

THE GENUS *OPHIOGLOSSUM* (OPHIOGLOSSACEAE) IN WEST BENGAL, INDIA

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ABSTRACT

The genus *Ophioglossum* has been studied to make a list of the species occurring in West Bengal, India, along with their distribution patterns in the State. In the present investigation we have found that *Ophioglossum* is represented in West Bengal by five or six species, *O. costatum*, *O. gramineum*, *O. parvifolium*, *O. pendulum*, *O. petiolatum* and *O. reticulatum*. *Ophioglossum pendulum*, if present, and *O. petiolatum* are restricted to the northern part of West Bengal whereas *O. gramineum* typically occurs in the southern part. *Ophioglossum costatum*, *O. parvifolium* and *O. reticulatum* are distributed throughout the State.

INTRODUCTION

Ophioglossum L., the type genus of family Ophioglossaceae, was described by Linnaeus (1753) in *Species Plantarum*. *Ophioglossum vulgatum* L. is the lectogeneritype (chosen by John Smith, Hist. Fil. 367. 1875). There has been considerable confusion regarding the number of species in the genus, but estimates vary from 42-52.

Clausen (1938a) treated nine species and three varieties of *Ophioglossum* from India, followed by Mahabale (1962), who treated 10 species; Wieffering (1964), in a less accurate work, treated only four species and two forms from India (and erroneously synonymised *O. petiolatum* within *O. reticulatum*); Panigrahi & Dixit (1969) and Dixit (1984) treated 11 species and four further varieties; while Goswami (1987; 2007) estimated 12 species and four varieties; Fraser-Jenkins (2008) treated nine species and excluded *O. vulgatum* and *O. nudicaule* as being extra-Indian. Recently Fraser-Jenkins et al. (2016; 2018; 2020) accepted 12 species of *Ophioglossum* in India, though Goswami, Patel and others treat more, including various new species from peninsular India.

Indian species accepted by Fraser-Jenkins et al. are: *O. costatum* R.Br., *O. eliminatum* Khand. & Goswami, *O. gomezianum* Welw. ex A.Braun apud Kuhn, *O. gramineum* Willd., *O. lancifolium* C.Presl (tentative identification), *O. lusoafricanum* Welw. ex Prantl, *O. parvifolium* Grev. & Hook., *O. pendulum* L., *O. petiolatum* Hook., *O. polyphyllum* A.Braun ex Seub., *O. reticulatum* L. and *Ophioglossum rubellum* Welw. ex A. Braun. He excluded *O. vulgatum* L., *O. nudicaule* L.f., *O. thermale* Kom. and *O. lusitanicum* L. as being extra-Indian, represented in India by different species, and now

partly tentatively synonymises eight recently described species from India, *O. oleosum* Khand., *O. indicum* B.L.Yadav & Goswami, *O. raphaelianum* Anto et al., *O. malviae* M.Patel & M.N.Reddy, *O. gujaratense* S.M.Patil et al., *O. hitkishorei* M.Patel & M.N.Reddy, *O. aletum* M.Patel et al. and *O. chaloneri* Goswami et al.. These synonymised species all occur in the Western Ghats of peninsular India and are not relevant to West Bengal, several are under further study by their authors and final numbers accepted for India may change later. At present the estimated number of species in India varies from 12 to 20 according to different authors.

Ghosh et al. (2004) listed seven species and two varieties from N.E. India, of which five species and one variety were listed as present in West Bengal, but their nomenclature, identification and taxonomy were often inaccurate and confused and they did not provide a reliable account.

West Bengal is one of the largest states of India, extending from Darjeeling in the north, situated in the East Central Indo-Himalayan ranges, to the Sunderbans in the south, on the coast of the Bay of Bengal. The mountainous region of the north is cool almost all the year around and is dominated by coniferous forest. By contrast, in the Sunderbans at near sea-level the soil is saline and the vegetation is predominantly warm tropical mangrove swamp. The plains of West Bengal are also very diverse as regards edaphic and prevailing climatic factors. The districts of Bankura and Purulia have lateritic soil and the climate is hot for most of the year. These regions are dominated by forests of *Shorea robusta* Gaertn.f. According to Manna and Roy (2014), it is possible to detect populations of *Ophioglossum* species by identifying plant-associations that are characteristic for them. They showed that some species of angiosperms are associated with *Ophioglossum* whereas other species of angiosperms have negative association.

