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SHORT COMMUNICATION

A NEW RECORD OF AN ENDANGERED AND ENDEMIC RARE REIN ORCHID *HABENARIA RARIFLORA* FROM GUJARAT, INDIA

Mital R. Bhatt

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A new record of an endangered and endemic rare Rein Orchid *Habenaria rariflora* from Gujarat, India

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Abstract: *Habenaria rariflora* A.Rich., a species endemic to the southern and western parts of India, is reported for the first time from Gujarat State, western India. A detailed description and photographs are provided here for easy recognition in the field. Further, morphology, distribution, habitat, ecology, anatomy of leaf, rarity index, and conservation status of the species are provided.

Keywords: Anatomy, conservation, rarity Index, taxonomy.

The genus *Habenaria*, belonging to the family Orchidaceae, subfamily Orchidoideae, tribe Orchideae, and subtribe Orchidiinae was described by Willdenow (1805). The generic name is derived from the Latin word “*habena*” means ‘a strap, holder, or rein’, probably attributed to the thread-like fringes of the lip in the flowers. It is one of the largest terrestrial orchid genera with c. 885 species worldwide (Govaerts et al. 2020). *Habenaria* species are distributed in both the New and Old World tropics and subtropics, with a few species in temperate areas, particularly in eastern India (Pridgeon et al. 2001). The genus is terrestrial, characterised by undivided tubers, spurred lip, short column, small & minute caudicle & viscidium, and long & free stigma drawn out at the entrance of spur (King & Pantling 1898; Pridgeon et al. 2001; Dangat 2015). *Habenaria* is represented by c. 62 species in India (Singh et al. 2019).

So far, six species have been recorded from Gujarat, making it the largest terrestrial genus of the family for the state (Shah 1978; Anonymous 1996). During the orchid survey, a remarkable species of *Habenaria* was collected from Chinchali Village of Dang District. Various morphological characters of this species did not match with the previously documented species from Gujarat State (Suryanarayana 1968; Desai 1976; Shah 1978, 1983; Vora 1980; Raghavan et al. 1981; Reddy 1987; Bole & Pathak 1988; Anonymous 1996; Tadvii 2014). Hence, the systematic treatment of this taxon along with a detailed description, morphology, anatomy, photographs, ecological notes, rarity index, and conservation status has been provided here.

MATERIALS AND METHODS

Field survey and collection

In the course of ongoing taxonomic studies on the family Orchidaceae in Gujarat State, an interesting but unknown species of *Habenaria* was collected from Chinchali Village of the Dang District in September 2017. The district is located in the southeastern part of Gujarat and is part of the Western Ghats. It lies between 20.561–21.086N & 73.466–73.943E. The species was collected during the flowering stage and was photographed in its

Editor: Anonymity requested.

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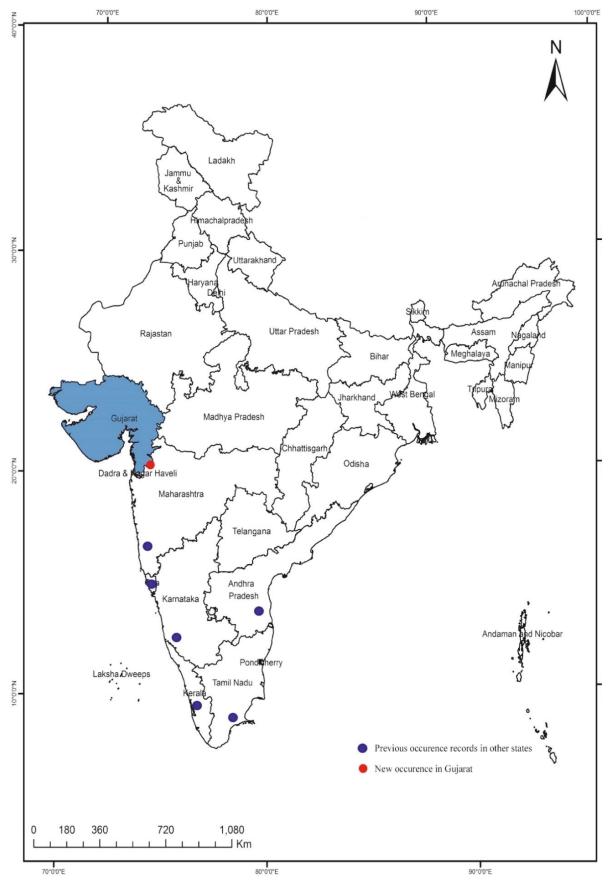


