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## Research

### *Echinops sahyadricus* sp. nov. (Asteraceae: Cardueae), from the northern Western Ghats, Maharashtra, India

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The new species *Echinops sahyadricus* is discovered and described from northern Western Ghats, India. It is endemic to the Maharashtra state and probably restricted to few high mountain peaks in Western Maharashtra. The new species is distinguished from the related *E. echinatus* by adaxially glabrous to sparsely elgandular hairy leaf surfaces, larger non-cornigerous synflorescences up to 9 cm in diameter and numerous (19–24) glabrous phyllaries up to 27 mm long. An identification key to all Indian taxa of *Echinops*, illustration and colour plates are provided.

Keywords: Asteraceae, Cardueae, *Echinops*, endemic, Maharashtra, northern Western Ghats

## Introduction

The genus *Echinops* L. belongs to tribe Cardueae of Asteraceae and comprises about 130 species distributed in tropical and north Africa, the Mediterranean Basin and the Middle East, extending eastwards to China and Japan, with the highest number of taxa (76) concentrated in the Iranian plateau (Bobrov 1962, Rechinger 1979, Jäger 1987, Meusel and Jäger 1992, Mozaffarian 2006, Susanna and Garcia-Jacas 2007, Sánchez-Jiménez et al. 2010, Mabberley 2017).

In India *Echinops* is represented by five taxa out of which three, *E. cornigerus* DC., *E. niveus* Wall. and *E. prionolepis* Bornm. & Mattf., are restricted to the Himalayas and neighbouring areas. *Echinops rajasthanensis* R.P. Pandey & V. Singh is endemic to Rajasthan, and *E. echinatus* Roxb. occurs throughout India, Afghanistan, Pakistan and Myanmar in dry open scrublands (Melchior 1940, Hajra et al. 1995, Pandey and Singh 1997, Karthikeyan et al. 2009).

While conducting fieldwork for the project 'Assessing the endemic biodiversity of high elevational plateaus of northern Western Ghats' initiated by H. Bhosale under Bombay Natural History Society, S. More came across a population of *Echinops* on the Rajgad fort. Later, additional populations were located in the northern Western Ghats, viz. Hatgad, Salher (Nashik District), Rajgad, Torna, Purandar (Pune District), Pateshwar, Sajjangad, Ajinkyatara (Satara District). A detailed morphological study



revealed that these plants are morphologically distinct from all known *Echinops* species, and they belong to a new species described here as *E. sahyadricus*. Specimens of *E. sahyadricus* have previously been collected from different localities but they have been misidentified as *E. cornigerus* in Malkapur, Kolhapur district, (Awale et al. 2011) and *E. echinatus* in Torna fort, Pune district (Nandikar et al. 2018),

## Material and methods

In order to investigate the morphological variability and to clarify the systematic position of the taxon, plants from the above mentioned localities were studied in the field and in the BLAT herbarium. Capitula were preserved in 70% alcohol for further taxonomic investigation. Two individuals have been cultivated from seeds by S. More for germination and developmental study. It was first identified as *Echinops sphaerocephalus* L., hence some herbarium specimens in APP and some digital images at B, G, JE, K, W, WU were examined for comparison. Morphological characters such as life form, habit, stem and leaf indumentum, synflorescences diameter, size of capitula and florets, connation of the five innermost bracts, presence or absence of rosette leaves, selected according to their common use for taxonomic identification within the genus *Echinops* (Mozaffarian 2006), were critically studied. Detailed description and illustrations were produced from fresh materials. Mitosis was studied from root tips of germinated seeds. Root tips of 4–10 mm length were pretreated with a saturated aqueous solution of para-dichlorobenzene for 3–4 h at  $9 \pm 3^\circ\text{C}$ . The root tips were then squashed in 2% propionic-orcein. The somatic chromosomes were counted from well spread somatic plates and photographed under microscope with microscope camera.

### *Echinops sahyadricus* S. More, F. Conti & H.S. Bhosale sp. nov. (Fig. 1–2)

**Type:** India, Maharashtra, Pune district, Velhe Taluka, Rajgad, WGS84  $18^\circ 14' 41.19''\text{N}$ ,  $73^\circ 41' 0.28''\text{E}$ , 1289 m a.s.l., below chor darvaja on a slope, 21 Nov 2019, S. More, SSM 161 (holotype: BLAT, isotype: CAL).

