

Geodorum laxiflorum (Orchidaceae) relectotypified with a new synonym

Swarnendu Mondal¹, Kasturi Chakraborty², Sayak Chakraborty², Shuvadip Sarkar², Sudipta Sardar², and Avishek Bhattacharjee²

¹M.U.C. Women's College

²Botanical Survey of India

January 30, 2024

Abstract

Geodorum laxiflorum Griff. (Orchidaceae) is relectotypified here by superseding Bhatt & al. (2015) and by designating a CAL-specimen as lectotype of *G. laxiflorum*, as the lectotype designated by Bhatt & al. (2015) for the name is found erroneous. Morphological variations along with an overlooked character of the labellum of this Indian endemic and vulnerable species of orchid are presented based on study of livespecimens collected in the wild for the first time from two Indian states. Further, the name *Eulophia diffusiflora* M.W. Chase, Kumar & Schuit. is synonymised under *G. laxiflorum* until *Eulophia* R. Br. is conserved against *Geodorum* Andrews.

Introduction

The genus *Geodorum* Andrews [Orchidaceae-Epidendroideae-Cymbidieae-Eulophiinae], a genus of terrestrial orchids, is represented by 12 species (Chase et al. 2015; Mabberley 2017) in the world and distributed in Indo-Malayan region and West Pacific (Mabberley 2017). Singh et al. (2019) reported 5 species of *Geodorum* from India and among these *G. laxiflorum* Griff., a 'Vulnerable' species [VU B2ab (i,ii,iii,iv), Bhatt & al., 2015] of the genus, is endemic to India. The species is known to occur in Assam, Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Odisha, Telangana and Maharashtra (Bhoyar et al. 2022). During field surveys in Hualtu Range, Tawi Wildlife Sanctuary, Mizoram, India, two of the authors (SC and Shuv. S) collected a few specimens (vegetative) of a terrestrial orchid in March, 2021 which flowered in the rooftop plant conservatory of the Central National Herbarium (CAL), Botanical Survey of India (BSI), Howrah in June, 2022. Further, one of the authors (SM) collected a few specimens (flowering) of *Geodorum* sp. from Garh Jungle forest of Paschim Bardhaman district of West Bengal, India, in June 2022 and brought the same in live condition to CAL for study and identification. Both the gatherings after detailed study were identified as *G. laxiflorum*, a hitherto unreported species from Mizoram and West Bengal in the wild. While studying the live-specimens we observed significant variations in some floral parts and also observed presence of microscopic cellular hairs on the adaxial surface of labellum which is not being described in most of the published literature. Further, the lectotypification of *G. laxiflorum* by Bhatt & al. (2015) is superseded and a lectotype is designated here for the name in the present treatment. The name *Eulophia diffusiflora* M.W. Chase, Kumar & Schuit. is treated here as a synonym of *G. laxiflorum* as the later has the priority over the former and as on date *E. diffusiflora* is not conserved.

Taxonomic treatment

Geodorum laxiflorum Griff., Calcutta J. Nat. Hist. 5: 356, t. 24. 1845; Hook. f., Fl. Brit. India 6: 18. 1890; Seidenf., Opera Bot. 72: 51. 1983; S. Misra, Orch. Orissa: 560. 2004; Misra, Orch. Orissa Handb.: 180. 2014; M.R. Bhatt et al. Richardiana 15: 335. 2015; Veeranjanyulu et al. Res. Ex. Inter. Multidis. Res. J.

7(7): 38. 2017; A.R. Bhoyar & al., J. Threat. Taxa 14(2): 20689. 2022 – **Lectotype (designated here):** INDIA. ‘HBC’, *Griffith s.n.* (CAL barcode CAL0000055002!, Fig. 2a; collector’s name not mentioned on label, but identified with *handwriting*).

Syntype. – Assam, *Jenkins s.n.* (CAL barcode CAL0000086400!, Fig. 2b).

[?] *Eulophia diffusiflora* M.W. Chase, Kumar & Schuit., Phytotaxa 49(1): 52. 2021, syn. nov.

