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RESEARCH ARTICLE

Present status of *Pubistylus andamanensis* Thoth. in Andaman Islands and its IUCN Red List Assessment

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Abstract

The endemic genus *Pubistylus* Thoth. was first described from the Interview Island in the North Andamans. The genus is represented solely by the species, *Pubistylus andamanensis* Thoth. It was previously known by a few collections from the North Andaman and Little Andaman Islands. The present authors have recently recorded the species from the Middle Andaman Island, showing its range extension in the Andaman group of Islands up to the Middle Andamans. Considering the limited distribution in the new locality and the decline in previously recorded areas, the species has been assessed as Endangered by applying the IUCN Red List Category and Criteria. As part of the ongoing activities on *ex-situ* conservation of endemic plants, the species has been introduced in the Dhanikhari Botanical Garden cum Arboretum of Botanical Survey of India, Andaman and Nicobar Islands.

Keywords: Conservation, Endemic Genus, Middle Andaman Island, Pubistylus, Range extension

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Introduction

The endemic genus *Pubistylus* Thoth. is one of the two monotypic genera in the tribe Alberteae of family Rubiaceae. *Octotropis* Bedd. is the other member that has been described from Travancore Hills in 1874. The type species, *Pubistylus andamanensis* Thoth. was described in 1966 from Interview Island in North Andamans. The species was subsequently collected from different localities in Little Andaman Islands (Hut Bay & Dugong Creek by N Bhargava; Quarryroad & 4 km north from Hut Bay by L Rasingam) and North Andaman (Interview Island by K Thothathri, East Coast by Lakshminarasimhan, West Coast and cave forest, by GS Lakra & VM Radhakrishnan). There was no additional information regarding its presence in the Andaman and Nicobar Islands until the present authors identified approximately25mature individuals, along with a few seedlings, collectively from Chitragud hill forests and Adajig forest in the Middle Andamans. Considering the restricted distribution and vulnerability of its habitat, the species has been assessed for the IUCN Red List Category.

Materials and methods

Survey and identification

Extended distribution of *Pubistylus andamanensis* was recorded during a floristic survey in 2021 at Chitragud hills and

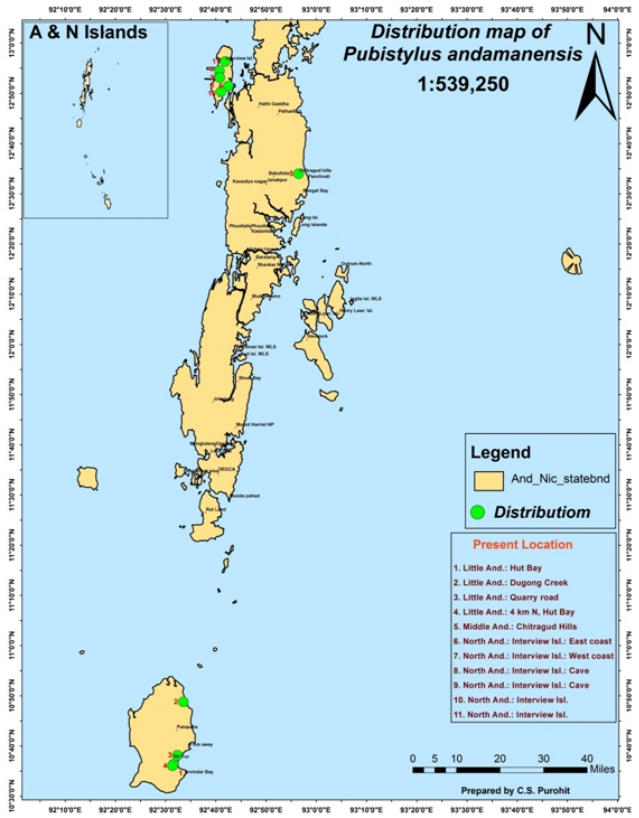

Fig. 1: Map showing the distribution of *Pubistylus andamanensis* Thoth. in Andaman & Nicobar Islands.

