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Original Research Article

New Distribution Record and Rare Habitat of *Stictocardia tiliifolia* (Desr.) Hall. F. (Convolvulaceae) from Kankeshwar Alibag Raigad Maharashtra, India

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Abstract: The genus *Stictocardia* Hallier f. which is known for its characterized black glands on lower leaf surface and distinctive fruit nature is represented by three species in India. The present paper describes the new distribution record and rare habitat of *Stictocardia tiliifolia* from Kankeshwar Alibag. The species *S. tiliifolia* is always under controversy for its nomenclature, the present paper thus provides detail taxonomic description along with photographs and relevant notes for its easy identification in field. The species *S. tiliifolia* is mostly mistaken as *S. beraviensis;* the former can be easily distinguished by its whitish-pinkish to purple corolla. The study area Kankeshwar is rich is biodiversity though least explored, such field studies will definitely add more data to flora of Alibag.

Key words: Convolvulaceae, fruits, habitat, Kankeshwar, rare, *Stictocardia tiliifolia*.

Introduction

The genus *Stictocardia* Hallier f. belongs to family Convolvulaceae which comprises of *ca.* 12 species, mostly distributed in Africa (Verdcourt 1963, POWO 2021) and South East Asia (Austin 1980, POWO 2021). In India, the genus is represented by three species viz. *S. beraviensis*, *S. tiliifolia* and *S. sivarajanii* (Biju et al. 1999).

The genus *Stictocardia* is characterized by having black dotted glands on lower leaf surface and indehiscent unique fruits having 4 lobed endocarp pockets that hold seeds until dispersal (Gunn 1972 and Austin and Eich 2001). Hallier (1894) described the genus *Stictocardia* based on *S.tiliifolia* (Choisy) Hall f. and then included the other two species namely *S. beraviensis* (Vatke) Hall f. and *S.multiflora* Hall f. All these three species showed characteristic features namely black glands on the lower surface of leaf, indehiscent fruits and hairy seeds; that he felt should be given generic consideration. The nomenclature of *S. tiliifolia* has always been the subject of discussion. Gunn (1972) recognized *Stictocardia campanulata* as a valid name and also used *Ipomoea campanulata* L. as one of its synonym. He also mentioned its frequent report as *S. tiliifolia* in literature without giving any references. However while investigating the generic status of *Stictocardia*, Austin et al (1978) accepted *S. tiliifolia* as the correct name for the type species of *Stictocardia* and stated that the description given by Gunn (1972) under the name of *S. campanulata* is actually the description of species *S. tiliifolia*. He also recognized *S. tiliifolia* and *I. campanulata* as two valid species on the basis of morphological characters like number of primary lateral veins of the leaves and presence or absence of dotted glands.

Beside characteristic black glands on lower leaf surface (Image 5), *Stictocardia* is also known for its unique and complex

fruits characters. The drawing of fruit interior was first provided by Gunn (1972) mentioning fruit as berry and 2 celled with each containing two seeds. Austin & Demissew (1996) were the first who pointed out the presence of exocarp and endocarp in the fruit. They also described the complex characters like 4 lobed septum, thin exocarp, 4 lobed endocarp with seed pockets and enlarged calyx covering the entire fruit which indicate the complex and unique nature of fruits which is different when compared with related genera thus suggested that *Stictocardia* should be maintained as distinct genus.

As the presence of black dotted glands is the distinctive character of the genus, Olaranont *et al* (2018) studied the morphology, anatomy and histochemistry of the black glands present on leaves and flowers of *Stictocardia* species and suggested that this should be considered as an important character along with other prominent characters to confirm the identification of this genus. But recent molecular studies by Munoz-Rodriguez *et al* (2019) do not support the retention of *Stictocardia* as separate genera and stated to be treated as *Ipomoea tiliifolia* (Desr.) Roem. & Schult.

The study area Kankeshwar is a hill with dense forest cover famous for its cool climate is located near the village of Mapgaon which is about 13 km from Alibag. Alibag is situated about 100 kms from Mumbai and is a coastal town in the Konkan region of Maharashtra and also headquarter of Raigad district of Maharashtra. The average rainfall is around 2402 mm per year and average annual temperature is about 26.1^{0}C. The highest humidity is recorded the month of July i.e. about 90.24% while the lowest is in December which is 59.08%.

