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Cover: A digital art of water birds of Noyyal River and its wetlands in Coimbatore District by Megha A. Kashyap.

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COMMUNICATION

Studies on *Heliotropium rottleri* Lehm. (Heliotropiaceae) – a threatened endemic plant of Tamil Nadu, India

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Abstract: *Heliotropium rottleri* Lehm. (Heliotropiaceae; previously Boraginaceae) is endemic to Coimbatore region. Its taxonomic status is ambiguous and unresolved because of mistaken identity of *H. marifolium* J. Koenig ex Retz. and *H. scabrum* Retz. by later botanists. So far, no efforts have been taken to assess its distribution, population size, and conservation. While working on *Heliotropium* L. genus in Tamil Nadu, we have collected it from four localities in the erstwhile undivided Coimbatore district (two in Udumalpet taluk, one in Palladam taluk) in January 2021 and identified with Madras Herbarium, Botanical Survey of India Southern Regional Centre. Our study indicates that it is now Critically Endangered as the habitats are very rapidly altered and changing due to real estate business. Unless urgent actions are taken, certainly this species will disappear. Therefore, it is suggested to take immediate action to conserve this species in its natural habitat.

Keywords: Coimbatore, Critically Endangered, curved raceme, divaricate branches, endangered, leaf margin revolute, perennial, Thiruppur.

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Author details: KADER, S.A., associate professor, is a field botanist and actively engaged in plant diversity survey. G. GOPAL, Ph.D. research scholar, is currently involved in vegetative propagation and floristic studies.

Author contributions: KSA has contributed the data, images, prepared manuscript etc. for the present study; GG has provided transported facility for the last field visit and helped in taking measurement and herbarium preparation.

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INTRODUCTION

The cosmopolitan genus *Heliotropium* L. (Heliotropiaceae; previously Boraginaceae) comprises of about 255 accepted species (POWO 2024) distributed mostly in the arid and semi-arid habitats of the world (Luebert et al. 2016). In British India, Wight (1850) had first reported six species and one variety, namely: *H. coromandelianum* Retz., *H. linifolium* Lehm., *H. marifolium* Retz., *H. rottleri* Lehm., *H. scabrum* Retz., *H. supinum* L. var. *supinum*, and *H. supinum* var. *malabaricum*. Later, Clarke (1885) had documented 16 species and four varieties in the '*Flora of British India'* (Hooker 1885). Furthermore, *H. keralense* was discovered by Sivarajan & Manilal (1972). Presently, there are about 22 *Heliotropium* sensu lato species, two subspecies and four varieties in India (Meena et al. 2020). *Euploca* Nutt. was delimited from *Heliotropium* L. based on presence of bracts in the inflorescence, fruit breaking up into four nutlets, nutlets with pits on endocarp and curved embryo (Dheeren 2021).

Heliotropium rottleri was first published by Lehmann in 1818 from India without specifying precise locality in *'Plantae e Familiae Asperifoliarum Nuciferae'*. Later, Wight (1850) and Gamble (1921) had collected this species from Coimbatore and the former provided a description and an illustration. Despite, its taxonomic status, it has been considered as unresolved (WFO 2023) because later botanists, namely, Ramamoorthy (1976), Matthew (1983), Sasidharan (2011), and Rao et al. (2019) have confused its identity with *H. marifolium* J.Koenig ex Retz. and *H. scabrum* Retz. Based on the above literature, Rao et al. (2019) have wrongly reported it from Andhra Pradesh, Telangana, and Kerala in *'Flora of Peninsular India'*. In fact, these three species are distinct and have been collected from Tamil Nadu during the revisionary studies by us. According to Wight (1850) *H. rottleri* was frequent in Coimbatore. In 1964, Chandrabose collected it from R.S. Puram and the subsequent workers have collected it from the foot-hills of Kuridimalai and Thadagam (all in Coimbatore) but now it is not found in Coimbatore city and rare in Kuridimalai and Thadagam. Ahmedullah & Nayar (1987) categorized its threat status as Endangered in southern Deccan, Coimbatore. While working on the genus *Heliotropium* in Tamil Nadu, we have collected *H. rottleri* from Masagoundanputhur and Raavanapuram (Udumalpet taluk), Puliyampatti, Kamanayakkan Palayam (Palladam taluk) and in adjacent Thiruppur district, Tamil Nadu during January 2021. Recently, Ancy et al. (2024) have published *H. rottleri* as *Euploca wightiana* sp. nov. Therefore, the aim of the present paper is to provide a complete botanical description and to establish the correct identity of *H. rottleri,* and the current status in Tamil Nadu.