Description. – Terrestrial herbs, 20–40 cm long or rarely up to 50 cm. Corms or pseudobulbs 2–4 cm long, 1–2 cm thick, oblique, ovoid, slightly compressed, greenish brown, with scars of fallen leaves, borne on a short rhizome. Roots few to many, 2–12 cm long, vermiform. Pseudostem 6–10 cm long, enclosed by 3–4 foliar imbricating sheaths. Leaves 2–5, arising from the basal node of tuber, alternate, lamina ovate-lanceolate to elliptic-lanceolate, 12–36 × 2.5–12 cm, entire, undulate, acute to subacuminate at apex, plicate, many-veined, with long petiolar sheathing base. Inflorescence 14–27 cm long, not exceeding the leaves, lateral, arising from the base of newly developed pseudobulbs; peduncle 11–24 cm long, erect, terete, bearing 3–4 tubular sheaths; sheaths oblong, acuminate at apex, greenish, membranous; rachis 2.5–3 cm long, mostly decurved towards the apex, laxly 6–14 flowered with 2 sterile bracts. Floral bracts oblong to lanceolate, 5–13 × 1.5–2 mm, shorter than pedicel plus ovary, sometimes longer, entire, acuminate at apex, membranous, green, obscurely 3-veined, externally pubescent; pedicel with ovary clavate, 5–10 mm long, green, ridged. Flowers 2–3 cm across, spreading, white, labellum with yellow disc near middle and purplish tinge at apex. Sepals subequal, oblong or oblong-lanceolate, entire, acute, 3–5-veined; dorsal sepal 1.3–2.2 × 0.6–0.7 cm; lateral sepals 1.4–2.4 × 0.7–0.8 cm, often oblique at base. Petals elliptic-obovate to oblong-obovate, broader than sepals, 1.4–2.3 × 0.7–1.2 cm, entire, obtuse at apex, weakly oblique at base, 5-veined. Labellum cymbiform, broadly ovate-cordate while spreading, 1.4–2 × 1–1.7 cm, sessile, ventricose at base, sac pointing backward, margin entire, undulate with erect lateral edges, slightly deflexed and emarginate at apex; disc pale to bright yellowish, often slightly padded, purplish towards apex, base with purplish-brown to creamy white to white short cellular hairs. Column oblong, 5–7 mm long, stout, hairy at base, slightly dilated above; stigma 1-lobed, ovate to dumbbell-shaped, slightly constricted at middle; clinandrium shallow, keeled inside; anther 2-loculed, broadly ovate-orbicular to orbicular-elliptic, 1.5–2.4 × 1.5–3 mm, locules pouch like, white with purplish tinge; pollinia 2, oblong-ovoid, c. 2 × 1.2 mm, deeply porate behind, yellow; caudicles hyaline, 1–1.2 mm long, subquadrate, dilated above; viscidium ovate, 0.4–0.7 mm long, toothed on both side, light yellowish-brown. Capsule 3–4.5 cm long, oblong-ellipsoidal, 6-ridged, drooping.

Flowering & Fruiting. – May–September.

Habitat. – In tropical moist deciduous open forests up to 1200 m elevation.

Distribution. – INDIA: Assam, Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Maharashtra, Mizoram (reported here), Odisha, Telangana, West Bengal (reported here); endemic.

Specimens examined. – INDIA: Assam, *Jenkins s.n.* (CAL, syntype of *G. laxiflorum*). Mizoram, Hualtu Range, Tawi Wildlife Sanctuary, 13.03.2021 (flowered at rooftop plant conservatory of CAL on 24.06.2022), *S. Sarkar & S. Chakraborty* 41667 (CAL). West Bengal, Howrah district, Acharya Jagadish Chandra Bose Indian Botanic Garden (‘HBC’, in cultivation), *Griffith s.n.* (CAL, lectotype of *G. laxiflorum*); Paschim Bardhaman district, Garh Jungle, 08.06.2022, *S. Mondal* 3614A, 3614B (CAL).

Notes. – *Geodorum laxiflorum* is highly variable species. The most significant variation is in the relative length of the floral bract with respect to pedicel plus ovary. Griffith (1845), Bhatt et al. (2015), Veeranjanyulu et al. (2017), Bhoyar et al. (2022) described/ illustrated bracts which were shorter than the pedicel plus ovary. During our study we have observed two kinds of bracts, even in the plants of same subpopulation – i) shorter than the pedicel plus ovary, and ii) longer than the pedicel plus ovary. The length of the bracts varies from 0.5 to 1.3 cm. The shape and size of anther are also significantly variable as the shape is broadly ovate-orbicular to orbicular-elliptic. The size of broadly ovate-orbicular anthers varies from 1.5–2 mm in length and 1.5–1.7 mm in breadth, whereas the size of orbicular-elliptic anthers is from 2–2.4 mm in length and 2.7–3 mm in breadth. The other variable characters in the species are length of the plants, colour of labellum, shape and

size of sepals and petals, size of pollinarium, shape and size of pollinia (Figure 1).