The Alibag region though rich in biodiversity has not been explored extensively except few floristic reports (Sagar *et al* 2014, Phate & Kawale 2019, Phate & Kawale 2021). The present study not only reports the new distribution record of *Stictocardia tiliifolia* from Kankeshwar but also a new rare habitat of the species.

Materials and methods

During regular field visits to Kankeshwar hill (18.745136, 72.921991), the authors encountered few plants growing in the locality that are belonging to family Convolvulaceae. The unidentified specimens were collected, observation notes and photographs of different plant parts were taken and after careful examination of the specimens using detailed relevant taxonomic literature (Singh and Karthikeyan 2001, Austin and Eich 2001), online floras (https://efloraofindia.com, https://indiabiodiversity.org and https://powo.science.kew.org) and expert scrutiny (Dr. George Staples), the specimen was identified as *Stictocardia tiliifolia*. The voucher specimens have been deposited in the herbarium of Botanical Survey of India, Pune; yet to receive the accession number. A detailed description, relevant notes and photographs are provided for the easy identification of the species.

Results

Taxonomic treatment:

Stictocardia tiliifolia (Desr.) H. Hallier Bot. Jahrb Syst. 18:159:1894.

Sant. & Patel in Prof. Agharkar Comm. 19: t. 3.1961; Austin in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 1: 360. 1980; *Convolvus tiliaefolius* Desr. in Lam. Encycl. 3: 544. 1792; *Argyreia tiliaefolia* Wight, Ic. t. 1358. 1848; C. B. Cl. in Hook.f. Fl. Brit. India 4: 184. 1883. (Image 2-4)

Perennial woody climber, with hairy stem. *Leaves* petiolate; petiole 2.5-15 cm long, hairy. Leaves dark green above while light green below, hairy on both sides with minute black glands on lower surface; leaf blade with 7-9 lateral veins on each side of the midrib, broadly ovate to orbicular with cordate base, notch about 1-2.5 cm, apex mucronate; lamina 5-16 ×4.5-15 cm. *Flowers* pale pink, in axillary cymes; peduncle 2-5 cm long, hairy, bearing 1- or rarely 2-4 flowers; bracteate; pedicels 1-4 cm long not thickening at maturity. *Sepals* 5, thick, unequal, hairy outside and smooth on inner side, less hairy at the time of fruiting, orbicular 1-1.3 × 0.6-0.8 cm at flowering and expanding to 2.5-5.0 × 3.5-4.5 cm at fruiting; inner sepals smaller than the outer one, persistent. *Corolla* infundibuliform, constricted just above calyx, purple whitish with dark purplish center and mid-petaline bands, 6-8 cm long and limb 6-10 cm wide, ciliate hairs along the margin of

Image 1. Study area Kankeshwar hill, Alibag.

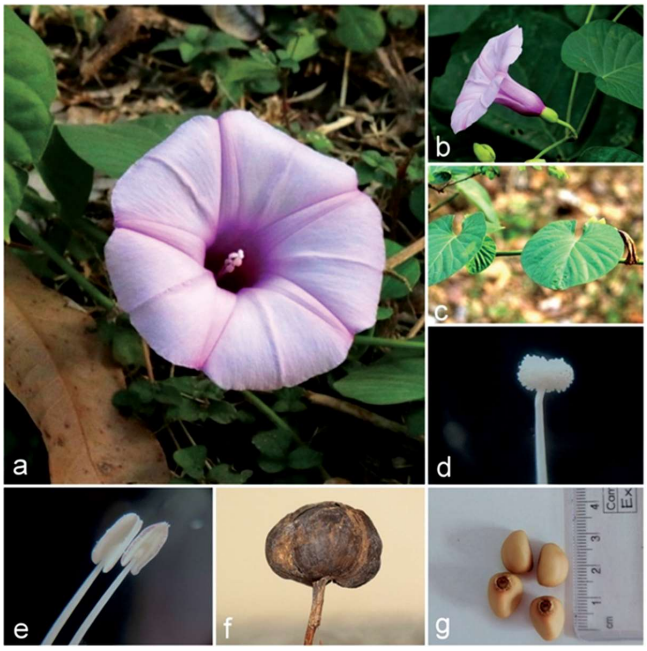

Image 2. *Stictocardia tiliifolia* (Desr.) H. a. Front view of flower; b. Side view of flower; c. Leaves; d. Stigma; e. Stamens; f. Capsule; g. Seeds.