MATERIALS AND METHODS

Extensive field survey was carried out for *Heliotropium rottleri* in its type locality and its neighbourhood regions. Specimens were studied at Presidency College, Chennai. Photographs were taken and taxonomical characters were recorded. The collected plant materials were processed following standard herbarium methods and made into herbarium specimens. The specimens were identified using relevant literature such as Hooker (1885) and Gamble (1921), and compared with authentic specimens deposited in the Madras Herbarium (MH). For threat status assessment, the number of individuals was recorded during each visit to the locations. The primary and secondary information required for assigning the criteria as per IUCN Red List Categories and Criteria were collected, following the IUCN guidelines (Standards and Petitions Working Group IUCN 2006).

RESULTS

Botanical Description

Habitat: Marginal waste lands in the plains with grassy, rocky, and calcareous soils. Habit: Erect stiff undershrubs; branches stout, divaricate, covered with white appressed strigose hairs (Image 1a). Leaves: Simple, alternate, scattered; petioles 2–4 mm long, lamina ovate-lanceolate acute with revolute margins, 6–15 × 3–5 mm, white-strigose (Image 1b,c). Inflorescence: Racemes terminal, curved, on divaricate branches, stiff; peduncles 4.6–8.4 cm long with distant leaves (Image 1d). Flowers: c. 2 mm across at mouth (Image 1e), pedicels 1–3 mm long (Image 1f). Calyx: 5-lobed, lobes basally connate, green, ovate-elliptic acuminate, white-strigose, accrescent (Image 1g). Corolla: Campanulate, 5-lobed, white with yellow centre (Image 1e). Fruits: 4-lobed depressed nutlets, c. 4 mm in diam. c. 3 mm thickness, completely covered with short grey adpressed hairs (Image 1g).

Flowering and Fruiting period: Almost throughout the year.

Associate species: *Acacia leucophlea* (Roxb.) Willd., *Abutilon pannosum* (G.Forst.) Schltdl., *Azadirachta indica* A.Juss., *Barleria buxifolia* L., *B. cuspidata* F.Heyne ex Nees, *Dichrostachys cinerea* (L.) Wight & Arn.,

Image 1. *Heliotropium rottleri* Lehm: a—Habitat | b—Habit | c—Leaf upper surface | d—Leaf lower surface | e—Flower | f—Fruits. © Kader, S.A.

Table 1. Morphological differences between *Heliotropium rottleri* Lehm., *H. marifolium* J.Koenig ex Retz., and *H. scabrum* Retz.

	Morphological characters	*Heliotropium rottleri*	*H. marifolium*	*H. scabrum*
1	Habit	Perennial, erect undershrub attaining about 30 cm height; branches divaricate and curved.	Procumbent annual herb; branches divaricate, and straight.	Prostrate woody annual herb; branches radiating from the root stock.
2	Leaves	Shortly petiolate, small, ovate-lanceolate acute with revolute margins, white-strigose, alternate but distant on stem.	Sub-sessile, ovate-lanceolate acute with flat margins, hispid, less scabrous, alternate, dense on stem.	Shortly petiolate, ovate-lanceolate acute with revolute margins, strigose-hirsute, scabrous, alternate and dense on stem.
3	Inflorescence	2.5–5 cm long stiff curved raceme.	Simple spikes of 2.5–5 cm long; bracts conspicuous. In *H. marifolium* ssp. *wallichii,* the spike is forked.	Subcapitate among leaf-like bracts.
4	Flowers	Pedicellate, 2 mm across, distantly arranged.	Sessile, 1 mm across.	Sessile, 2 mm across.