The species of *Ophioglossum* occurring in West Bengal have not so far been reliably documented and as the region is representative of much of northern India for this genus, we have attempted to list them and show their distribution-patterns in the State.

MATERIALS AND METHODS

Field survey was carried out in a number of localities in West Bengal and the specimens collected were processed in the laboratory for preparation of herbarium specimens. One set of specimens has been deposited in the Central National Herbarium, Botanical Survey of India, Howrah (Kolkata), West Bengal (CAL), and another set was deposited in the Department of Botany, Burdwan Raj College, Bardhaman, West Bengal (BRCH). Identification of specimens was done by reference to literature, including Beddome (1883), Ghosh et al. (2004), and Fraser-Jenkins et al. (2015; 2016) and also by reference to the digital herbarium of the Royal Botanic Garden, Kew, England. Some of our identifications were confirmed by Dr. Pushpesh Joshi of the Botanical Survey of India, Northern Regional Centre, Dehradun, India, and others were identified by Mr. C.R. Fraser-Jenkins, Cascais, Portugal. We have also studied the holdings of *Ophioglossum* from West Bengal etc. at CAL.

From these studies we have listed the species of *Ophioglossum* growing in West Bengal with their diagnostic features and places of occurrence. Their distribution patterns are shown in the map of West Bengal below (Figure 1).

TAXONOMIC TREATMENT

Key to West Bengal *Ophioglossum* species

It is important in *Ophioglossum* to study a number of specimens in the population to

understand the range of variation in shape and size. A single specimen on a herbarium-sheet can often be difficult to recognise and identify.

- 1) Plants epiphytic*Ophioglossum pendulum*
- 1) Plant terrestrial2
- 2) Rhizome globose, roots thin, sterile blade often with a slightly paler median band*Ophioglossum costatum*
- 2) Rhizome cylindrical, erect, roots slightly fleshy, sterile blade never with a paler median band3
- 3) Trophophyll linear*Ophioglossum gramineum*
- 3) Trophophyll lanceolate to ovate4
- 4) Sporangia five to eight pairs per spike*Ophioglossum parvifolium*
- 4) Sporangia more than eight pairs per spike5
- 5) Trophophyll cordate or truncate at base*Ophioglossum reticulatum*
- 5) Trophophyll elliptic, narrowed to base*Ophioglossum petiolatum*

1. *Ophioglossum costatum* R.Br., Prodr. Fl. Nov. Holland. 163. 1810.
Ophioglossum pedunculatum Desv., Mag. Neuesten Entdeck. Gesammten Naturk. Ges. Naturf. Berlin 5: 306. 1811.
Ophioglossum fibrosum Schumach., Beskr. Guin. Pl. 452. 1827.
Ophioglossum wightii Grev. & Hook., Bot. Misc. 3: 218. 1833.
Ophioglossum vulgatum L. var. *costatum* (R.Br.) Hook.f., Fl. Nov.-Zeland. 2(2): 50. 1854.
Ophioglossum brevipes Bedd., Ferns S. India 23, t. 72. 1863.
 Plants 8.0-25.0 cm long; rhizome globose or spherical bearing many thin, yellow-brown

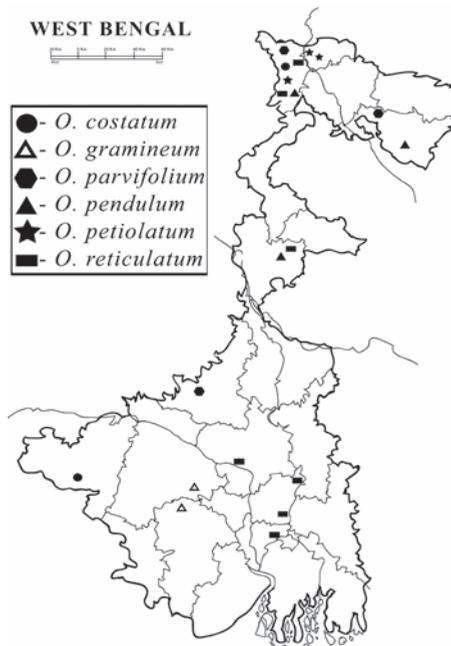


Figure 1: Map of West Bengal showing the distribution of different species of *Ophioglossum*

fibrous roots, without stolons or proliferous buds; common stalk up to 4.0 cm long; trophophylls 1-4, 2.5-12.0 × 1.0-2.7 cm, elliptic-lanceolate, sometimes ovate or obovate, acute or obtuse, herbaceous, often with a prominent median band of veins, primary veins forming large, oblong to hexagonal areoles in which are included networks of secondary veinlets forming smaller secondary areoles; fertile stalk 3.0-18.0 cm long; spike 1.0-6.0 × 0.25-0.4 cm with no sterile tip, sporangia 20-30 in each of the two rows; spores 20-40 μm in diameter, trilete, finely reticulate (Figure 2A).