In the protologue of *G. laxiflorum*, Griffith (1845) described the labellum with a patch of purplish, short cellular hairs on the adaxial surface near the base. These hairs are too tiny to be seen properly even with modern dissecting stereo microscope and thus, this character has not been described by the subsequent workers (Seidenfaden 1983; Misra 2004; Misra 2014; Bhatt et al. 2015; Veeranjanyulu et al. 2017; Bhoyar et al. 2022). During our study we observed not only the microscopic cellular hairs near the base of labellum, but also variation in their colour, which range from purplish to purplish-brown to creamy white to white (Figure 1 k1, k2).

Geodorum laxiflorum was first described by William Griffith (Griffith, 1845) based on Major Jenkins's collection from Assam, which flowered in the then Calcutta Botanic Garden (now Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah) in the month of May. Seidenfaden (1983) doubted the existence of any original material, except a "fine drawing by Griffith at K". Misra (2004) followed Seidenfaden (1983) and mentioned the same in his work, though he did not see the Griffith's K-drawing. Bhatt et al. (2015) designated Griffith's drawing at K as lectotype of *Geodorum laxiflorum*. However, Bhatt et al. (2015) did not see the K-drawing which was evident from their citation of the lectotype. Dr Harry Smith, Curator-Botanist, Asia Team, Science Collections, Herbarium, Royal Botanic Gardens, Kew, sent us digital image of the only illustration of this species present at K and mentioned (pers. comm., 12.07.2022) – "the information on the sheet does not unequivocally suggest that it is indeed a drawing by Griffith". We are also in same opinion that the K-drawing (K001535002, Figure 3) was not drawn by Griffith, but it is a copy from the original drawing drawn by M.C. Noble in 1889 and therefore, it is not an original material of *G. laxiflorum* as it postdates the publication of the name. Dr Henry Noltie, Royal Botanic Garden, Edinburgh, informed (pers. comm., 13.10.2022) that the K-drawing is undoubtedly an exact copy of the original Griffith's drawing of CAL. In the 1880s there was a reciprocal exchange, i.e. drawings at CAL were copied for K and drawings at K were copied for CAL, especially of orchids. Dr Noltie also added "The name of the copy-artist is M.C. Noble, but I haven't come across this name and don't know if he/she did the copying at CAL (most likely) or whether the drawings were sent to Kew, copied by an artist there, and then returned to CAL". The writing 'Ic Herb Calcutta' by J.D. Hooker and the writing 'by M.C. Noble 1889' on the K-drawing also confirms that the K-drawing was copied from Griffith's original drawing at CAL. Though we did not found Griffith's original drawing at CAL in spite of thorough search, we found one of the unnoticed type-specimens of *G. laxiflorum* at CAL (CAL0000086400, Figure 2b) which was collected by Jenkins from Assam and was mixed with other Orchid-specimens at the general herbarium of CAL. Though the flowers of the CAL-specimen are in bud condition, but undoubtedly it is one of the original materials of *G. laxiflorum*. Griffith (1845) mentioned that Jenkins's collected plants from Assam flowered later in May, and thus it is natural that the CAL-specimen was in bud condition when mounted. While describing *G. laxiflorum*, Griffith (1845) compared it with *G. dilatatum* R. Br. [= *Geodorum recurvum* (Roxb.) Alston] and distinguished it from *G. dilatatum* in having thinly flowered spike, broad petals, and the round cochleariform entire labellum, which when spread out is of a cordate shape. *Geodorum laxiflorum* is also morphologically similar to *G. densiflorum* (Lam.) Schltr., but can be readily distinguished from the later in having much shorter inflorescence, i.e. inflorescence not exceeding the leaves, absence of longitudinal, irregular, yellow to whitish callus on disc of labellum (but often slightly padded), and the labellum lacking crimson-purple venation and streaks below the disc. In *G. densiflorum* the inflorescence usually exceeds the leaves, the disc of labellum with low but prominent, longitudinal, irregular (2-many dentate), yellow to whitish callus, and the labellum with crimson-purple venation and streaks below the disc. Further, the inflorescence of *G. laxiflorum* is often comparatively less flowered, lax and flowers are more open than that of *G. densiflorum*. We have traced out another interesting specimen at CAL (CAL0000055002, Figure 2a) with Griffith's annotation ('HBC', i.e. Hortus Botanicus Calcuttensis) which was identified by Griffith as '*Geodorum laxiflorum*'. This CAL-specimen is also with an inflorescence not exceeding the leaves and moreover, the flowers are much open and in completely blooming condition. This specimen also belongs to one of the original materials of *G. laxiflorum* as Griffith (1845) mentioned that Jenkins's Assam-plants flowered in the Calcutta Botanic Garden. However, the other data written on the herbarium-label are not readable due to the damage of the