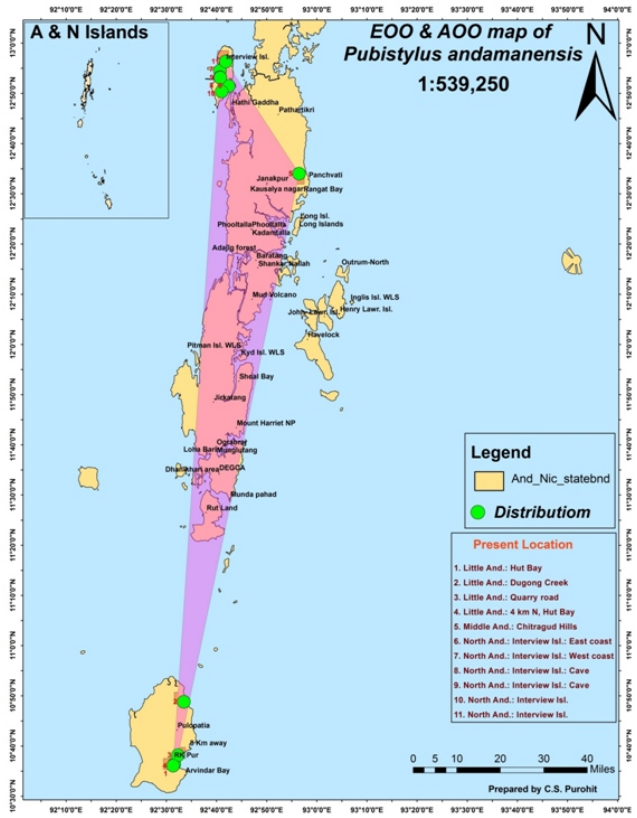

Fig. 2: Map showing EOO & AOO of *Pubistylus andamanensis* Thoth. in Andaman & Nicobar Islands.

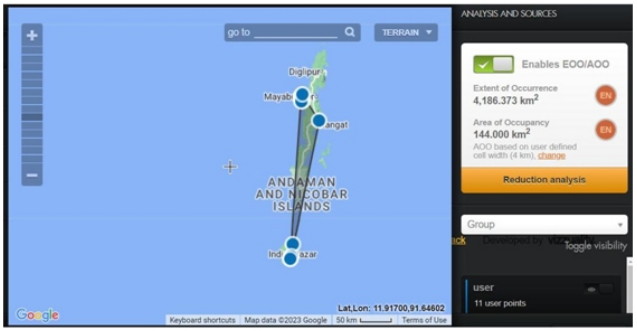

Fig. 3: Convex hull of occurrence points for analysis of EOO and AOO using GeoCAT.

Adajig forest in the Middle Andamans (Fig.1). The voucher specimens were prepared and deposited in the herbarium of Botanical Survey of India, Andaman and Nicobar Regional Centre (PBL). The identity and the present distributional status of the species were determined with the help of relevant literatures (Thothathari, 1966; Gangopadhyay & Chakrabarty, 1988, 1993; Bhakat, 1990; Ali & Robbrecht, 1991; Deb & Rout, 1993; Hajra *et al.,* 1999; Sinha, 1999; Pandey & Diwakar, 2008; Selvan, 2014; Murugan *et al.,* 2016; Mao&Dash, 2020; Kamble, 2020; Rasingam & Diwakar, 2021; Singh *et al.,* 2021; Purohit & Vivek, 2022; Purohit *et al.*, 2023) and herbarium specimens deposited at PBL, CAL, K, and BLAT.

Assessment with Geo CAT (geospatial conservation assessment tool)

Current and past distribution maps of the species were prepared with the help of GPS coordinates of collection localities of earlier reports and the present survey (Fig.1) and its population data were used to assess the IUCN threat category (IUCN, 2013). Online software GeoCAT (http://geocat.kew.org/.) was used to calculate the Extent Of Occurrence (EOO) and Area Of Occupancy (AOO) by keeping a grid size 4×4 km (Fig. 2 &3).

Results and discussion

The species has been dealt with in the paper with a detailed description, distribution, ecology, notes, threat status, distribution maps, AOO & EOO maps and photographs.