Collections: Darjeeling Distr., Sikkim, *T. T[homson]*. 2841 spec. 833, 1857, BM (suspected to be mislocalisation); Purulia Distr. (formerly Manbhum), Purulia, *Revd. J. Campbell* 27171, 12.5.1951, CAL.

Distribution in West Bengal: Darjeeling, Purulia.

As with most earlier collections, Campbell's specimen was identified tentatively as *O. vulgatum*, but was reidentified as *O. fibrosum* by H.L. Chakravarty, 12.5.1951, later confirmed as *O. costatum* by J. H. Weffering as in 1963.

2. *Ophioglossum gramineum* Willd., Abhandl. Kurf.-Mainz. Akad. Nütz. Wiss. Erfurt 2(6): 18, t. 1, f. 1. 1802.

Ophioglossum vulgatum L. var. *gramineum* (Willd) Hook.f., Fl. Nov.-Zeland. 2(2): 50. 1854.

Ophioglossum prantlii C.Chr., Index fil. 471. 1906.

Ophioglossum gramineum var. *majus* (Alderw.) Wieff., Blumea 12(2): 324. 1964.

Plants 4.0-12.0 cm long; rhizome cylindrical, erect, with few, slightly fleshy roots running obliquely downward; common stalk up to 3.5 cm long; trophophylls 1-3, 1.0-3.0 × 0.13-0.3 cm, linear, grass-like, ascending, acute, herbaceous with 2-3 parallel veins; fertile stalk 1.5-3.5 cm long; spike 0.5-2.5 × 0.1-0.3 cm with a very small sterile tip, strobili bearing 5-10 pairs of sporangia arranged in 2 alternate rows, pale-green to yellow; spores 25-40 μm in diameter, trilete, broadly reticulate (Figure 2B).

Collections: Paschim Medinipur [Midnapore] Distr., Mondolpuskarini, Garbeta, *R.H.N. Chaudhuri*, 8.1975, no details about deposition (Chaudhuri & Pal, 1979); Bankura Distr., Joypur Forest, *A.B. De BUR*1908, 8.2019, BRCH.

Distribution in West Bengal: Bankura, Paschim Medinipur.

We did not find any West Bengal specimens of this species in CAL, but we collected this inconspicuous and often overlooked species at Joypur Forest, Bankura. In West Bengal, *O. gramineum* was first collected from Mondolpuskarini, Garbeta in the district of Midnapur (now Paschim Medinipur) in August, 1975 as *O. gramineum* var. *gramineum* (Chaudhuri & Pal, 1979), but they did not provide any details about deposition of their collected specimen.

3. *Ophioglossum parvifolium* Grev. & Hook., Bot. Misc. 3: 218. 1833.

Ophioglossum macrorrhizum Kunze, Analect. Pteridogr. 2. 1837.

Ophioglossum schmidii Kunze, Linnaea 24: 246. 1851.

Ophioglossum vulgatum L. var. *macrorrhizum* (Kunze) Lueres., J. Mus. Godeffroy 3: 242-244. 1875.

Ophioglossum pumilum (Racib.) Alderw., Malayan Ferns, Suppl. 1: 453. 1916.

Ophioglossum nudicaule var. *macrorrhizum* (Kunze) R.T.Clausen, Mem. Torrey Bot. Club 19(2): 150. 1938.

Ophioglossum nudicaule var. *tenerum* (Mett. ex Prantl) R.T.Clausen, Mem. Torrey Bot. Club 19: 146. 1938.