Figure 1. Distribution of *Habenaria rariflora* in India.

natural habitat as well as in the laboratory using various digital cameras (Nikon Coolpix P600, Nikon 5300). Details on habit, habitat, flowering, and fruiting period were recorded at the time of collection.

Herbarium preparation and identification

The species was studied for its gross morphological characters during the collection and critically examined under stereo zoom microscope for its detailed taxonomic identification. After a meticulous examination of its morphology and perusal of the relevant literature, the species was identified as *Habenaria rariflora* A. Rich. (Hooker 1890; Santapau & Kapadia 1964; Abraham & Vatsala 1981; Misra 2007). The description of vegetative and reproductive characters is based on live plants. All the representative parts for identification of orchids were collected and used for herbarium preparation. The prepared herbarium specimens were deposited at the Herbarium of The Maharaja Sayajirao University of Baroda (BARO) and Botanical Survey of India, Arid Zone Regional Centre, Jodhpur (BSJO).

Anatomical study

The matured and fresh young leaf samples of *H. rariflora* were fixed in FAA (Formaldehyde: acetic acid: ethanol 10: 5: 50, v/v/v) for preservation (Berlyn et al. 1976). The fixed samples were dehydrated with a graded series of TBA and processed for paraffin embedding (Johansen 1940; Ruzin 1999). Transverse sections of 15–20 µm thickness were taken using Leica rotary microtome (Leica RM 2035). The sections were stained with Safranin-Astra blue stain combination and mounted with DPX for permanent slide. The permanently mounted sectors on slides were observed and all the important features were photographed using a Leica DM1200 microscope coupled to an image capture system.

Rarity status analysis

Rarity index was calculated to assign a status to the species at the regional level (Jalal 2012). A statistical formula was developed considering five quantification parameters (Table 1). The rarity value of the species depends on all the five quantifiable parameters as mentioned in the below formula. The data were entered into an excel spreadsheet and summarized using descriptive statistics.

$$R = \frac{h^1 + s^1 + p^1 + p^2 + p^3}{5}$$

Where, h^1 = a number of habitats, s^1 = a number of sites in Gujarat, p^1 = distribution in India, p^2 = phytogeographical distribution within the Indian subcontinent, p^3 = phytogeographical distribution globally.

The scale of rarity index ranges from 1 to 5. Rarity ranking (Very Rare: 0.5–1; Sparse: 1.1–2; Occasional 2.1–3; Common: >3).

RESULTS

Taxonomic treatment

Habenaria rariflora A. Rich. in Ann. Sci. Nat., Bot. ser. 2, 15: 70, t. 2D. 1841; Hook.f., Fl. Brit. India 6: 136. 1890; T. Cooke, Fl. Bombay 2: 716. 1907; Santapau and Kapadia, Orchids Bombay 15, t. 3, f. 9, 10. 1966; Abraham & Vatsala, Introd. Orchids 216. 1981; Lakshmin. in B.D. Sharma et al., Fl. Maharashtra 2: 43. 1996.