Image 2. *Heliotropium marifolium* Retz. subsp. *wallichii.* © Kader, S.A.

Image 3. *Heliotropium scabrum* Retz. © Kader, S.A.

Parthenium hysterophorus L., *Passiflora foetida* L., *Pergularia daemia* (Forssk.) Chiov., *Prosopis juliflora* (Sw.) DC., *Senna auriculata* (L.) Roxb., and grasses.

A comparative account of *Heliotropium rottleri* Lehm. (Image 1), *H. marifolium* J.Koenig ex Retz. (Image 2) and *H. scabrum* Retz. (Image 3) are given in Table 1.

DISCUSSION

Although, *Heliotropium rottleri* Lehm. (Image 1) resembles *H. marifolium* J.Koenig ex Retz. (Image 2) and *H. scabrum* Retz. (Image 3) in flower, bracts and appressed hairs its habitat and habit differ. *Heliotropium rottleri* typically inhabits marginal waste lands in the plains with grassy rocky and calcareous soils; usually grows gregariously reaching up to 30 cm height and easily recognized by its whitish round growth habit. *Heliotropium marifolium* ssp. *wallichii* is a perennial

Image 4. *Heliotropium marifolium* Retz. subsp. *rottleri.* © Kader, S.A.

decumbent plant with, divaricate straight slender fleshy branches, flat leaf margins and flowers in forked little curved spikes as shown in Image 2, while *H. scabrum* is an annual procumbent plant with twiggy branches, revolute-margined leaves and flowers in sub-capitate inflorescence among leaf-like bracts as shown in Image 3. Furthermore, *H. marifolium* var. *rottleri* is a different plant (Image 4). Despite, Ancy et al. (2024) have recently published *H. rottleri* Lehm. as *Euploca wightiana*, we have already reported *H. rottleri* Lehm. from Coimbatore and Thiruppur districts and its conservation status (Kader & Akram 2020; Kader & Gopal 2022).

According to Wight (1850), and Ahmedullah & Nayar (1987), *H. rottleri* is found only in Coimbatore region of Tamil Nadu, in India. Our study also supports the views of earlier reports that *H. rottleri* Lehm. is strictly confined to Coimbatore and Thiruppur districts. So far, no efforts have been taken to assess its distribution, population size and conservation. Our study based on survey indicates that it is Critically Endangered as the habitats are very rapidly altered and changing due to real estate business (one habitat is located along the National Highway and the other near main road). Populations in one location is declined to 50% and have been extirpated in other location within three years (between 2021 and 2023). The present population is of less than 500 mature individuals, of which about 100 individuals are restricted in a very small area (less than 1 km^2) at Raavanapuram. Data collected during the present study indicates that *Heliotropium rottleri* fulfils the necessary criteria (Appendix 1) to place it in the 'Critically Endangered' category as it faces a high risk of extinction. Therefore, it is strongly suggested here that implementation of effective in situ conservation measures are necessary to prevent this habitat-specific narrowly endemic species from extinction. We appeal the competent authorities to intervene and take immediate action to conserve this species in its natural habitat.

CONCLUSION

The present study revealed that *Heliotropium rottleri* Lehm., *Euploca marifolium* (J. Koenig ex Retz.) Ancy and P. Javad, *E. marifolia* var. *rottleri* (Lehm.) Ancy and P.Javad, and *H. scabrum* Retz. are different species and all occur in Tamil Nadu. Furthermore, *H. rottleri* Lehm. occur only in Coimbatore and Thiruppur districts of Tamil Nadu, and its reports of occurrence in other southern Indian states are based on misidentification. Finally, recently published *Euploca wightiana* Ancy et al., from Coimbatore is relegated as a synonym under *H. rottleri* Lehm.