Plants occasionally up to 10 cm long, usually less; rhizome cylindrical with a few downward or sideways-directed fleshy roots, which often bear proliferous buds; common stalk up to 1.5 cm long; trophophylls 1-3, 0.4-1.0 × 0.3-0.8 cm, ovate-lanceolate, acute, slightly succulent-herbaceous with simple reticulate venation; fertile stalk 2.0-5.0 cm long; spike 0.5-1.7 × 0.1-0.2 cm with a very small sterile tip, strobili bearing 5-8 pairs

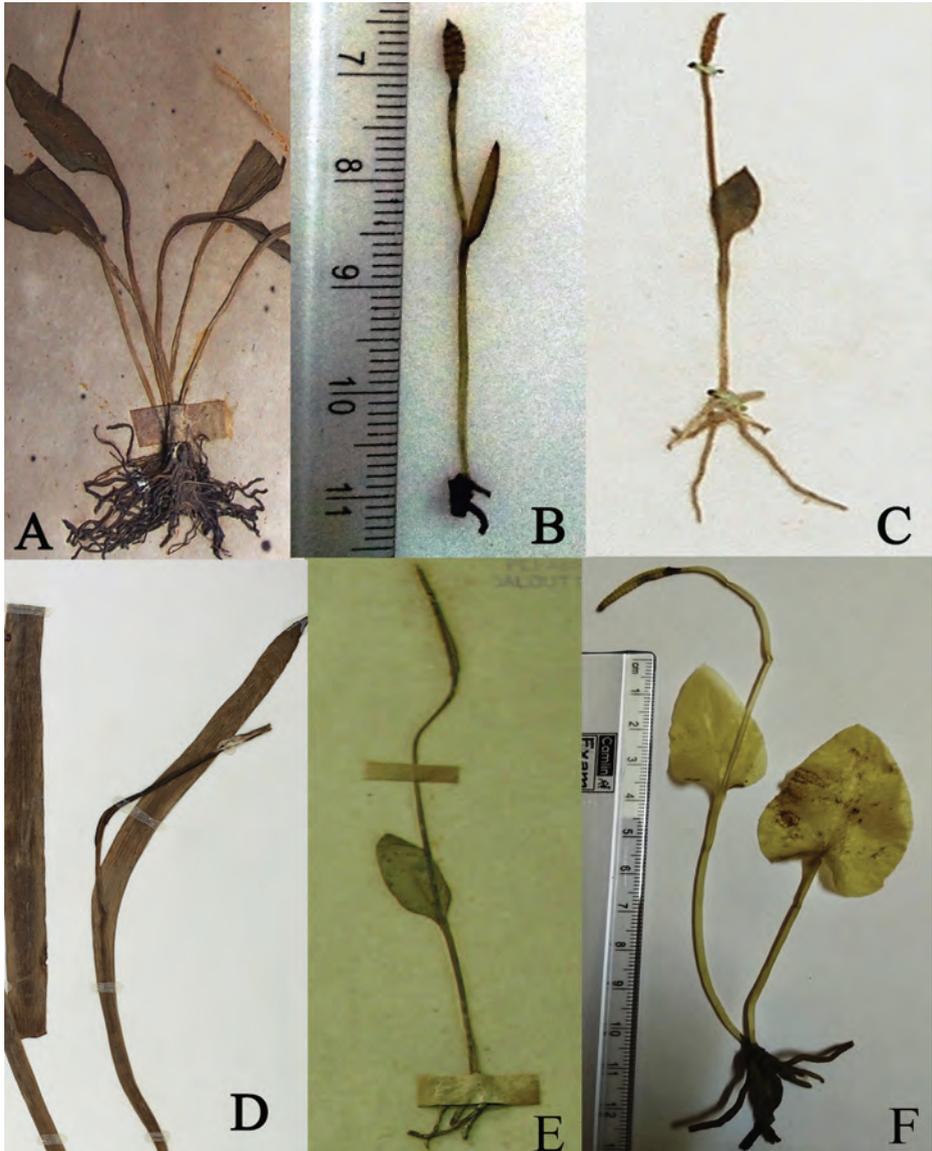


Figure 2: A. *Ophioglossum costatum* Purulia, Revd. J. Campbell 27171, CAL; B. *Ophioglossum gramineum* Joypur Forest, A.B. De BUR1908, BRCH; C. *Ophioglossum parvifolium* Kachujore Forest, Suri, R.K. Basak s.n., CAL; D. *Ophioglossum pendulum* Perak, Malaya, L. Wray 1133, CAL; E. *Ophioglossum petiolatum* Sureil, 5200 ft., Darjeeling, D.D. Prain 27195, s.d., CAL; F. *Ophioglossum reticulatum* Burdwan Univ. Campus, Bardhaman, S. Jash & A.B. De BUR1912, BRCH.

of sporangia arranged alternately in 2 rows; spores 30-45 µm in diameter, trilete, coarsely reticulate (Figure 2C).