Pubistylus andamanensis Thoth., Reinwardtia 7: 283. 1966. Bhakat, J *Econ.Taxon.Bot.*14 (1): 215.1990; Ali & Ribbrecht, Blumea 35(2): 305. 1991. *Diplospora parkinsonii* Gang. et T Chakrab., *J Econ. Taxon. Bot.*12 (2): 497.1988; Gangopadhyay & Chakrab., *J Econ. Taxon. Bot.*17 (2): 439. 1993. *Diplospora andamanensis* (Thoth.) Gang & T Chakrab, *J Econ. Taxon. Bot.* 18 (2): 397. 1994;

AA Mao & SS Dash, *Fl. Pl. India Annot. Checkl.* 1: 698. 2020.

Type: Interview Island, 12.02.1959, *K Thothathri* 9204A (holo CAL-551295). *Local name: Haddi-Balli.*

Shrub or small tree, 2–4 m high, glabrous; branches more or less drooping, glabrous; stem angular. Leaves elliptic to lanceolate, 8–9 × 2–3.5 cm, entire, membranous, caudate-acuminate at apex, cuneate at base, glabrous; petiole 5.5–8 mm long; stipule broadly ovate, acute. Inflorescence panicled cyme, 3.5–5.5 cm long, axillary or rarely terminal. Flowers white, 3.2–5.2 mm long; pedicels slender, 4.5–8 mm long; bract small, ovate, ciliate; bracteole just below the middle of the pedicel. Calyx tube turbinate, 1–2 mm long, slightly lobed. Corolla campanulate, 2.5–3.5 mm long, 5-lobed; lobes ovate, twisted, villous within. Stamens 5; filaments short; anthers 1–1.5 mm long, linear-oblong, 2-celled. Ovary 2-celled; ovule single in each cell; style clavate, 2–2.4 mm long, pubescent; stigma bifid. Fruit globular to sub-globular, deep green, glabrous, *c*. 1 cm in diameter (Fig. 4).

Flowering and Fruiting

Fig. 4: *Pubistylus andamanensis* Thoth.: (A-D) Natural Habitats & Habits; (E-F) Twigs showing leaf morphology; (G-I) Inflorescence & Close-up of flower; (J-M) Fruiting branches & Close-up of fruits.

August–December (All the previous records indicate that the flowering and fruiting of the species occur from August to September. However, the present study has documented flowering and fruiting in December, indicating the extension of the reproductive period.

Habitat

The species is growing in the Inland evergreen forests between 20–150 m elevations, in association with *Mesua manii* (King) Kosterm., *Cassia fistula* L., *Knema andamanica* (Warb.) WJde Wilde, *Ardisia oxyphylla* Wall. ex A.DC., *Blachia andamanica* (Kurz) Hookf, *Dillenia andamanica* CE Parkinson, *Grewia calophylla* Kurz ex Mast, *Canarium euphyllum* Kurz, *Capparis floribunda* Wight, *Drypetes longifolia* (Blume) Pax & K Hoffm, *Ficus racemosa* L., *Garcinia xanthochymus* Hookf, *Myristica andamanica* Hookf, *Terminalia procera* Roxb., *Vitex diversifolia* Kurz ex CB Clarke, etc.

Distribution

INDIA: Andaman and Nicobar Islands, North Andamans (Interview Island: East & West coast, cave forest); Little Andaman (Hut Bay, Dugong Creek, Quarry road, 4 km); Middle Andaman (Chitragud hill, Adajig forest). Endemic.

Threat

The population of *Pubistylus andamanensis* is found in fragments in its habitats with a limited number of individual plants. The stem is hard and straight. Local people prefer the stem for crafting polls and sticks. In addition, unsustainable forest clearing poses a threat to its survival.

Voucher specimens

Andaman Islands, Middle Andaman, Chitragud hills, forest trekking path, N12°32'48.79", E 92°58'21.65", 12.12.2021, *CS Purohit & Vivek CP* 34201 (PBL); Adajig forest, N 12°18'21.10", E 92°46'44.55", 13.12.2021, *CS Purohit & Vivek CP* 34212 (PBL).