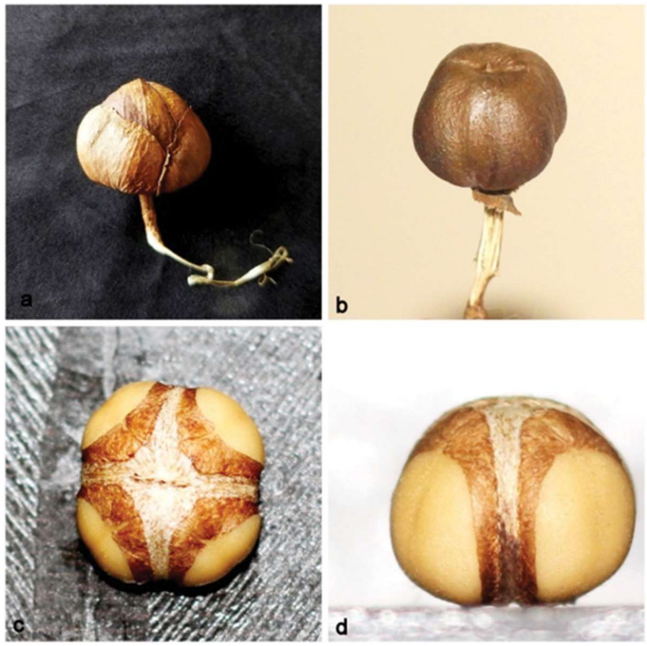

Image 3. *a. Stictocardia tiliifolia* (Desr.) H. fruit with accrescent calyx; b. intact exocarp; c. 4 lobed septum; d. endocarp valves enclosing seeds.

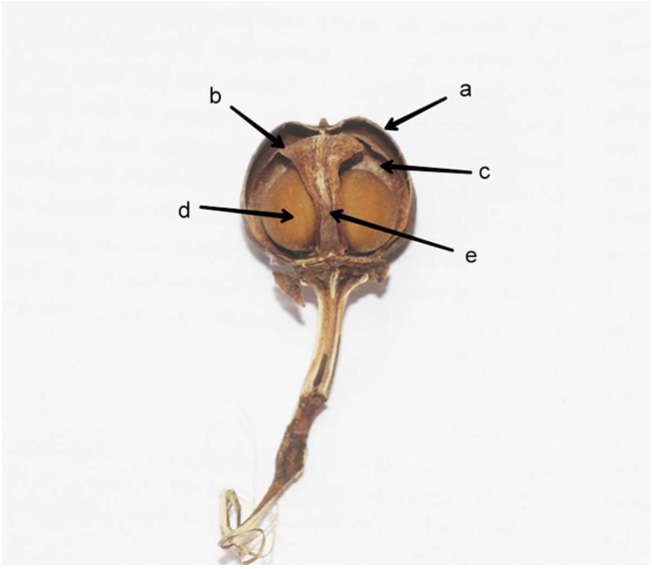

Image 4. Complex fruit of *Stictocardia tiliifolia* (Desr.) H. a. Exocarp; b. Endocarp; c. Endocarp valve; d. Seed and e. 4 lobed septum.

mid-petaline bands, a central guide in each fold, fold margin glabrous. Stamens 5, whitish included in the tube, sagittate, unequal in length, 3.3-4 cm long, dense purplish hair at base of filament; pollen echinulate, globular. *Ovary* 4-celled with 1 ovule per celled. *Stigma* white, bilobed with hair like protuberances, overtopping the anthers, style 3-5.5 cm long. *Capsule* ovoid, globose, 2.5-4 ×2.5-4.5, dark brown in color, 4 celled, glabrous with exocarp and endocarp; *Exocarp* glabrous but rough in touch, brown outside creamish inside, 4 valved, each valve with single septum joining the base, at the top a small beak about 2-6 mm, each valve up to 1.7 ×1.5 cm.