A species morphologically similar to *E. echinatus* (Fig. 3) but differing in floret length (32 mm versus 16 mm), adaxial leaf surface indument (glabrous to sparsely eglandular hairy versus densely glandular-pubescent), synflorescence size (non-cornigerous, 6–9 cm in diameter versus cornigerous, 2.5–3.5 cm in diameter), and number and length of phyllaries (19–24 up to 27 mm long versus 14 up to 21 mm long).

### Etymology

The specific epithet '*sahyadricus*' refers to the Sahyadri Mountains where the new species occurs.

### Description

Perennial spiny herb, robust, 120–180 cm tall, branched above. Roots woody, thick, ca 15 cm long. Stems one or two

arising from the same base, grooved vertically, lanate, hairy whitish, dense. Rosette leaves absent. Cauline leaves ca  $18\text{--}30 \times 7\text{--}10$  cm, diminishing in size upwards, elliptic in outline, spinescent, acute, attenuate and almost amplexicaul at base, pinnatisect, with 7–8 pairs of acuminate lobes; adaxial surface glabrous to sparsely eglandular hairy; abaxial surface densely whitish arachnoid–tomentose; margins spiny, revolute, with spines 3–8 mm long. Primary synflorescences spherical, 6–9 cm in diameter; secondary synflorescences smaller, 3.5–4.4 cm in diameter. Brush (setae) 8–18 mm long, dull brownish-yellow. Phyllaries 19–24, 3–4 seriate, glabrous; the outer 10–12 mm long, oblanceolate with minute branched hairs; the median 13–27 mm long, spatulate–lanceolate, in upper half with slightly lacinate margin, and spiny tips; the inner 25 mm long, connate forming a coriaceous tube; lobes five, unequal, lacinate at the apices; tube dilated, five angled. Receptacle capitate, 7 mm in diameter, with common oblanceolate involucre 9–17 mm long. Florets 3.2 cm long, bisexual. Corolla white; tube  $10 \times 1$  mm, glandular outside; lobes 7 mm long, glabrous, recurved. Anthers 9 mm long, brown, rigid, forming a tube with five ensiform lobes, basifixed; filaments 2 mm long. Style glabrous, enclosed by anther tube, 20 mm long, bifurcate, villous at the deltoid tips. Achenes 13–15 mm long, oblongoid, densely hairy with ascending light brownish hairs. Pappus 1–2 mm long; hairs connate, seldom hidden by the achene hairs.

### Chromosome number

A single population from Satara resulted in  $2n = 30$ .

### Phenology

*Echinops sahyadricus* grows vegetatively during four months of monsoon and blooms from November to December. Fruiting was observed in January.

### Distribution

*Echinops sahyadricus* is distributed in northern Western Ghats from Salher (Nashik District) in the north to Kolhapur in the south (Fig. 4). It is endemic to Maharashtra state, India.

### Habitat and ecology

*Echinops sahyadricus* grows on open mountain slopes, from 800 to 1400 m a.s.l., among grasses; associated with *Arundinella metzii* Hochst. ex Miq., *Capillipedium filiculme* (Hook.f.) Stapf, *Pseudanthistiria heteroclita* (Roxb.) Hook.f., *Themeda* sp., *Swertia densifolia* (Griseb.) Kashyapa, *Vigna khandalensis* (Santapau) Sundararagh. & Wadhwa, *Barleria sepalosa* C.B. Clarke, *Delphinium malabaricum* (Huth) Munz, *Ceropegia noorjahaniae* Ansari. *Apis dorsata* Fabricius, one of the major pollinators was observed pollinating the plants.

### Conservation status

The 'extent of occurrence' (EOO) is ca 11 700 km<sup>2</sup>, calculated with minimum convex hull polygon, and the area of occupancy (AOO) is 40 km<sup>2</sup>, calculated with a  $2 \times 2$  km fixed grid cell. The population is not declining at present, and there are no indications of extreme fluctuations and no

