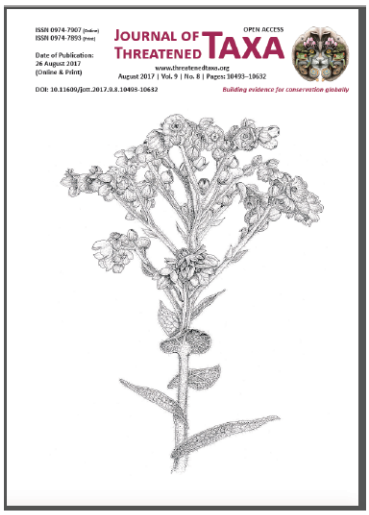

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## Note

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# Additional record and conservation measures of *Ceropegia odorata* Nimmo ex J. Graham from Gujarat State, India

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Sabarkantha District is situated in the northeastern part of Gujarat State between 23.05000000–24.50000000 N & 72.71666667–73.65000000 E; has a rich floristic diversity and is well explored by various plant taxonomists. During our intensive botanical explorations in various parts of Vijaynagar forest in Sabarkantha District, seven individuals of *Ceropegia* sp. were recorded by the SKP (senior author), growing amongst grasses on slopes. Specimens were collected and properly processed for the herbarium by using standard herbarium methods recommended by Jain & Rao (1977). After critical examination of dissected floral parts, other morphological features and perusal of relevant literature available, the specimens were identified as *Ceropegia odorata* Nimmo ex J. Graham (Ansari 1984; Jagtap & Singh 1999). This species has not been recorded or documented in many significant floristic contributions pertaining to Gujarat (Cooke 1901–1908; Blatter 1908-1909; Saxton & Sedgwik 1918; Saxton 1922; Thaker 1926; Santapau 1962; Yogi 1970; Raghavan et al. 1981; Bole & Pathak 1988; Pilo et al. 1996; Pandey & Singh 1999; Singh & Parabia 2003; Meena & Pandey 2004; Meena 2012; Parmar 2012; Patel 2013). It was reported as a new record to the flora of Gujarat from only one locality (i.e., Pavagadh Hills in Panchmahal District) by Sabnis & Bedi (1971) and that is the only documented evidence about its occurrence in Gujarat; however, several explorations made from time to time by field botanists from different academic and research institutions (Punjani 1997; Patel 2003, 2013; Pandey 2011; Meena 2012; Parmar 2012; Desai 2013) could not re-collect this taxon from Pavagadh. Its occurrence in Pavagadh, therefore, was doubtful or the species may have become locally extinct from the state (Singh et al. 2014). Hence, this is the first record of this species as a new distribution and range extension record to the flora of Gujarat. The distribution records for the species is from Mount Abu in Rajasthan (Ansari 1984), Maharashtra (Jagtap et al. 2004; Yadav & Kamble 2008; Singh et al. 2014) and Madhya Pradesh (Mujaffar et al. 2015). The distribution and current localities of *Ceropegia odorata* Nimmo ex J. Graham in India is depicted in Fig. 1. A voucher specimen (SKP-427) is deposited at the Government Science College, Gandhinagar, Gujarat. In addition, a brief description along with photos is provided to facilitate easy identification of the species in the wild.

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***Ceropegia odorata***
**(Image 1 a–g)**

Nimmo ex Hook.f., Fl. Brit. India 4: 75. 1883; Santapau & Irani, Univ. Bombay Bot. Mem. 4: 29. 1962; Sabnis & Bedi, in Kew Bull. 25: 57–60. 1971; Shah, Fl. Gujarat State 1: 424. 1978; Ansari, Fasc. Fl. India 16: 26. 1984; Jagtap & Singh, Fasc. Fl. India 24. 1999; Karthikeyan et al., Flowering Plants of India: Dicotyledons 1: 163. 2009. *C. blatteri* McCann in J. Bomb. Nat. Hist. Soc. 45: 210. 1945.

Large twining tuberous herbs or twiners. Stems usually glabrous, sometimes sparsely pubescent, branches reaching nearly 1–3 meter. Leaves opposite, 12–26 x 1.7–3.6 cm; petioles 1–1.2 cm long, glabrous; blades linear-lanceolate or lanceolate-narrowly ovate, acuminate at apex, hairy, rounded or acute at base, ciliate along margins, usually puberulous above and along the nerves beneath, sometimes glabrous on both surfaces; nerves prominent beneath. Juvenile plants show three leaves at each node while they are opposite in mature plants. Inflorescences in axillary, 9–20 flowered umbellate cymes; peduncles 2.2–5.5 cm long, hirsute, greenish-yellow and sometimes with a purplish tinge. Flowers fragrant, pale yellow/yellowish-green, 3-4 cm long, bracteate; pedicels 0.3–0.4 cm long, usually glabrous, rarely pubescent; bracts 0.5–1 cm long, linear. Calyx up to 0.5cm long, five pertite, linear, acuminate, glabrous. Corolla tubular, 3–3.5 cm long, pale yellow/yellowish-green, sometimes with purplish tinge on tube; tube 1.5–4 cm long, inflated at base; lobes 1.5–3 cm long, equal or shorter than tube; outer corona of five entire lobes, glabrous; inner corona linear-oblong, erect, divergent at apex. Follicles in pairs, up to 13.5cm long, erect, tapering at both ends, glabrous.