Lithophytic or terrestrial herb, 13.0–15.0 cm high with inflorescence. Tubers 1 or 2, small, ovoid or oblong. Leaves 3.0–5.0 × 1.1–1.8 cm, radical, oblong to lanceolate, broadly oblong, ovate to elliptic, or even ovate. Inflorescence 10–12 cm long, 1–4-flowered terminal racemes. Flowers 2.0–2.5 cm long, white,



Image 1. *Habenaria rariflora* A. Rich. a—habit | b—front view of flower | c—side view of flower. © Vinod Gosavi

pedicellate, bracteate. Bracts 1.9–2.2 × 0.7–0.8 cm, ovate to lanceolate, acute. Pedicel with ovary c 4.0 cm long. Sepals subequal, subacute; dorsal sepal c 1.0 × 0.6–7.0 cm, broadly ovate; lateral sepals c 1.1 × 0.6 cm, obliquely ovate, spreading, apical portions slightly decurved. Petals 2-partite; upper segment 0.8–1.0 × 0.4–0.6 cm, obliquely triangular–ovate; lower segment 1.0–1.3 cm long, filiform, acute. Lip c 1.5 cm long, tripartite from a little below middle; lateral segments scarcely 0.8–1.0 cm long, filiform or narrowly linear to subulate; mid segment 0.8–0.9 × 0.2 cm, linear, subobtuse. Spur 4.5–4.6 cm long, curved, white. Column c 0.5 × 0.3 cm, oblong, rounded, greenish-white. Pollinia yellow, ovoid to oblong, caudicle slender. Capsules 2.0–3.0 cm long, strongly ribbed, beaked (Image 1).

Specimen Examined: 0208 (BSJO), 10.ix.2017, Chinchali ((20.749N & 73.933E, 1,000m), Ahwa, Dangs,

Gujarat, India, coll. Mital R. Bhatt (Image 2).

Phenology: August (flowering) and September–October (fruiting).

Distribution: This endemic species is reported to occur in Andhra Pradesh, Goa, Gujarat (present report), Karnataka, Kerala, Maharashtra, and Tamil Nadu (Figure 1).

Habitat and Ecology: The habitat is dominated by tropical moist deciduous vegetation with an average rainfall of 2,000 mm. The species was found growing on vertical rocks and old walls along with grasses up to an elevation of 1,000 m.

Only a few individuals were located from the site.

Anatomical study

In the transverse section, the leaf shows a crescent shape with a minor abaxial groove in the middle section.

Table 1. Quantification parameters of rarity (Jalal 2012).

	Parameters	Documentation	Scoring (Quantification)
1	Number of habitats (h ¹)	A number of habitats in which each orchid species found were recorded.	Three habitats depending on how many habitats, a particular orchid occurred in.
2	Number of sites (s ¹)	A number of sites in which each orchid found were recorded.	"1" for single site; "2" for < 5 sites; "3" for < 10 sites; "4" for < 15 sites and "5" for > 15 sites.
3	Distribution in India (p ¹)	Divided into six divisions 1. Andaman & Nicobar Islands 2. Northeastern India 3. Western Himalaya 4. Western Ghats 5. Eastern Ghats 6. Central India	1 to 4 divisions depending on the occurrence of species in a particular division.
4	Phytogeographical distribution (p ²)	Indian subcontinent (Bangladesh, Bhutan, Nepal, Pakistan, Sri Lanka)	Depending on how many species are spread in a particular region.
5	Phytogeographical distribution (p ³)	Europe, Sino-Japan, China, Indo-Malaya, Africa, Australia, and North & South America	Depending on how many species are spread in a particular region.



HERBARIUM UNIVERSITATIS BARODENSIS (BARO)
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA,
VADODARA-390002, GUJARAT, INDIA

Flora of: Gujarat
Coll. No. MB 206 Date 28-01-2017
Family: Orchidaceae
Genus: Habenaria
Species: rariflora
Vernacular Name _____
Locality: Chikhali
District: Dang
Lat. & Long _____
Elevation _____ Frequency _____
Notes: Lithophyte on rocky slopes along with grasses
Collected By: M. J. R. Bhatt
Identified By: M. J. R. Bhatt

MR BHAT

Image 2. Herbarium sheet of *Habenaria rariflora* A. Rich.