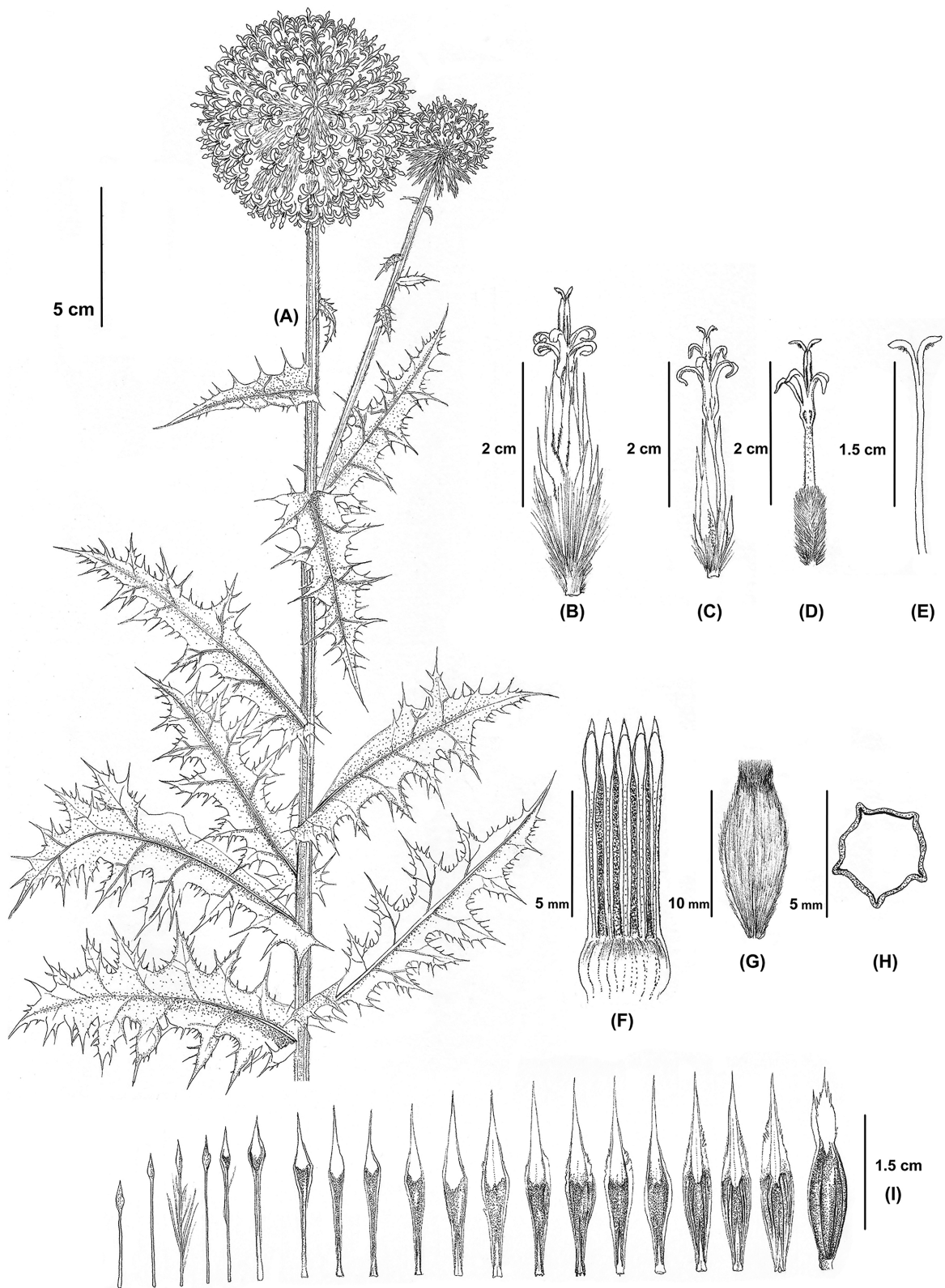


Figure 1. *Echinops sahyadricus* sp. nov. (A) habit, (B) lower capitulum, (C) upper capitulum, (D) floret, (E) style, (F) anthers, (G) achene, (H) t.s. of innermost connate phyllaries showing five angles, (I) phyllaries. Illustration by Priyanka Ambavane.