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Appendix 1. IUCN Red List Assessment: *Heliotropium rottleri* Lehm.

Kingdom: Plantae
Division: Tracheophyta
Class: Dicots
Order: Boraginales
Family: Heliotropiaceae
Genus: *Heliotropium*
Species: *rottleri*
Authority: Lehmann, J.G.C.

Common name: Nil

Taxonomic notes: The species was described by Lehmann in 1818 from India without specifying precise locality and published in *'Plantae e Familiae Asperifoliarum Nuciferae'*. Later, Wight (1850) had collected this species from Coimbatore and provided a description and an illustration. It is a low erect perennial plant reaching only about 30 cm height, having characteristic divaricate curved stiff branches covered with whitish hairs and small ovate-lanceolate very shortly-petioled revolute-margined leaves.

ASSESSMENT INFORMATION

Red List Category and Criteria (Version 3.1): Critically Endangered B1ab(iii)+2ab(iii)
Justification: *Heliotropium rottleri* Lehm. is assessed as Critically Endangered as it is restricted only with the extent of occurrence less than 50 km^2 area. In 2006, only two mature individuals per hectare were recorded in Masagoundanputhur; in 2020, more than 250 individuals per hectare area was recorded in Raavanapuram, and about 25 individuals per acre in Kamanayakkan Palayam. But in 2022 no individuals was recorded in Masagoundanputhur; less than less than 100 individuals were recorded in Raavanapuram as the locality was converted into industrial purpose; and in Kamanayakkan Palayam site was completely used for house construction.

GEOGRAPHIC RANGE / DISTRIBUTION INFORMATION

Range description: The species is restricted to Coimbatore and Thiruppur Districts of Tami Nadu, India.
Countries of occurrence: Native to India (Tamil Nadu State).
Extent of Occurrence (EOO): EOO is approximately 1 km^2 area considering the present population at Raavanapuram. The present population is at about 60 km away from the type locality.
Area of Occupancy (AOO): AOO is 1,143 km^2.
Number of locations: The species is currently restricted to four locations. The species is extirpated from its type locality and other two locations. No other populations have been observed until now.

POPULATION INFORMATION

Population: The species is estimated to have less than 500 mature individuals, of which about 100 individuals are restricted to Raavanapuram.
Population trend: The population appears to be declining at present. Over the last three years road widening, industrial development, real estate business and house constructions have caused severe damage to the population. Populations in one location is declined to 50% and have been extirpated in other location.

