



On the identity and occurrence of *Ophioglossum costatum* (Pteridophyta: Ophioglossaceae) in Andhra Pradesh, India

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The members of the genus *Ophioglossum* L. (Ophioglossaceae) are known as snake tongue or adder's tongue ferns. The genus comprises, worldwide, an estimated 28-58 (Panigrahi & Dixit 1969) to 40 species (Singh et al. 2009). In India, it is represented by 12 species (Yadav & Tripathi 2002; Goswami et al. 2008; Singh et al. 2009). Pullaiah et al. (2003) recorded three species of the genus for the state of Andhra Pradesh, namely, *Ophioglossum gramineum* Willd., *O.nudicaule* L.f. and *O. reticulatum* L. However, earlier Rao et al. (1999) reported *O. pedunculatum* Desv. to be common on the hills of Tuni in East Godavari District which is synonymous with *Ohioglossum costatum* R.Br. - a distinct, widespread

species often misidentified with *O. nudicaule* L.f. The present paper attempts to look at this problem and adds a note on the field identity and occurrence of the paleotropical fern, *Ophioglossum costatum* R.Br., in Andhra Pradesh.

Taxonomic identity

In the herbarium, often, the differences between the specimens of *O. costatum* and *O. nudicaule* are not perceived properly and confused when the particulars of the subterranean parts such as rhizome shape, size, number of fibrous roots, origin of trophophylls, depth at which the rhizome is buried, presence of stolons, etc. are missing or not indicated. Table 1 provides the differences between these species for their proper identification.

Although the sterile fronds arise from the subterranean part of the rhizome in *O. costatum*, *O.nudicaule* and *O. polyphyllum*, the plants attain a height of about 4cm, the rhizome is tuberous, cylindrical with a growing point, stolons help in vegetative propagation, the angle between peduncle and lamina is 90° and the venation of the sterile frond is not double in *O. nudicaule*. The plants can reach a height of 25cm, the rhizome is globose, tuberous with an apical cupule, no stolons but bear profuse lateral roots and the trophophyll is with a distinct pale midrib in *O. costatum*, whereas, the sterile fronds are many (2-5; usually 4) and without the distinct costa in *O. polyphyllum*.

Ophioglossum costatum

Ophioglossum costatum R.Br., Prodr. Fl. Nov. Holl.: 163. 1810; Balakrishnan et al. in Bull. Bot. Surv. India 2: 337. 1960; Panigrahi & Dixit in J. Indian Bot. Soc. 35: 249. f. 38, 39. 1969.

O. pedunculatum Desv., Mag. Ges. Nat. Fr. Berlin 5: 306. 1811; Clausen in Mem. Torrey Bot. Club 19(2): 140. 1938.

O. pedunculatum Desv. ex Poir., Enc. Suppl. 4: 164. 1816 (error).

Abbreviations: BSID - Herbarium of Deccan Circle, Botanical Survey of India, Hyderabad; KUH - Kakatiya University Herbarium, Warangal; SKU - Herbarium of Department of Botany, Sri Krishna Devaraya University, Anantapur.

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Table 1. Comparison of diagnostic characters between *Ophioglossum costatum* and *O. nudicaule*.

Trait	<i>Ophioglossum costatum</i>	<i>Ophioglossum nudicaule</i>
Plant height	13-19.7 cm.	3.59 ± 0.74 cm.
Rhizome (Diameter/length)	0.6-0.9 cm.	0.42 ± 0.02 cm.
Roots:		
(a) Origin	Basipetal.	Acropetal.
(b) Length	3.8-6 cm.	0.87 ± 0.32 cm.
(c) Distribution	Arising mostly on the circumference of the knob-like rhizome.	Arising on the entire length of the rhizome.
(d) Stolons	Absent (no vegetative propagation by stolons).	Frequently present, arising from the base of rhizome.
Trophophylls (Sterile fronds):		
(a) Origin	Arising from the centre of the cupule of the rhizome.	Arising from the tip of the rhizome.
(b) Number	1-4 (5 rare) per plant.	1-2 per plant.
(c) Shape	Elliptic.	Ovate.
(d) Lamina	4.81 ± 0.7 x 2.14 ± 0.27 cm; spread over the soil surface forming an angle of 40-60° with the fertile segment.	0.70 ± 0.12 x 0.53 ± 0.10 cm; spread over the soil surface forming an angle of 90° with the fertile segment.
(e) Trophophore	About 70–90% of its length subterranean.	Sessile, arising from the base of the substratum as in <i>O. costatum</i> .
(f) Midrib	Present; a band of 3-4 prominent median veins form the midrib.	Absent.
Spike	Length 1.2-2.9 cm, width 0.2-0.25 cm; no sterile tip.	Length 0.78 ± 0.17 cm; sterile tip present.
Sporangia	25-35 pairs per spike.	7-10 pairs per spike.