label in the lower part, and due to unreadability of the date/ month/ year of collection. In December 1844 Griffith sailed for Malacca from India for the second time and could not return to India as he was seized with a fatal illness and died on 9 February 1845 in Malacca. Therefore, it is obvious that this CAL-specimen (CAL0000055002) annotated by Griffith predates the publication of *G. laxiflorum* and part of the original material of the name. Interestingly, this CAL-specimen (CAL0000055002) is very much matching with the K-drawing of *G. laxiflorum* (especially with respect to two apical leaves, inflorescence and flowers) which was copied from Griffith's original drawing at CAL (presently not traceable). The other existing original material of the name is the illustration [Icon Griffith (*Geodorum laxiflorum*) , Calcutta J. Nat. Hist. 5: Pl. XXIV, tt. 1–7. 1845] published by Griffith (1845) in the protologue. Among the all available original materials of *G. laxiflorum* , the CAL-specimen 'CAL0000055002' is the most suitable choice for lectotypification as the diagnostic characters of *G. laxiflorum* are more evident in this specimen. Hence, we are superseding the lectotypification by Bhatt et al. (2015) in accordance with Art. 9.19 of the ICN (Turland et al. 2018) and designating the CAL-specimen (CAL0000055002) as lectotype of *G. laxiflorum* according to Art. 9.3, 9.12 of the ICN (Turland et al. 2018) as it has precedence over the illustration published in the protologue. It is worth mentioning that another name under the genus, viz. *G. rariflorum* Lindl. [= *G. densiflorum* (Lam.) Schltr.], was also based on Jenkins's collection from Assam, i.e. specimen with same label-data ('Assam, Jenkins'). However, the types of *G. laxiflorum* (CAL!) and of *G. densiflorum* (K!) are taxonomically different.

Chase et al. (2021a) recently reduced *Geodorum* under *Eulophia* R. Br. based on phylogenetic study and subsequently proposed (Chase et al., 2021b) to conserve *Eulophia* over *Geodorum*. Chase et al. (2021a) treated *Geodorum laxiflorum* Griff. under *Eulophia* as *E. diffusiflora* M.W. Chase, Kumar & Schuit. (replacement name). However, treating *Eulophia* as a conserved name over *Geodorum* is subject to acceptance the proposal in the XX International Botanical Congress to be held in Madrid, Spain in 2024 and therefore, *Geodorum* must be treated as correct name at present due to priority. Hence, *E. diffusiflora* M. W. Chase, Kumar & Schuit. is treated here as a homotypic synonym of *G. laxiflorum* Griff. until *Eulophia* is conserved against *Geodorum* .

Acknowledgements

The authors are thankful to the Director, Botanical Survey of India (BSI), Kolkata and the Head of Office, Central National Herbarium, Botanical Survey of India, Howrah for facilities and encouragement. The first author is grateful to Mr Mangal Hembram of Banagram, near Garh jungle, West Bengal, for help in field survey. Two of the authors (SS and SC) thankfully acknowledge the Ministry of Environment, Forests and Climate Change, New Delhi for financial assistance to the project 'Systematics and conservation of Indian orchids with special emphasis to Himalayan species' under Himalayan Research Fellowship scheme of National Mission on Himalayan Studies. Dr Harry Smith, Curator-Botanist, Asia Team, Science Collections, Herbarium, Royal Botanic Gardens, Kew, is thankfully acknowledged for sending digital image of the K-drawing (K001535002) and type-image of *G. rariflorum* (K), and Dr Henry Noltie, Royal Botanic Garden, Edinburgh, for his useful comments. The authors are thankful to Dr Dinesh Kumar Agrawala, Scientist E, BSI for providing an important literature and to Dr Subir Bandyopadhyay, retired Scientist, BSI for his useful comments.