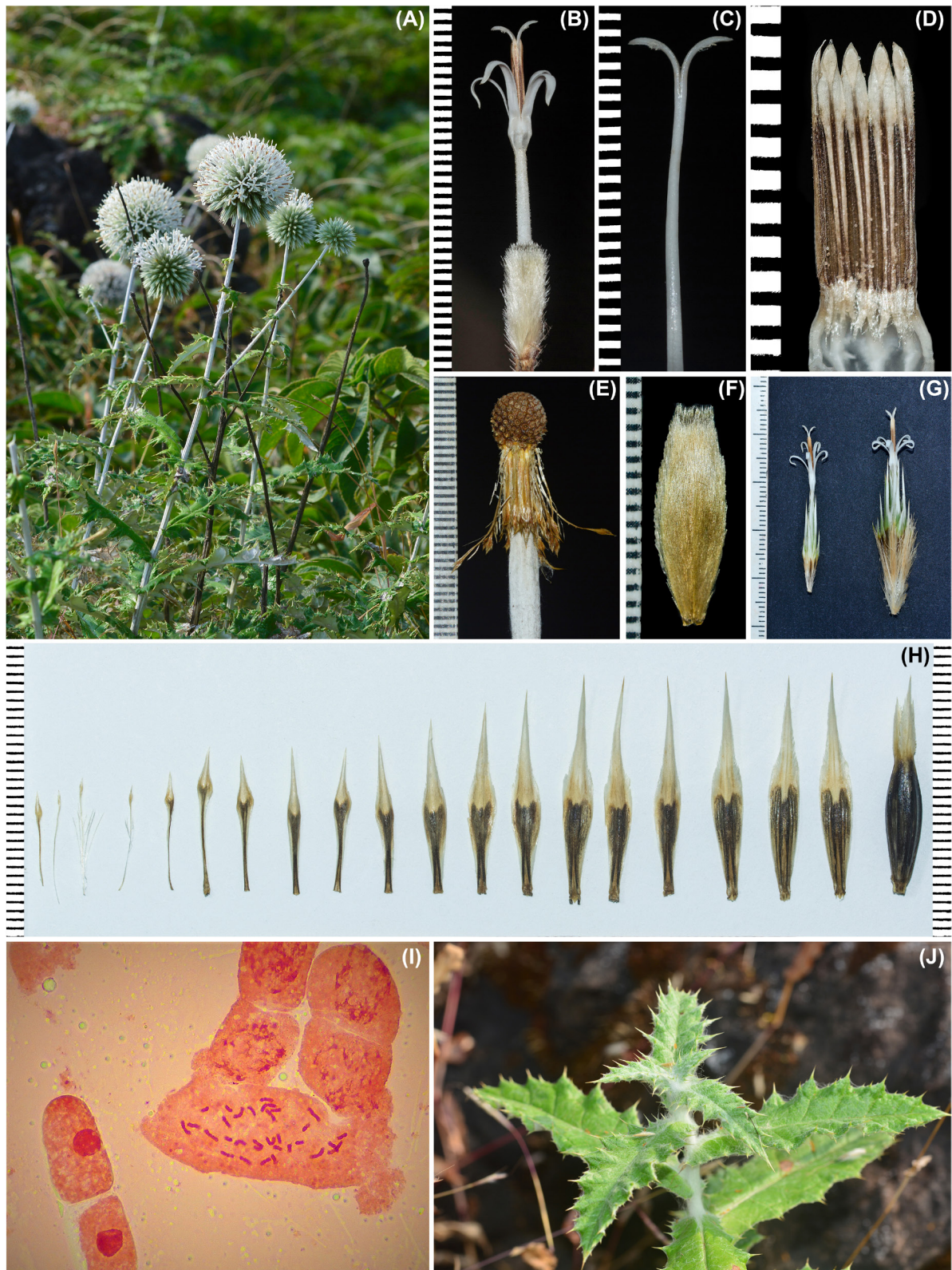


Figure 2. *Echinops sahyadricus* sp. nov. (A) habit, (B) floret, (C) style, (D) anthers, (E) receptacle, (F) achene, (G) left – upper capitulum, right – lower capitulum, (H) phyllaries, (I) metaphase plate with  $2n = 30$  chromosomes, (J) young plant (without rosette leaves). Photographs by Sushant More.