Collections: Darjeeling Distr., Rungeet, [below] Darjeeling, 2000 ft., C.B. Clarke 27160, 22.8.1875, K (sub “*O. vulgatum?*”, part reidentified by F. Ballard as *O. nudicaule* var. *tenerum*); Birbhum Distr., Kachujore Forest, near Suri, R.K. Basak s.n., CAL.

Distribution in West Bengal: Birbhum, Cooch Behar (Chowdhury *et al.*, 2016), Darjeeling.

Ophioglossum parvifolium was formerly included, along with other small species, within reports from India of *O. nudicaule*, but that species is now understood to be endemic to South Africa and is not present in India. Basak (1968) reported this species from Birbhum under the name *O. nudicaule* var. *macrorrhizum*. Chowdhury *et al.* (2016) also reported *O. nudicaule* from the Duars [Dooars] foothills in Cooch Behar District, but no details or description were given and they did not indicate if any specimen was collected. The identity of this record cannot be confirmed, but if they had not misapplied the name to *O. petiolatum* or *O. reticulatum*, it should presumably have referred to the present species.

4. *Ophioglossum pendulum* L., Sp. Pl., ed. 2, 2: 1518. 1763.

Ophiderma pendula (L.) C.Presl, Suppl. Tent. Pterid. 56. 1845.

Plants epiphytic; rhizome small, white, creeping, bearing many fleshy roots; 1-6 fronds arising close together directly from rhizome, trophophylls up to 200 cm long and 0.6-9.0 cm wide, ribbon-like, pendulous, narrowed towards the base, often one or more times furcated, apex acute or obtuse, texture thin, flaccid-succulent, veins forming a series of long narrow areoles, clearly visible in dried specimen; fertile branch single, rarely two, borne from the middle of the width of the lamina, 6.0-45.0 cm long and 0.5-1.5 cm wide, about 200 sporangia arranged in 2 rows; spores triangular, rarely circular, 40-50 µm in diameter, trilete, smooth (Figure 2D).

Collections: We have not seen any collections from West Bengal and there is only one report by Sanyal *et al.* (2012) from Cooch Behar, Darjeeling and Malda, listed without specimen citation.

Distribution in West Bengal: Doubtfully from Cooch Bihar, Darjeeling and Malda.

Ophioglossum pendulum is an epiphytic species, known from Sikkim State, Assam State, Arunachal Pradesh, Kerala and the Andaman Islands (Fraser-Jenkins *et al.*, 2016), but previously unknown from West Bengal. There are no West Bengal specimens in international or Indian herbaria and no reports apart from by Sanyal *et al.* (2012). We have reason to doubt their report as their list contains many errors and lists numerous species known only from further east in N.E. India, but not West Bengal. As no further details were given, nor even the name of the compiler, we could not investigate or confirm this unlikely report.

5. *Ophioglossum petiolatum* Hook., Exot. Fl. 1: 56, t. 56. 1823.

Ophioglossum moluccanum Schldt., Adumbr. Fil. Prom. Bon. Spei 9. 1825.

Ophioglossum vulgatum L. var. *australasiaticum* Luerss., J. Mus. Godeffroy 3: 246, t. 13, 15. 1875.

Ophioglossum reticulatum L. var. *complicatum* (Miq.) Wieff., Blumea 12(2): 330. 1964.

Plants 10.0-20.0 cm long; rhizome short, erect, cylindrical, slender, bearing several fleshy roots, which often bear proliferous buds; common stalk up to 6.0 cm long, whitish at base; trophophylls 1-3, up to 6.0 cm long and 3.0 cm wide, but usually smaller, shortly

petiolate, elliptical or lanceolate, acute at apex, base gradually narrowed, slightly succulent-herbaceous, with reticulate venation, veins anastomosing, 6-10 veins forming basal midvein-like structure; fertile branch 5.0-10.0 cm long; spike up to 5.0×0.5 cm with a small sterile tip, sporangia up to 30 pairs, arranged alternately in 2 rows; spores 30-45 µm in diameter, trilete, somewhat coarsely reticulate (Figure 2E).