The cuticle is thin and smooth followed by epidermis, ground tissues and vasculature (Image 3a). The leaf shows a single-layered epidermis with thin-walled cells. The abaxial epidermal layer is interrupted by superficial

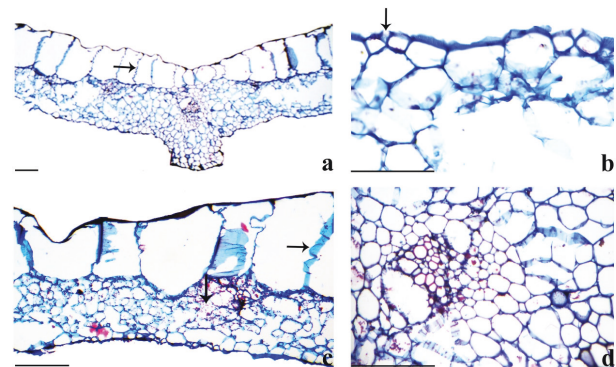


Image 3. Photomicrographs of a sector of leaf blade of *H. rariflora*: a—transverse section | b—hypostomatic stomata showing cuticular projection and sub-stomatal cavity | c—starch grains and undulating anticlinal walls of adaxial epidermis | d—midvein vascular bundle. Scale bars = 100µm.

stomata (hypostomatic) having a cuticular extension and sub-stomatal cavity (Image 3b). Adaxial cells are usually larger than abaxial ones occupying half the volume of leaf (Image 3a,c). The anticlinal walls of adaxial cells are undulating (Image 3c). The outer cell wall is thicker compared to other cell walls which are generally flat to slightly round. Hypodermis and fibre bundles are absent in this species. The mesophyll layer comprises homogenous, thin-walled parenchymatous cells. It is 4–6 cells wide with comparatively smaller intercellular spaces. Raphide bundles are absent. Starch grains are the most common cellular inclusion (Image 3c). Vascular bundles are conjoint, collateral and closed with a larger one in the midrib and smaller in the side vein region. They are arranged in a single series across the blade. The vascular sclerenchyma is absent (Image 3a, d).

Identification Key to the *Habenaria* of Gujarat

- 1a. Petals divided 2
 2a. Plants with inflorescence up to 45cm tall, leaves spreading all along the stem, flowers greenish white *H. gibsonii*
 2b. Plants with inflorescence up to 12–55 cm tall, leaves radical, flowers white 3
 3a. Leaf solitary or occasionally two, cordate, appressed to the ground *H. grandifloriformis*
 3b. Leaves few, oblong-lanceolate, not appressed to the ground *H. rariflora*
 1b. Petals undivided 4
 4a. Flowers white 5
 5a. Plants reaching up to 45cm height, leaves 1–5, radical, spur equal to the length of ovary *H. plantaginea*
 5b. Plants reaching up to 80–120 cm height, leaves many, cauline, neither spreading nor flat on the ground, spur much longer than the length of ovary *H. longicorniculata*
 4b. Flowers green or yellow 6
 6a. Leaves radical, clustered at base of stem, with narrow pale yellow margins, flowers yellow, spur geniculate, clavate at apex *H. marginata*
 6b. Leaves clustered about middle of the stem, not margined, spur linear, incurved *H. furcifera*

Rarity status

As per the present study and rarity status analysis, the species is considered as very rare as the rarity index value is 0.8 and the species is located only from the single locality.

Conservation status

Habenaria rariflora is an endemic terrestrial orchid of peninsular India. Based on the current survey and literature study it is revealed that the species is reported from seven different states of India (Figure 1). In the present study, only a few individuals were located from Chinchali Village of Dangs District in Gujarat State. The particular site is prone to soil erosion due to agricultural invasion and grazing. The ex situ conservation for this species have been made at Wagahi Botanical Garden, Dangs and Maharaja Sayajirao University of Baroda, Vadodara. The species has not been evaluated for its threat status till date.

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