**Type:** India: Maharashtra; Concan (Konkan), Salsette island (Bombay) Stocks in Stocks & Law, 239 (K, Lectotype)

**Specimen examined:** SKP-427, 13.ix.2016, village Zer (23.89136111 N & 73.23666667 E, 488m), Vijaynagar forest area, Sabarkantha District, Gujarat, India, coll. S.K. Patel, Government Science College, Gandhinagar, Gujarat (Image 2).

**Vernacular name: '**Kundher', 'Kundhar', 'Vahodiyo',

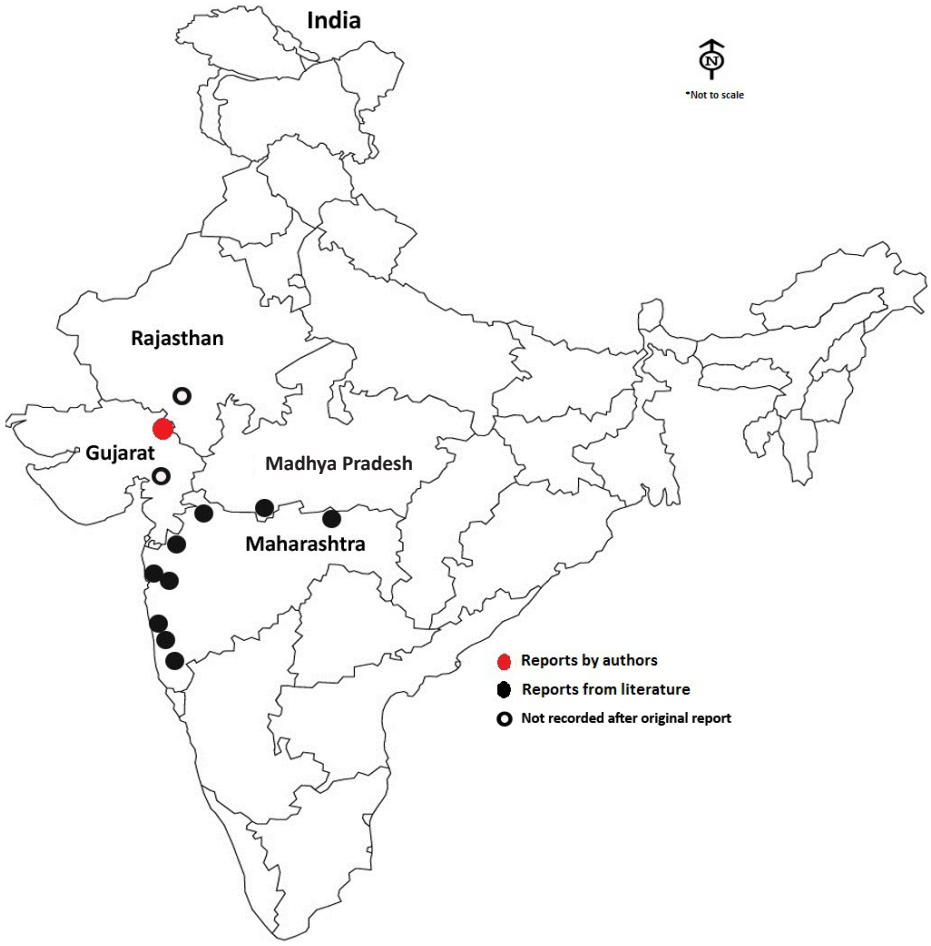


**Figure 1. Location map of *Ceropegia odorata* Nimmo ex J. Graham in India.**


**Image 1. *Ceropegia odorata* Nimmo ex J. Graham**
**a - tuber; b - habit; c - flower in full bloom; d - inflorescence; e - measurement of flower; f - (i) single flower, (ii) L.S. of flower; g - follicles**

'Vansadiyo', 'Khaloro'

**Synonyms:** *Ceropegia blatteri* McCann

**Status:** Highly threatened (proposed as Critically Endangered by Singh et al. 2014)

**Flowering:** August–September

**Fruiting:** October–November

**Distribution in India**: Endemic to western India; Gujarat (Pavagadh Hill; Panchamahal District), Rajasthan (Mount Abu, Sirohi District), and Maharashtra. At present, no individual is reported from Pavagadh Hill and from Mount Abu. Previously only five localities in Maharashtra, viz., Bhoste Ghat, Borivali, Hativale, Matvan, Toranmal and Melghat were recorded but recently two more localities in Madhya Pradesh and Gujarat (Sabarkantha District, northern Gujarat) are added.