Collections: Darjeeling Distr., “[British] Sikkim”, Goke (“Goak”), 4000 ft., *T. Anderson*, *M.D.* 1409, 15.6.1862, K, CAL; Darjeeling Distr., “Sikkim Himalaya”, Teesta, *G. King* s.n., 25.2.1876, K, CAL; Darjeeling Distr., “Sikkim”, Sureil, 5200 ft., *D.D. Prain* 27195, s.d., CAL; Darjeeling Distr., Kalimpong, 4000 ft., *E.A.C.L.E. Schelpe* 3669, 9.8.1952, BM; Darjeeling Distr., Tiger Hill, 8500 ft., *S.C. Verma* 201, 8.1956, PAN (62, 201), sub *O. vulgatum*, redet. C.R. Fraser-Jenkins as *O. petiolatum*; Darjeeling Distr., Senchal Forest, 8000 ft., *S.C. Verma* (as “Versima” in error) 3, 24.8.1956, K; Darjeeling Distr., Senchal Forest (Chaudhuri & Sarkar, 2003); Kalimpong Distr., Youth Hostel Bungalow Compound, 1200 m, *S.R. Ghosh* 57687, 7.1983, CAL.

Distribution in West Bengal: Darjeeling, Kalimpong.

Ophioglossum petiolatum has been much confused with *O. reticulatum* due to the variability in frond-shape of the latter, which can have narrower leaves with less obvious abrupt narrowing to their bases and is often then confused with *O. petiolatum*. Most of the reports of *O. vulgatum* from India apply to *O. petiolatum*, or otherwise to *O. reticulatum*. *O. petiolatum* was incorrectly synonymised into *O. reticulatum* by Wieffering (1964). It was reported to grow on moist sandy, alluvial soil among grasses and mosses from 600-2400 m altitude by Ghosh *et al.* (2004). Ghosh and Majumdar (2018) have mentioned the occurrence of *O. petiolatum* in Bhadreswar and reported for first time from Hooghly district. But they did not provide any description of specimen as well as any details about deposition. So it can be concluded as a doubtful record.

6. *Ophioglossum reticulatum* L., Sp. Pl. 2: 1063. 1753.

Ophioglossum cordifolium Roxb., in Griffith, *Calcutta J. Nat. Hist.* 4: 475. 1844.

Ophioglossum cognatum C.Presl, *Suppl. Tent. Pterid.* 53. 1845.

Ophioglossum vulgatum L. var. *reticulatum* (L.) D.C.Eaton, *Mem. Amer. Acad. Art. Sci.*, n. s., 8: 218. 1861.

Plants up to 30 cm long; rhizome cylindrical, erect, bearing a few long, thick, fleshy, unbranched roots, which often bear proliferous buds; common stalk 4.0-10.0 cm long, dark green; trophophylls 1 or 2, rarely 3, up to 10 cm long and 4 cm wide, broadly ovate or cordate, sometimes elongated and parallel-sided when among thicker vegetation, usually obtusely pointed apically, widest towards the base which narrows abruptly to the petiole, base truncate to often cordate, succulent herbaceous, with strongly reticulate venation; fertile segment up to 15 cm long; strobilus up to 5.0 × 1.0 cm, without any sterile tip, sporangia 20-42 pairs, arranged alternately in 2 rows; spores 30-45 µm in diameter, trilete, finely reticulate (Figure 2F).

Collections: Hooghly Distr., Bengal, Nemora Bengalia, *W. Roxburgh* s.n., 1808, in Wallich Num. list no. 47.1 pp., K-W, K, US, BM; Howrah Distr., inter mangiferas, in H[ort.] B[ot.] C[alcutta], *N. Wallich* Num. List no. 47.1 pp., 9.1825, K-W and 10.1817, BM, UC; Hooghly Distr., Serampores, [*N. Wallich*], herb. Hookerianum, K; Bengalia, *N. Wallich* s.n., 1829, herb. Hookerianum, K; Hooghly Distr., Serampore, *W. Griffith* s.n., s.d., BM; ditto, *Dr. Lemann* s.n., s.d., BM; Darjeeling Distr., Darjeeling, *W. Griffith* s.n., s.d., herb. Hookerianum, K; Calcutta, *A. W. Helfer* s.n., K; Darjeeling Distr., Tukvar, in garden soil, [*T. Anderson* s.n.], 16.9.1857, CAL; Darjeeling Distr., Darjeeling, *R.H.*