(After the present study; Yadav & Tripathi 2002; Singh et al. 2009).

O. fibrosum Schumach. in Beskr. Guin. Pl.: 452. 1827; Bedd., Handb. Ferns Brit. India: 465. t.289. 1883; Mahabale in Bull. Bot. Surv. India 4: 71. 1962.

O. wightii Grev. et Hook., Bot. Misc. 3(8): 218. 1833.

O. brevipes Bedd., Ferns South. India: 23, t. 72. 1863.

O. bulbosum Bedd., Handb. Ferns Brit. India, Suppl.: 28. t.72. 1876, non Michx. (1803), nom.illeg.

Diagnosis: Perennial herbs (geophyte) of 13-19.7 cm high; rhizome tuberous, globose (Image 1d), 0.6 to 1 cm diam., with 37-54 lateral, fibrous, radiating or descending, non-proliferous roots arising from the entire periphery of the knob-like rhizome except at the bottom (Images 1c,e); stolons absent. Trophophylls (sterile fronds) 2 or 3, rarely 4 (even 5 c.f. Beddome, loc. cit. ff. 72, 289) or single arising from a crater (pit-like depression); 3-7 x 1-3 cm, green with distinct pale midrib; usually flat, at times folded or concave; ovate or ovate-lanceolate or elliptic, slightly fleshy, broadly cuneate at base; apex acute to obtuse; margin entire or wavy; standing at 40-60° from the ground; trophophore 70–90% of its length subterranean.

Common stipe 0.8-1.8 cm; peduncle 9.1-14.4 cm, fertile segment (strobilus) arising above the middle of the stalk [peduncle] (Images 1a,b); strobilus 1.2-2.9 cm (length) x 0.2-0.25 cm (diam.); green (Image 1f), yellowish when ripe (Image 1g); ratio of common stipe, peduncle and strobilus 1.0:7.5:1.5; sporangia 25-35 pairs per spike; length 0.75-1 mm, with no sterile tip. Spores trilete.

Distribution: (a) Global: Tropical Africa, Madagascar, India to Australia and New Zealand. (b) India: Chattisgarh, Madhya Pradesh, Tamil Nadu (Balakrishnan et al. 1960); Uttar Pradesh, Bihar, West Bengal, Maharashtra and Kerala (Panigrahi & Dixit 1969); found in open grassy forest floors, margins of ditches or hill slopes, next to rock boulders, etc.

Ex Siccate: 13.vii.2010, Osmania University campus, Hyderabad, Andhra Pradesh, India, (17°25'57.7"N & 78°31'47.2"E, 517m), V.S. Raju & M.V. Ramana, 001923 (BSID); 14.viii.2010, Pakhal Wildlife Sanctuary, Warangal District, (17°57'41.5"N & 79°59'00.7"E, 256m altitude); V.S. Raju, A. Ragan & S. Suthari, 1853 (KUH); 06.xii.2002, Chandragiri, Chittoor District, P.A. Lakshmi, 26240 (SKU).



Image 1. *Ophioglossum costatum*
 a - Whole plant (Pakhal); b - Dugout plant (Hyderabad);
 c - Rhizome with roots (note the origin of fronds from a
 depression at the top of the rhizome); d - Roots cut to ex-
 pose the globose nature of the rhizome; e - Rhizome shown
 topsy-turvy to disclose the baldness at the bottom; f & g -
 Strobilus (young and mature); h - Grazed plant.

Note: (i) Plate 2 by Pullaiah et al. (2003) carry the picture of plants of *Ophioglossum nudicaule* from Chandragiri, Chittoor District which clearly pertain to *O. costatum*. Prof. R.R.V. Raju (pers. comm.) confirms the herbarium specimen cited above of the collector at SKU as of *O. costatum*; (ii) Pullaiah et al. (2003) also failed to record the presence of *O. pedunculatum* in

Tuni Hills of East Godavari District of Andhra Pradesh reported by Rao et al. (1999); *O. pedunculatum* Desv. is now treated conspecific with *O. costatum* R.Br.; (iii) The specimens of *O. costatum* from Madhya Pradesh and Chattisgarh were found to be larger bearing long elliptic leaves, etc. (Balakrishnan et al. 1960); (iv) Although *O. costatum* is not in endangered list, its habitats are threatened due to alien plant invasions (by *Hyptis suaveolens*, *Parthenium hysterophorus*, etc.), grazing (Image 1h), etc.

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