

Figure 3. *a*, Habit; *b*, Flower; *c*, Dissected flower; *d*, Corona; *e*, Pollinarium; *f*, Follicle and *g*, Seed.

2. Corolla lobes and outer corona glabrous *C. noorjahaniae*
3. Corolla lobes shorter than corolla tube 4
3. Corolla lobes as long as or longer than corolla tube 5
4. Corolla lobes forming long beak *C. mahabalei*
4. Corolla lobes forming ampulliform head *C. mohanramii*
5. Corolla lobes with dark brown spot on either side in basal portion *C. anantii*
5. Corolla lobes otherwise 6
6. Corolla lobes with club-shaped hairs *C. spiralis*
6. Corolla lobes with simple hairs 7

7. Flowers up to 7.5 cm long with attenuate head *C. attenuata*
7. Flowers up to 3.5 cm long with obovate head *C. anjanerica*

Series *Attenuatae* is now represented by eight species in India and their distribution is shown in Figure 1. *Ceropegia spiralis* (Figure 2g) is sporadically distributed in South India and recorded from Balghat hills near Chennai, Bangalore, Cuddapah district in Andhra Pradesh and Gokak in Belgaum district, Karnataka. *Ceropegia fimbriifera*⁶ restricted to hills in South India grows at higher altitudes and is known to occur at Anamallai, Coimbatore, Hassan, Kolar, Mysore, Nilgiri, Salem and Shevoroy. The remaining six species are found in Central and northern western Ghats. *C. attenuata* (Figure 2c) is found growing at lower altitudes from Mumbai to Udipi and located at Bhatkal, Borivali National Park, Deogad, Karwar, Kasara, Khandala, Malwan, Matheran, Mumbai, Trombay, Vaibhavwadi and Vengurla, and shows significant diversity in flower size, shape and colour patterns. It is also reported from Galta area of Jaipur district, Rajasthan⁷. *C. noorjahaniae* (Figure 2f) is reported from Pasarni Ghat between Wai and Panchagani, Karthikswami, Khambatki Ghat and Jarandeshwar hills of Satara district. This species is recently collected from Melghat area of Amravati district, Maharashtra. *C. mahabalei* (Figure 2d) is restricted to hills around Junnar tahsil of Pune and Kasara of Thane district. *C. anantii* (Figure 2a) is so far known from hills around Salva and Phonda in Konkan. *C. mohanramii* (Figure 2e) is so far collected from only one location on lateritic plateau at Kochra in Sindhudurga district. *C. anjanerica* sp. nov.

(Figure 2b), similar to *C. attenuata*, is collected from Anjaneri hill near Nashik.

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A new variety of *Ceropegia oculata* Hook. (Apocynaceae: Asclepiadoideae) from Satpuda hill ranges of Maharashtra, India

Ceropegia L. included within-tribe Ceropegieae Decne. ex Orb. and subtribe Stapeliinae G. Don¹, comprising some 200 species which are distributed from southern Africa around the perimeter of the Indian Ocean to Australia² or 160 species distributed in Arabia, warm Africa, including Canary Island, Asia to Australia³. Ansari⁴ in his treatise on Indian *Cero-*

pegia described 44 species, of which 28 are endemic to India. Jagtap and Singh⁵ reported 45 species and three varieties from India. Subsequently, Sreekumar *et al.*⁶ and Yadav *et al.*⁷ added new species each from the Andaman Islands and Western Ghats of Maharashtra respectively. Jagtap and Das Das⁸ reported 22 species and one variety from Maharashtra

alone. Almeida⁹ reported 20 species and four varieties from Maharashtra. At present, the Satpuda hill ranges of Maharashtra together with the northern Western Ghats host 23 species and two varieties, of which 17 species and one variety are endemic. Among these, 15 species and one variety are strictly limited to these two regions^{10,11}, suggesting that they are

the possible loci of diversification of *Ceropegia*.

During the course of botanical exploration in Satpuda hill ranges of Nandurbar

district, Maharashtra, a few interesting specimens of *Ceropegia* were collected. A perusal of literature reveals that this plant represents a hitherto undescribed

novelty, allied to the typical variety of *C. oculata* Hook. A colour plate and description with comparison with the type variety was sent to Siro Masinde, East African Herbarium, Kenya. According to Masinde (pers. commun.) 'it is a form of *C. oculata*'; however, there exists an interesting variation'. We made fresh collections in October 2004 and August 2005. On the basis of our own observations we are of the opinion that the plant is distinct from the typical variety of *C. oculata* and hence it is described as a new variety under *C. oculata*.

Ceropegia oculata var. *satpudensis* Puneekar, S. Jagtap & Deokule var. nov.

Type: India, Maharashtra, Nandurbar District, Akrani Taluka, Toranmal, Legapani village, 9 August 2003, S.D.J. 2919 (holotype CAL; isotype BSI); same locality, 25 October 2004, S.A.P., 186120 (paratype BSI, AHMA).