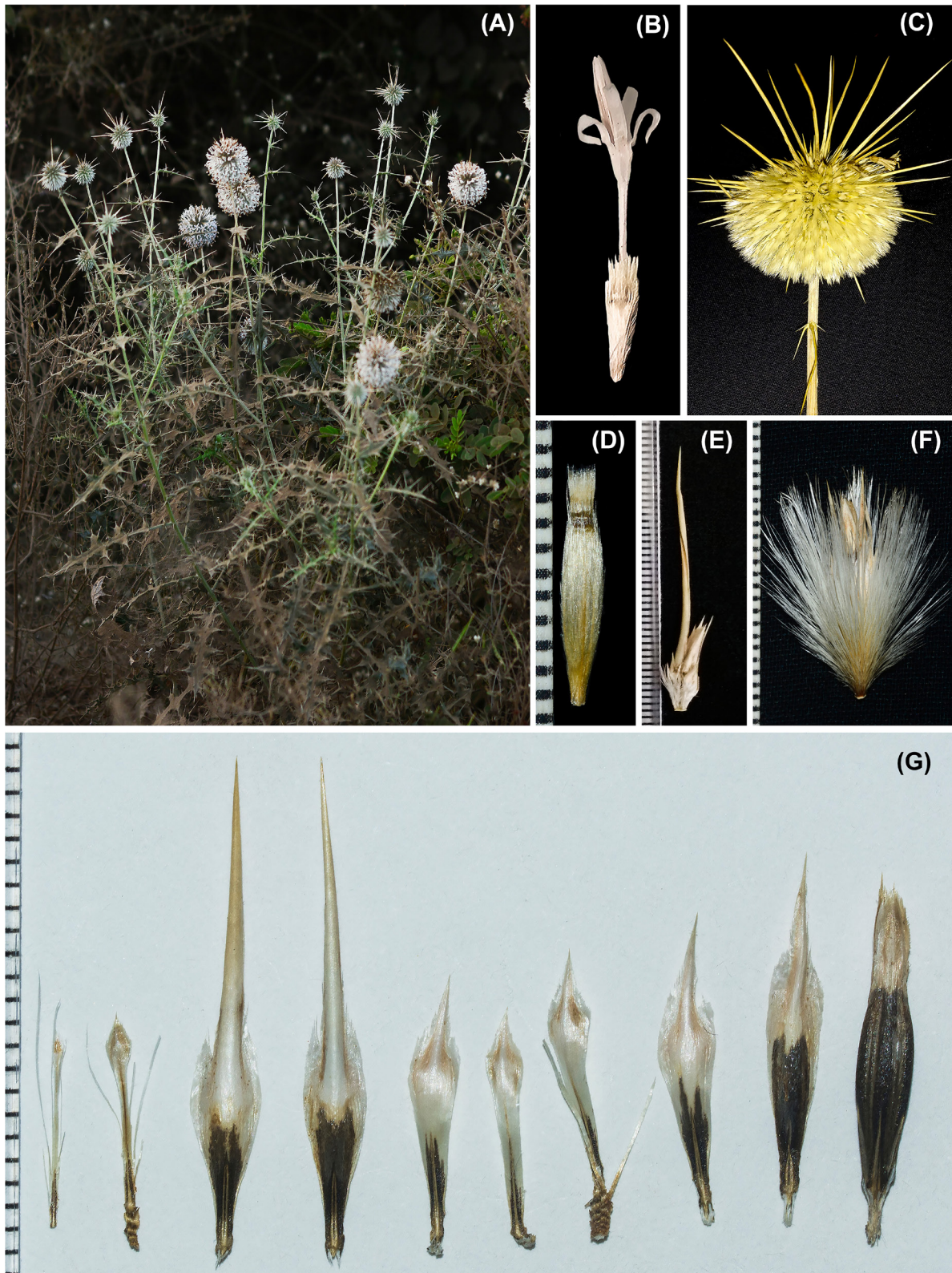


Figure 3. *Echinops echinatus* Roxb. (A) habit, (B) floret, (C) synflorescence, (D) achene, (E) cornigerous capitulum, (F) non-cornigerous capitulum, (G) phyllaries. Photographs by Varsha Giri, Rushabh Chaudhary and Sushant More.