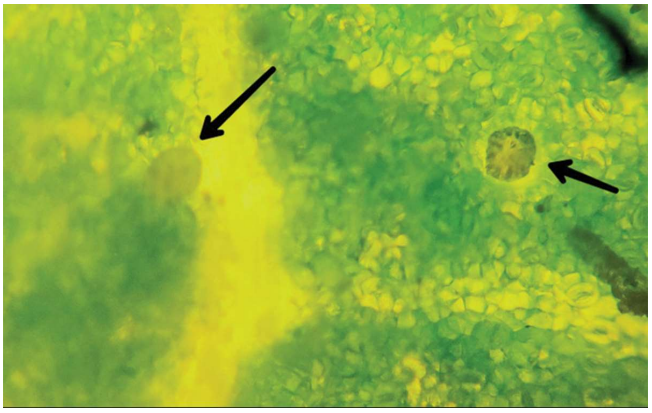

Image 5. *Stictocardia tiliifolia* (Desr.) H. T.S of leaf showing black glands (peltate glands)

Endocarp thin membranous, 4 valved with seed pockets ca. 8 mm deep, seed pockets opening ca. 1.2 cm wide, valves joined by two well-developed creamish white ridges measuring about 2 cm per valve. *Seeds* 4, globular ovoid, creamish brown in color, 10-12 mm × 5 mm wide, pubescent, hairy around hilum.

Flowering & Fruiting: December to March

Habitat: The species is fairly common on sandy soil in tidal areas along the sea shore and is rare in interior away from the shores of Maharashtra (Mumbai, Ratnagiri and Sindhudurg districts).

Distribution: Asia, Africa, North America, Central America, the Carribbean, Europe, South America, Oceania and India (Maharashtra, Karnataka, Kerala and Tamil Nadu)

Etymology: The generic epithet *Stictocardia* Haill. f. is derived from "*Sticta*", referred to the sunken glands while "*cardia*" referring to the heart-shaped leaves (Gunn 1972) while the specific epithet '*tiliifolia'* is referring to the leaves resembling that of the Linden (Tilia) tree (Johnson 2004).

Conservation status: Least concern

Specimens examined: India: Maharashtra, Mumbai, Mahim sea shore (Pahelgadh), 8 Jan 1957, Patel Viloo M., 0000024936538(BR), http://specimens.kew.org/herbarium/K000830834.

Notes*: S. tiliifolia* has been always confused with *Ipomoea campanulata* (L.) Merrill and can be distinguished from later having glandular dots on lower leaf surface, calyx and corolla, coracious sepals covering the entire fruit at maturity and 7-9 lateral veins on either side of midrib.

Discussion

The genus *Stictocardia* from family Convolvulaceae is known for its characteristic black glands on abaxial leaf surface and unique fruit characters. The taxonomic position of genus *Stictocardia* was always a debatable topic. Though the above stated distinctive characters suggest the retention of *Stictocardia* as genus (Gunn 1972, Austin *et al.* 1978, Austin & Demissew 1996 Ooststroom 1943 and Olaranont *et al.* 2018); recent molecular studies (Munoz-Rodriguez *et al.* 2019 and Wood *et al.* 2020) do not support its retention as separate genus and treat it as *Ipomoea tiliifolia*.

Although molecular studies (Munoz-Rodriguez *et al.* 2019) merge this genus into genus *Ipomoea*, we would like to stick to the genus *Stictocardia* because it shows constant taxonomic characters namely black gland on lower leaf surface, accrescent calyx surrounding the fruit, presence of exocarp and endocarp.

While going through literature it was noted that Gunn (1972 pp. 170-172) who provided the fruit interior drawings of *Stictocardia* were incorrect in several ways where he mentioned fruit as berry and 2 celled with each containing

Table 1. Distinction between *Stictocardia tiliifolia* and *Ipomoea campanulata*

Stictocardia tiliifolia	*Ipomoea campanulata*
Leaf blade with (5) 7-8 pairs of primary lateral veins	Leaf blade with 10-15 pairs of primary lateral veins
Dark glands on the lower leaf surface	No glands on lower leaf surface
Flowers usually solitary	Flowers usually in groups of three
Sepals equal	Sepals unequal
Corolla unlobed or only slightly lobed	Corolla distinctly lobed
Fruits indehiscent	Fruits dehiscent
Seeds short pubescent	Seeds with long, woolly indument

two seeds while in actual the fruit is 4 lobed and 4 seeded (Image 3c-d). After Gunn, Austin & Demissew (1996) observed the more complex nature of fruits and pointed out the presence of exocarp and endocarp in the fruit which was very unique and also provided drawings of fruit interior. Though the drawings of fruit interior provided by Austin and Demissew (1996 pp. 162-163) are complete and correct, one would get confused in understanding the different parts of the fruits as the drawings are complicated to understand. Most of the literature (Gunn 1972, Austin & Demissew 1996, Johnson 2004) describes details only about capsule and seeds; none of the above literature provides detail morphological details about exocarp and endocarp. The complex and unique fruit characters which separate the genus *Stictocardia* from other genera within family Convolvulaceae thus needs to be evaluated in detail. The paper not only provide labeled colorful pictures of dissected fruit interior (Image 3 & 4) in such a way that one would easily know the uniqueness of fruit in *Stictocardia* genus but also complete morphological description of fruit including details of exocarp and endocarp.