Diagnosis: A varietate typica folia elliptica vel lanceolata, basi rotundata, truncata vel cuneata, apice caudata et curvata, pedicellis sparse pilosis vel glabrescentibus, floribus roseo-brunneis vel malvinis, tubo corollae ad basin paulatim aliquantum dilatato atque intus fusco-rubro, lobis corollae atque lobis coronae brevioribus (c. 1.2 cm et c. 3.5 mm tantum longis), corpusculo magis longo quam lato atque ad apicem truncato differt.

A tuberous twining herb. Tuber 2–4 cm across, depressed globose. Stem unbranched c. 50–70 cm long, terete, striate, glabrous, purplish in older part, greenish in younger. Leaves opposite; petioles 1.2–3 cm long, channelled, glabrous; lamina elliptic-lanceolate, up to 14 cm long and up to 5.5 cm in breadth, base rounded, truncate or cuneate, apex caudate, acumen curved, sparsely hairy above and on the nerves beneath, margin ciliolate; secondary nerves 5–6 pairs, curving upwards, looping along the margin, lower pair of nerves emerging from leaf base. Flowers in axillary, peduncled, 2–4-flowered umbellate cymes; peduncles hirsute up to 7 cm long; bracts subulate, up to 4.5 mm long, glabrous, scarious along margins, pale pink; pedicels terete, hairy or glabrescent, pink, grooved, 1–2 cm long. Calyx five-partite, lobes subulate, c. 5 mm long, glabrous or rarely sparsely hairy, three-nerved, tips often recurved. Corolla up to 6 cm long, slightly curved; tube up to 5 cm long, up to 4 mm across in the middle, funnel-shaped at apex, glabrous at mouth, uni-



—d. *Ceropegia oculata* var. *satpudensis* Puneekar et al. a, Flower; b, Flower bud; c, Base of corolla tube cut open to show window bands and corona; d, Pollinarium (arrow showing truncate corpuscle head); e–h, *Ceropegia oculata* Hook. var. *oculata*. e, Flower; f, Flower bud; g, Base of corolla tube cut open to show window bands and corona; h, Pollinarium (arrow showing obtuse corpuscle head). Scale bars: a–c, e–g = 1 cm; d, h = 100 μ m. Photos by S.A.P. and S.D.J.

SCIENTIFIC CORRESPONDENCE

Table 1. Comparison between *Ceropegia oculata* var. *oculata* and *C. oculata* var. *satpudensis*

<i>C. oculata</i> var. <i>oculata</i>	<i>C. oculata</i> var. <i>satpudensis</i>
Leaves long petioled, orbicular or broadly ovate, cordate at base, acute to acuminate at apex, acumen straight, coriaceous	Leaves short petioled, elliptic-lanceolate, rounded, truncate or cuneate at base, caudate at apex, acumen always curved, membranous
Pedicels glabrous	Pedicels hairy or glabrescent
Flowers pinkish outside with distinct white spots at apical portion of corolla tube	Flowers uniformly pink-brown or mauve outside without any white spots at apical portion of the tube
Corolla tube distinctly dilated at base (globose)	Corolla tube gradually dilated at base (oblong or elongated)
Corona c. 6.5 mm high; outer corona consists of five distinctly bifid subsubulate lobes	Corona c. 3.5 mm high; outer corona consists of five slightly bifid or notched subdeltoid lobes
Corpuscle longer than broad, obtuse at apex	Corpuscle broader than long, truncate at apex

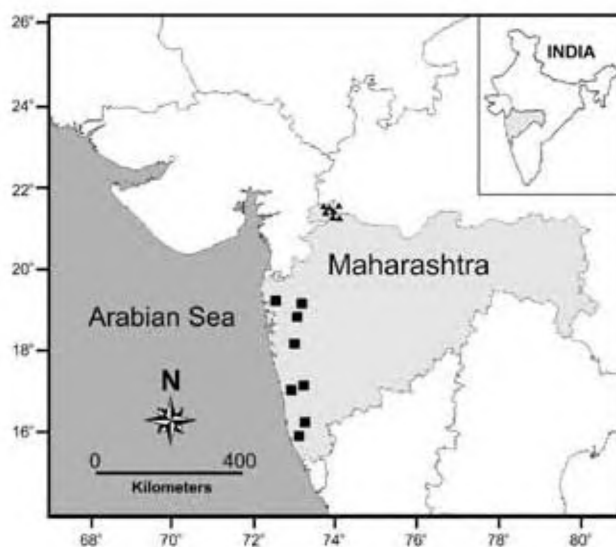


Figure 2. Distribution of varieties of *C. oculata* Hook.: var. *oculata* (square); var. *satpudensis* (triangle) in Maharashtra.

formly pink-brown or mauve outside, dark red inside, gradually slightly dilated at base, the lower slightly dilated portion oblong or elongated, reddish inside with red-purple lines; corolla lobes linear above from oblong base, up to 1.2 cm long, linear portion green, oblong portion brown, connate at tips, forming a short beak, folded, pubescent inside, glabrous outside. Corona biseriate, yellow; outer (gynostegial) corona lobes cupular, consisting of five slightly bifid lobes, c. 2 mm long, sparsely hairy inside at base, glabrous along margins; inner (staminal) lobes five, linear, erect, glabrous, free except apex, c. 3 mm long. Pollen masses yellow, erect, waxy with pellucid layer, 0.3×0.2 mm, beaked at apex, beak transparent, pollen mass attached to corpuscle with broad, short caudicle; corpuscle brown, truncate at apex, broader than long, gradually narrows down. Follicles double, up to 6 cm long, one straight and

one curved, tapering to fine point (Figure 1 a–d).