Beddome s.n., s.d. K; Darjeeling Distr., Observatory Hill, Darjeeling, 7160 ft., *H.C. Levinge* s.n., 6.1880, K, CAL (det. as *O. reticulatum* by C.B. Clarke and by Dr. Pushpesh Joshi); Lower Bengal, Howrah Distr., wild in H[ort]. B[ot]. C[alcutta], in grass by the side of the Oreodoxa Avenue, *Mr. Davies* s.n., 1.8.1896, CAL; Malda Distr., Hatimari, *R.M. Dutta* 480, 24.8.1966, CAL; Hooghly Distr., Balagarh, Guptipara, *S. Deb* 133, 8.2014, KAL (Deb et al., 2018); Purba Bardhaman Distr., Burdwan University Campus, Golapbag, *S. Jash & A.B. De* BUR 1912, 2.2019, BRCH.

Distribution in West Bengal: Darjeeling, Hooghly, Howrah, Malda and Purba Bardhaman.

Most of the older specimens were originally misidentified as *O. vulgatum*, which was the name usually used by earlier botanists before the species of *Ophioglossum* in India became better known. Clausen (1938b) cited *O. cognatum*, described from Calcutta (*A.W. Helfer*), as a synonym of *O. petiolatum*, but with its ovate frond and rounded base it was more likely to be a specimen of *O. reticulatum* with a thicker midrib, than usual. The presence of endophytic bacteria in the roots of *O. reticulatum* from Darjeeling was documented by Mukherjee *et al.* (2017).

DISCUSSION

Ophioglossum is a difficult genus with much variation within the species, not only in sterile blade shape (particularly in *O. reticulatum* and *O. petiolatum*), but also in size. Populations of small, almost dwarf specimens can occur in those two species, which can create confusion with *O. parvifolium*, for example, and has also led to description of unwarranted new species in peninsular India. In addition most species have been found to contain more than one cytotype so that cytology alone is not a determinant of specific identity. Although spore-ornamentation is an important and useful means of differentiation of some species, it is also subject to some variation within species. It is therefore necessary to combine all these different aspects when identifying collections, even though trophophyll morphology remains the most useful guide. Many collections are not sufficient for definite identification due to having insufficient material on the sheet to be able to understand the degree of variation, one or two specimens only in herbarium-specimens or in illustrations in publications may not be sufficient and as long as it does not cause too much damage to the population, it is better to collect a reasonable number of specimens to help with accurate determination.

Chhetri *et al.* (2005) reported *O. vulgatum* from Darjeeling at 1500-2400 m, but they did not study ferns in detail. Their report should be either *O. petiolatum* or *O. reticulatum*, but we have not seen their collection for further identification.

We have excluded *O. lusitanicum* from West Bengal. West Bengal was listed in the distribution of this species by Patil & Dongare (2014) and Kachhiyapatel *et al.* (2018), but no-one has specified a collection or place of occurrence in West Bengal. As this species was not detected by us during our surveys and we have seen no specimens in herbaria or precise reports in literature, we exclude it from West Bengal pending further investigation.

From the present investigation we have found that *Ophioglossum* in West Bengal is represented by five or six species out of an average of 14 species reported from India. These are *O. costatum*, *O. gramineum*, *O. parvifolium*, ?*O. pendulum*, *O. petiolatum* and *O. reticulatum*, and have been found to grow in 11 out of the total 23 Districts of West Bengal. The distribution-pattern of these species is of interest as it may be related to the phylogeographical relationships of the species concerned, not only their local habitat and

climate requirements. If really present, *O. pendulum* is apparently restricted to the northern part of West Bengal, whereas *O. gramineum* occurs only in the southern part, as currently known. *Ophioglossum costatum*, *O. parvifolium* and *O. reticulatum* grow in both north and south. The distribution of *O. petiolatum* may also be confined to the north and at slightly higher altitude than the others, but this record is not yet verified; we suspect Clausen's report of it from Kolkata could be merely a less characteristically wide-based specimen of *O. reticulatum*, although we have not seen the specimens. Subsequent collecting activity and comparative studies on the genus could perhaps reveal the possible presence of further species in West Bengal and should certainly reveal further localities of occurrence.

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