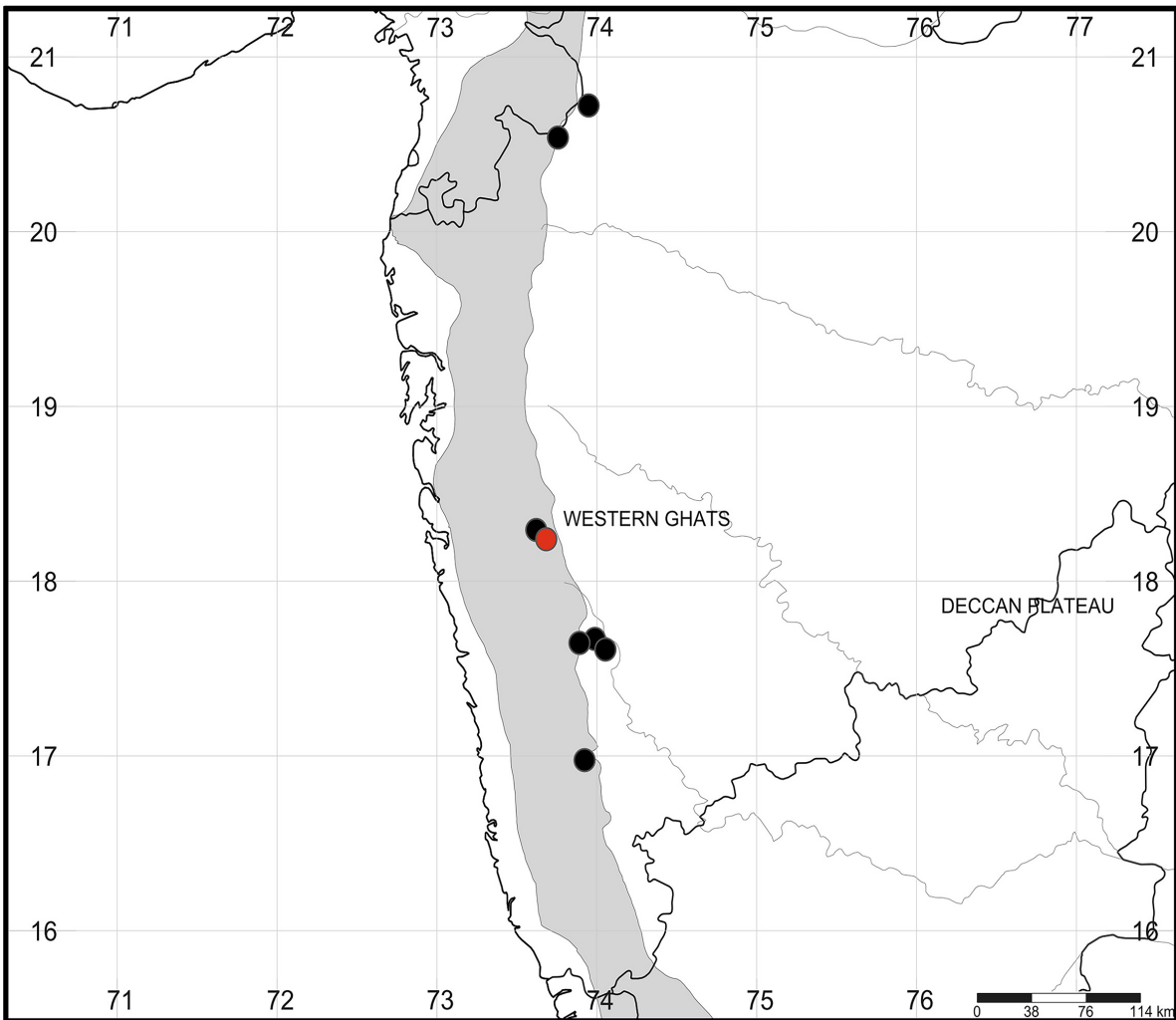
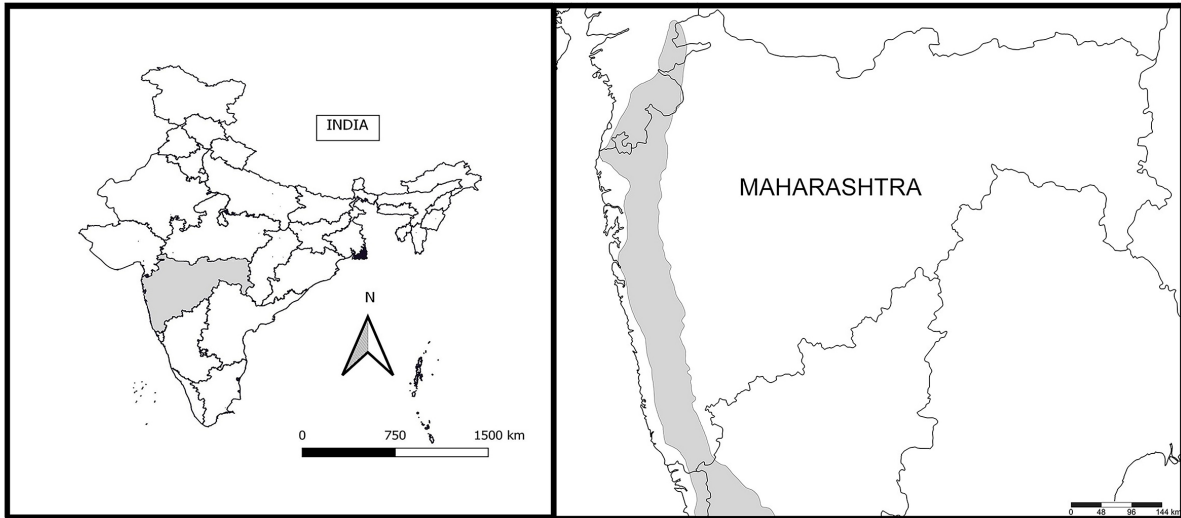