**Parts used:** As discussed with tribal people of the area, edible tubers of the plant species along with other similar plants (locally called Kundher) have been consumed before the onset of flowering for more than 50 years.

**Habitat:** This species grows in dense forest areas with rocky slopes along with grasses and bushes in loamy, mixed gravelly soils. The slope falls to a deep valley on its western side with slightly hilly undulating macro-habitat. The habitat is predominantly covered by tree species mixed with grasses and herbs.

**Threats:** Our observations showed that anthropogenic disturbances, removal of edible tubers, over grazing, destruction of forests, habitat loss due to soil erosion or land slides are the major threats. Among all these threats, removal of tubers for food is the major threat.

**Present status in India:** It is sparsely distributed (Yadav & Kamble 2008). Based on assessment and field observations from 2007 to 2013, Singh et al.

(2014) propose *Ceropegia odorata* under the Critically Endangered category [B2b (i,ii,iii,v)c(i,ii,iv)].

**Field Notes:** Only seven individuals were recorded from the present locality, with only one individual reaching fruiting stage during our field observations from 2013–2016. Hence, it is necessary to conduct long-term ecological monitoring studies with pollination biology to understand the pollinators and barriers. Surveyed areas are classified under dry deciduous forest dominated by trees such as *Wrightia tinctoria* R.Br., *Tectona grandis* L.f., *Anogeissus latifolius* (Roxb. ex DC.) Wall. ex Guillem & Perr. and *Diospyros melanoxylon* Roxb.. Several other plant species are predominantly associated with recorded individuals include *Apluda mutica* L., *Capillipedium huegelii* (Hack.) Camus, *Setaria pumila* (Poir.) Roem. & Schult., *Crotalaria triquetra* Dalz., *Exacum* sp., *Tricholepis glaberrima* DC., *Dendrocalamus strictus* (Roxb.) Nees and *Tylophora fasciculata* Buch.-Ham. ex Wight.

## Conservation Recommendations

Several tribal communities of these areas eat tubers of this plant during the initial emergence of a shoot from the tubers; hence awareness among selected groups of local villagers is suggested as an immediate requirement.

As a part of in situ conservation, anthropogenic disturbances should be minimised to safeguard the extant miniature population, by fencing off approximately 1km$^2$ area with participatory approach.

Since tubers of this plant species are used as a nutritional supplement, a special program on species multiplication through tissue culture technique is recommended. In addition, the fruit and seed setting in the species, makes it a suitable species for tissue culture and re-introduction of the species in the wild.

Digging out tubers by local tribes needs to be banned completely with the help of the Forest Department and general awareness should be created towards long-term sustainable utilization and conservation.

For more participatory conservation, IEC (information, education and communication) material should be developed in the local language, mobilizing forest frontline staff towards the importance and rarity of this species in the state.

With the help of Biodiversity Management Committee (BMC) of the local village Panchayat under the Biological Diversity Act (BDA), 2002 and respective Forest Range Offices, nurseries must be developed as soon as possible, very close to prime habitats of the species. In addition, the Gujarat Biodiversity Board (GBB), Gandhinagar must give encouragement to protect the microhabitat of the plant species as part of the Seed Conservation Areas (SCA).

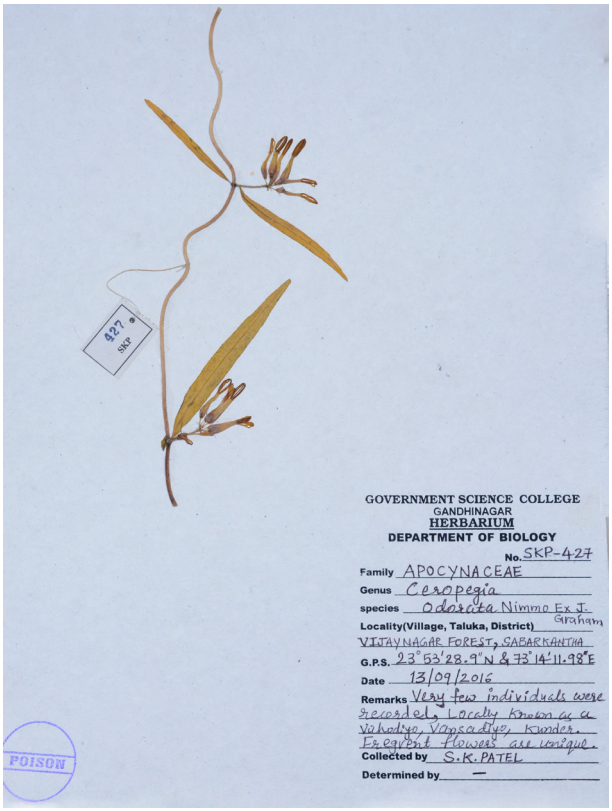


**Image 2. Herbarium sheet of *Ceropegia odorata* (SKP-427)**

As part of long-term ecological study of this plant species, systematic grid samplings of the entire recorded locality should be suggested with maintaining proper landscape level climatic and microhabitat data.

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