Flowers and fruits: August–November.

Vernacular Name: ‘Khutti’ (Local Language ‘Pawari’).

Distribution: India, Maharashtra: Nandurbar District, Akrani Taluka, Ranipur forest range, Shahada forest division, Ambaghat (N $21^{\circ}50'$ and E $74^{\circ}27'$), Ghodamba, Kalapani (N $21^{\circ}51'$ and E $74^{\circ}28'$), Kelpani (N $21^{\circ}49'$ and E $74^{\circ}27'$), Legapani (N $21^{\circ}49'$ and E $74^{\circ}26'$) and Toranmal (N $21^{\circ}51'$ and E $74^{\circ}28'$). According to local ‘Pawri’ people, this variety is also distributed in Zapi village, Badwani District, Madhya Pradesh (Figure 2).

Ecology: This variety is common in the above localities and grows at an altitude from 584–1118 m amsl in shady places of bamboo (*Dendrocalamus strictus*) thickets and among grasses in dry deciduous forests. The population is

maximum between Ambaghat, Kalapani and Legapani and it has c. 200 individuals in each location. However, the population significantly reduces to c. 50 individuals at Ghodamba, Kelpani and Toranmal.

Note: *C. oculata* var. *satpudensis* Puneekar *et al.* is allied to the typical variety of *C. oculata* Hook., but differs from it as below (Table 1.) Apart from the morphological differences, the typical variety of *C. oculata* is distributed in high rainfall area of the Western Ghats and Konkan extending up to Kerala and Tamil Nadu¹¹ having moist deciduous to semi-evergreen scrub forests, whereas var. *satpudensis* is so far known from dry deciduous forests of Satpuda hill ranges which experience low rainfall.

Etymology: The varietal epithet of the new variety is based on the type locality, viz. Satpuda hill ranges of Maharashtra.

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Echolocation sounds of the painted bat *Kerivoula picta* (Vespertilionidae)

So far nine species of insectivorous bats have been reported in Madurai (9°58'N, 78°10'E) and their field ethology, neurophysiology and chronobiology have been studied extensively¹. These bats use species-specific echolocation calls of various frequencies while hunting and are classified as surface gleaners, within foliage foragers and open-air foragers². The ultrasonic calls emitted by bats may be of constant frequency (CF) or frequency modulated (FM) or both (CF/FM)^{2,3}.

One of the most attractive among bats, especially in the family Vespertilionidae is the painted bat, *Kerivoula picta* (Microchiroptera: Kerivoulinae). This species, captured at the Madurai Kamaraj University (MKU) campus is a new addition to the list of bats in Madurai. Apart from taxonomy, distribution, roosting and scanty reports on reproduction, no other information is available on this species^{4–6}. Here we present the structure and characteristics

of the echolocation calls of this little known species *K. picta*.

On 22 January 2006, around 2100 h while monitoring the activity patterns of fruit bats in the MKU quarters garden, a female *K. picta* (Figure 1a and b) was found trapped in the mist net that was erected to capture fruit bats. We carefully transported the individual to the laboratory and released it into a free-flight room (3.1 mL × 2.4 mW × 4.0 mH) around 2146 h. The flight room was provided with several perches made of wooden pieces fixed permanently to the walls on all sides for the bats to roost. The echolocation calls of the bat were recorded during flight as well as at rest using the method described below. We took photographs using a digital camera (Nikon Coolpix E2500) and released the individual in the university garden around 0050 h on the next day.

Echolocation calls emitted by *K. picta* were recorded using a SM2 microphone

(Ultra Sound Advice, UK) and filtered using a SP2 Pre-amplifier (cut-off frequency 25 kHz) and fed into the Portable Ultrasound Signal Processor (PUSP: Ultra Sound Advice, UK) which time-expanded 2 s of sound by 10X at a sampling rate of 448 kHz. The calls were recorded onto Sony HF90 cassettes using a Sony WM-D6C Professional Walkman cassette recorder (Sony Corporation, Japan).

The time-expanded sounds from the Sony Walkman were digitized and analysed using BatSound v 2.00 (Pettersson Elektronik AB, Uppsala, Sweden) with a 16 bit A: D converter at a sampling rate of 44.1 kHz. The threshold level was set at 16 in BatSound and the FFT size was 512 points. Interpulse interval (onset of first call to the onset of the next call) and call duration were measured from oscillograms. From the sonagrams, the maximum and minimum frequencies of each call were measured. The peak frequency of the