HABITAT AND ECOLOGICAL INFORMATION

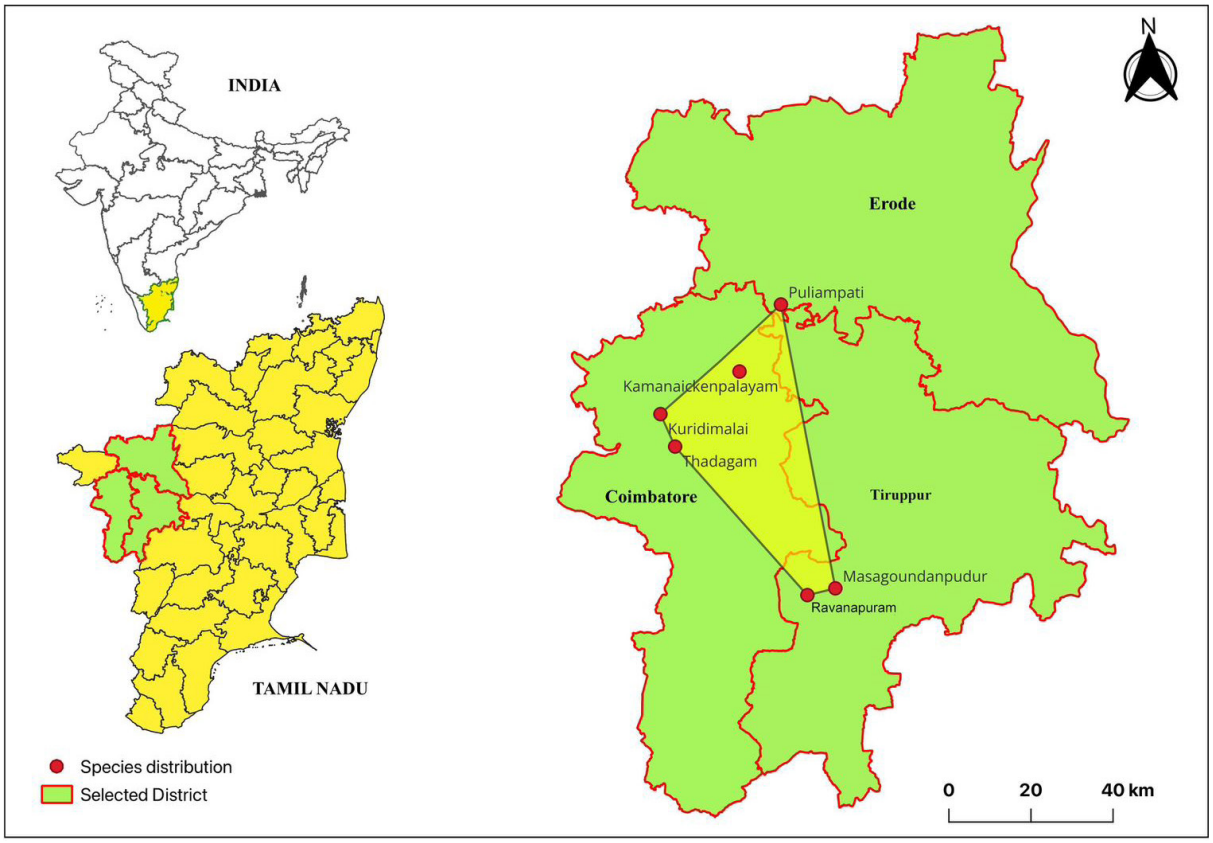
Habitat and ecology: Marginal fallow lands in the plains with grassy, rocky, and calcareous soils. The habitat is shared by *Acacia leucophlea* (Roxb.) Willd., *Abutilon pannosum* (G.Forst.) Schltdl., *Azadirachta indica* A.Juss., *Barleria buxifolia* L., *B. cuspidata* F.Heyne ex Nees, *Dichrostachys cinerea* (L.) Wight & Arn., *Parthenium hysterophorus* L., *Passiflora foetida* L., *Pergularia daemia* (Forssk.) Chiov., *Prosopis juliflora* (Sw.) DC., *Senna auriculata* (L.) Roxb., and grasses.

INFORMATION ON THREAT

Threats: The main threats to the remaining population are road widening and developmental activities. The present available population is near the highway and thus the road widening can cause severe damage to the population.
Additional threats: Real estate business and other developmental activities.

USE AND TRADE INFORMATION

Use: Local people do not collect the species as there is no usage value for the plant.
Livelihoods and sustenance: Communities are not dependent on this species for their livelihoods or sustenance.
Trend in off take from the wild: Not yet observed.
Trend in off take from cultivation: It is not cultivated.
Commercial value: The species has no known local, domestic, national or international commercial value.



INFORMATION ON CONSERVATION ACTIONS

Conservation actions: Until now no actions.
Research in Place: There is no systematic research in place other than causal surveys.
Research needed: Systematic surveys, monitoring, propagation studies, effects of threats on population, and in situ conservation.
Monitoring in place: There is no monitoring off the species, population or habitat in place.
Monitoring needed: Population and site monitoring is essential and must be implemented at the earliest.
Education in place: No formal or informal education about the species is in place.
Education needed: Outreach programmes about the species to local communities and forest department are crucial.

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