It was also noted that the species *S. beraviensis* which is an ornamental climber cultivated for its beautiful crimson yellow corolla is mostly mistaken as *S.tiliifolia* (Gunn 1972, Austin *et al.* 1978 and Kunnath & Mamiyil 2012) where the later can be distinguished by its whitish to pinkish or purple corolla (Austin & Eich 2001 andJohnson 2004). Moreover the occurrence of *S. tiliifolia* in interior away from sea shore is said to be rare as the species is mostly found along sea shore. The present specimen is collected from Kankeshwar which is a 900 ft. high hill and is 15 km away from sea shore; the present study thus reports new distribution record and rare habitat for the species.

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References

Austin DF. 1980. Additional comments on infrageneric taxa in *Ipomoea* (Convolvulaceae). Taxon. 29(4): 501-502.

Austin DF and Demissew S. 1996. Unique Fruits and Generic Status of *Stictocardia* (Convolvulaceae). Kew Bulletin. 52(1): 161-169.

Austin DF and Eich E. 2001. Synopsis of *Stictocardia* with another Madagascan species, *S. mojangensis* (Convolvulaceae). Willdenowia. 31(1): 79-85.

Austin DF, Powell DA and Nicolson DH. 1978. *Stictocardia tiliifolia* (Convolvulaceae) re-evaluated. Brittonia. 30(2): 195-198.

Biju SD, Pushpangadan P and Mathew P. 1999. *Stictocardia sivarajanii*, a new species of Convolvulaceae from Kerala, India. Novon. 9(2): 147-149.

Gunn CR. 1972. Notes on *Stictocardia campanulata* (L.) Merrill and *S. jucunda* (hw.) C. R. Gunn (Convolvulaceae). Brittonia. 24(2): 169-176.

Hallier H. 1893 (dated 1894). Convolvulaceae Africanae. Botanische Jahrbuecher fuer Systematik. 18: 81-160.

Kunnath A. and Mamiyil S. 2012. Pollination Biology of *Stictocardia tiliifolia* (Desr.) Hall. F. (Convolvulaceae). International Journal of Plant Reproductive Biology. 4:5-8.

Munoz-Rodriguez P, Carruthers T, Wood JRI, Williams BRM, Weitemier K, Kronmiller B,Goodwin Z, Sumadijaya A, Anglin NL, Filer D, Harris D, Rausher MD, Kelly S, ListonA and Scotland RW. 2019. A taxonomic monograph of *Stictocardia* integrated across phylogenetic scales. Nature Plants. 5: 1136-1144.

Phate P. and Kawale P. 2019. *Ipomoea clarkei* Hook. f. (Convolvulaceae)–A new distributional record for Raigad District, Maharashtra, India. IJSRR. 8(2): 2970-2976.

Phate P. and Kawale P. 2021. *Ipomoea sindica* Stapf (Convolvulaceae): A new distribution record from Raigad Maharashtra, India. The Journal of Plant Science Research. 37(1): 109-113.

Olaranont et al 2018. Investigation of the black dots on leaves of *Stictocardia* (Convolvulaceae) using anatomical and histochemical analyses. Flora. 249: 133-142.

Ooststroom SJ van. 1943. The Convolvulaceae of Malaysia IV. Blumea. 5(4): 339-383.

Sagar HC, Aditya PK, Pratik VP and Preeti VP. 2014. First report of *Ceropegia bulbosa* Roxb. from coastal habitat of Kulaba fort, Alibag, Maharashtra. Indian Journal of Plant Sciences. 4(4): 23-27.

Singh NP and Karthikeyan S. 2000. Flora of Maharashtra State: Dicotyledones, Vol. II (Combretaceae to Ceratophyllaceae) Botanical Survey of India.

Verdcourt B. 1963. Convolvulaceae. In: C. E. Hubbard & E. Milne-Redhead, Flora of Tropical East Africa. Pp.: 161.

Wood JRI, Munoz-Rodriguez P, Williams BRM and Scotland RW. 2020. A foundation monograph of *Stictocardia* (Convolvulaceae) in the New World. Phyto Keys. 143: 1-823.