References

- Bhatt, M. R., Jalal, J. S. & Nagar, P. S. 2015. Extended distribution of *Geodorum laxiflorum* (Orchidaceae) in Gujarat, India. *Richardiana* 15: 333–341.
- Bhoyar, A. R., Nandgawe, S., Ahmed, S. A. & Madavi, S. 2022. *Geodorum laxiflorum* Griff. (Orchidaceae), a new distribution record for Maharashtra state of India. *J. Threat. Taxa* 14(2): 20689–20691. <https://doi.org/10.11609/jott.7643.14.2.20689-20691>
- Chase, M. W., Schuitman, A. & Kumar, P. 2021a. Expansion of the orchid genus *Eulophia* (Eulophiinae; Epidendroideae) to include *Acrolophia*, *Cymbidiella*, *Eulophiella*, *Geodorum*, *Oeceoclades* and *Paralophia*. *Phytotaxa* 491 (1): 047–056.

- Chase, M. W., Christenhusz, M. J. M., Kumar, P. & Schuiteman, A. 2021b. (2805) Proposal to conserve *Eulophia*, nom. cons., against the additional name *Geodorum* (Orchidaceae: Eulophiinae). *Taxon* 70 (2): 432–433.
- Chase, M. W., Cameron, K. M., Freudenstein, J. V., Pridgeon, A. M., Salazar, G., Van Den Berg, C. & Schuiteman, A. 2015. An updated classification of Orchidaceae. *Bot. J. Linn. Soc.* 177: 151–174.
- Griffith, W. 1845. On some plants in the H.C. Botanic Gardens. *Calcutta J. Nat. Hist.* 5: 355–373.
- Hooker, J. D. 1890. Orchidaceae. Pp. 1–198 in *The Flora of British India*, vol. 6. London: L. Reeve & Co.
- Mabberley, D. J. 2017. *Mabberley's Plant Book – A portable dictionary of plants, their classification and uses* (ed. 4). Cambridge: Cambridge University Press.
- Misra, S. 2004. *Orchids of Orissa*. Dehra Dun: Bishen Singh Mahendra Pal Singh.
- Seidenfaden, G. 1883. Orchid genera in Thailand XI. Cymbidieae Pfitz. *Opera Bot.* 72: 1–124.
- Singh, S. K., Agarwala, D. K., Jalal, J. S., Dash, S. S., Mao, A. A. & Singh, P. 2019. *Orchids of India- a pictorial guide*. Kolkata: Botanical Survey of India.
- Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W. H., Li, D-Z., Marhold, K., et al. editors. 2018. *International Code of Nomenclature for algae, fungi and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017*. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books.
- Veeranjaneyulu, D., Ram Mohan, M., Ravikanth, M., Jyothi, K., Suneela M., & Kalyan Chakravarthy. B. 2017. *Geodorum laxiflorum* Griff. (Orchidaceae), a new Distributional record Telangana state, a endemic species in India. *Res. Exp. Int. Multidis. Res. J.* 7(7). 36-39.

Figure legends

Fig. 1: Morphological variations in *Geodorum laxiflorum* Griff.: Habit (a1) (a2), Flowers with bracts (b1) (b2), Bracts (c1) (c2), Labellum (d1) (d2), Dorsal sepal (ventral view) (e1) (e2), Petal (ventral view) (f1) (f2), Lateral sepal (ventral view) (g1) (g2), Anther (ventral view) (h1) (h2), Anther (dorsal view) (i1) (i2), Pollinarium (j1) (j2), Portion of adaxial surface of labellum showing cellular hairs under compound microscope (k1) (k2). Source: a1–k1, *S. Mondal* 3614A (CAL); a2–k2, *S. Mondal* 3614B (CAL).

Fig. 2: *Geodorum laxiflorum* Griff.: a. Designated lectotype (CAL0000055002; (c) Director, Botanical Survey of India; Kolkata); Residual syntype (CAL0000086400; (c) Director, Botanical Survey of India; Kolkata).

Fig. 3: *Geodorum laxiflorum* Griff.: A facsimile of the original CAL-drawing by M.C. Noble preserved at K (K001535002; (c) Board of Trustees of the Royal Botanic Gardens, Kew).