Figure 4. Distribution of *E. sahyadricus* sp. nov. Red dot shows the 'locus classicus' (Rajgad).

current threats have been observed. However, future development projects like road widening in Ghats and construction activities on forts could affect some populations of the species. According to IUCN (2019), *Echinops sahyadricus* should be categorized as 'Least Concern' (LC).

#### Taxonomic remarks

Because of the five inner phyllaries connate up to  $\frac{2}{3}$ , forming a coriaceous pentagonal tube, *Echinops sahyadricus* belongs to *E. sect. Oligolepis* Bunge (Bunge 1863, Mozaffarian 2006, Sánchez-Jiménez et al. 2010) despite its number of phyllaries being 19–24. The connation of the five innermost phyllaries is considered to be the most important diagnostic character at the sectional level (Montazerolghaem et al. 2017). All other taxa of *Echinops* occurring in India belong to the same *E. sect. Oligolepis*, except *E. prionolepis* that belongs to *E. sect. Echinops*. At first the new plant was attributed to *E. sphaerocephalus* but after the critical study of specimens from Maharashtra, India and of *E. sphaerocephalus* from Italy we concluded that these plants are different and they belong to different sections. *Echinops sphaerocephalus* has free inner phyllaries and belongs to *E. sect. Echinops*, while *E. sahyadricus* has connate inner phyllaries and belongs to *E. sect. Oligolepis*. *Echinops sahyadricus* also shows morphological similarity to *E. rajasthanensis*, *E. cornigerus* and *E. niveus*, but differs from these species in morphological characters specified in the identification key below.

#### Additional specimens examined (paratypes)

India, Maharashtra, Nashik district, Satana Taluka, Salbari range, Baglan, Salher, 1408 m a.s.l., 15 Dec 2019, S. More, SSM 165 (BLAT); Pune district, Velhe Taluka, Torna, 1114 m a.s.l., 21 Nov 2019, S. More, SSM 163 (BLAT); Satara district, Sajjangad, 864 m a.s.l., 24 Dec 2019, S. More, SSM 164 (BLAT); Satara district, Pateshwar, 899 m a.s.l., 5 Oct 2019, S. More, SSM 166, 167 (BLAT).

#### Identification key to Indian taxa of *Echinops*

1. Inner phyllaries free..... *E. prionolepis*  
– Inner phyllaries connate.....2
2. Leaves adaxially glabrous to sparsely eglandular hairy; synflorescences non-cornigerous, up to 9 cm across.....  
.....*E. sahyadricus*  
– Leaves hairy or arachnoid adaxially; synflorescences cornigerous or non-cornigerous, up to 7.5 cm across.....3
3. Stem much-branched from the base; pappus ca 2 mm long.....*E. echinatus*  
– Stem usually erect, simple or slightly branched; pappus more than 5 mm long .....4
4. Synflorescences non-cornigerous; inner involucre bracts ca 10 mm long.....*E. rajasthanensis*  
– Synflorescences usually cornigerous; inner involucre bracts 16–25 mm long.....5
5. Leaves narrow, much divided, lobes narrow; inner involucre bracts ca 25 mm long; stem simple.....*E. niveus*  
– Leaves broader, lobes broad; inner involucre bracts ca. 16 mm long; stem slightly branched.....*E. cornigerus*

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