and 3-4 trophophylls per rhizomorph, with the presence of a pseudo-midrib. This makes it distinct from *O. indicum* (Yadav and Goswami, 2010), which shows a subglobose-knob like stalk, a common stalk that is both subterranean and terranean, and 1-2 trophophylls per rhizomorph. The detailed

**Table 1.** Comparative morphology of *O. costatum*, *O. parvifolium*, *O. gujaratense*, and *O. rubellum*.

Species	<i>O. costatum</i>	<i>O. parvifolium</i>	<i>O. gujaratense</i>	<i>O. rubellum</i>
<b>Attributes</b>				
<b>Plant Height (cm)</b>	15-25	Up-to 10	2-10	4-7
<b>Rhizomorph</b>	Tuberous, disc like or globose	Subglobose-tuberous	Subglobose-tuberous, with stoloniferous roots	Strictly Subglobose
<b>Trophophore</b>	2-3 cm, base white, apex pale green	Subterranean, white, glabrous;	0.2-1cm long mostly subterranean, white-light green.	0.6–1.5 cm, white, subterranean
<b>Trophophylls</b>	Erect, Arising from the centre of the cupule of the rhizome.	Attached to the substratum, forming Strictly 90° angle to the fertile stalk.	Horizontally attached to the substratum, slightly convex adaxially, bending towards soil.	Attached to the substratum, forming 60°- 90° angle to the fertile stalk.
<b>Trophophylls Number</b>	1-4 (rarely 5)	1-2	2-5 (rarely >5)	3-4 (rarely >4)
<b>Colour</b>	green	green	Pale-dark green	Green, brownish green on maturity
<b>Trophophylls shape</b>	Elliptic- lanceolate or obtuse-ovate	Ovate, elliptic, sometimes orbicular	Slightly convex adaxially, ovate-elliptic or elliptic-lanceolate (Lindley)	Ovate-circular
<b>Apex Base</b>	Obtuse- mucronate	Acute-apiculate	acute- obtuse	acute- obtuse
<b>Fertile segment</b>	cuneate-attenuate	cuneate	obtuse- cuneate	truncate
<b>Length of Fertile segment (cm)</b>	pale yellow	green	pale-green	brownish green
<b>Length of Strobilus (cm)</b>	6 -10	1.8-3.2	2-8	2.8-5.5
<b>Sporangia in pairs</b>	4-5.8	1.8-3.2	0.5-2	0.5-1
<b>Spores size (µm)</b>	20-35	4-8	5-15	5-8
	36-38	30-35	18-28	25-35

comparative morphology of *O. rubellum*, *O. parvifolium*, *O. costatum*, and *O. gujaratense* is presented in tabular format for populations observed at the same sites (Table 1). The present study documents this distribution from India: Maharashtra, Bhandara district, in the areas adjoining the Nawegaon-Nagzira Tiger Reserve (NNTR). This is a new distributional record for Maharashtra state.

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### Conflict of Interest

Authors have no conflict of interest to declare

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