Others specimen examined

Little Andaman, Way to Forest Nursery, Hut Bay, 14.08.1976, *N Bhargava* 4118 (PBL-9838, 9839); Dugong Creek, 25.11.1977, *N Bhargava* 6561 (PBL-14586, 14587); Quarry road, 22.04.2006, *L Rasingam* 20950 (PBL-24760, 24761); 4 km North from Hut Bay, 27.05.2004, *L Rasingam* 19876 (PBL-25118, 25119). North Andaman, Interview Island: East coast, 22.02.1991, *P Lakshminarasimhan* 15665 (PBL-19759, 19760); Interview Island: way to West coast, 23.09.2010, *GS Lakra & VM Radhakrishnan* 28725 (PBL-27971, 27972);

Interview Island: way to cave forest, 25.02.2011, *GS Lakra* 28855 (PBL-28317, 28318); Interview Island: way to cave forest, 26.02.2011, *GS Lakra* 28871 (PBL-28347, 28348); Interview Island, 12.02.1959, *K Thothathri* 9204A (CAL-551295).

Notes

Gangopadhyay & Chakrabarty (1988) synonymized the genus *Pubistylus* Thoth. under *Diplospora* DC., highlighting the morphological similarities between the two genera. Subsequently, Bhakat (1990) identified distinct morphological characteristics of *Pubistylus*, including acute stipules, more branched cymes, lax panicle, 5-merous flowers, pubescent and clavate style, and 2-celled pendulous ovary with single ovule per cell. Ali & Robbrecht (1991), while working on the Tropical Asian and Australian species of Rubiaceae included in *Diplospora* and *Tricalysia* A.Rich. ex DC., favoured the reinstatement of *Pubistylus*. Deb & Rout (1993) supported Bhakat's argument for the reinstatement by providing additional characteristic features and clarifying the taxonomic position. Gangopadhyay & Chakrabarty (1993) recognized *Diplospora* and *Pubistylus* as distinct sections based on the comparative length of inflorescence, suggesting that *Diplospora andamanensis* (Thoth.) Gang & T Chakrab. and *Diplospora parkinsonii* Gang & T Chakrab. should be treated conspecific with *Pubistylus andamanensis*. Govaertz (2003) adopted the treatment proposed by Gangopadhyay & Chakrabarty (1993). In a more recent study, Mao & Dash (2020) also treated *Pubistylus* as an established endemic genus in the Andaman Islands.

Red list assessment as per IUCN criteria

For Red List assessment of *Pubistylus andamanensis*, we used the guidelines of IUCN Red List criteria (IUCN, 2013). Criteria A has not been followed due to non-availability of sufficient quantified data on population reduction over specified time. The EOO of the species has been calculated using the GeoCAT online tool as 4,186 km^2 (Fig. 3), which is between the threshold of 100 km^2 and 5000 km^2, favoured its placement under B1 Endangered Category. The AOO has been calculated as 144 km^2 (Fig. 3) which is between the threshold of 10 km^2 and 500 km^2,favoured its placement under B2Endangered Category.

The species had previously been documented in five sites in the Andaman Islands, of which it could be relocated at one site from Little Andaman. This indicates a decline in its population within its natural habitat. Further, the population was found to have fragmented into the newly identified 2 sites. Over the past 4 years, a gradual decrease in the number of mature individuals has been noted, suggesting its placement in B1+2ab under the Endangered category. The consistent reduction in its AOO, EOO, and overall population justifies its placement in B1+2ab(i,ii,iv,v) under the Endangered category. Due to insufficient data or a lack of studies, Criteria C has not been applied.

The species has been distributed in small pockets in its natural habitats and the total number of mature individuals has been counted as about 103,which is between the threshold of 50 and 250 for placing it under D1 Endangered category. No sufficient data was available for applying the Criteria E. Hence, its final assessment using IUCN criteria best fitted under the category Endangered [criteria - EN/B1+2ab(i,ii,iv,v); D1].

Conclusion

The present study identifies the Chitragud hills and Adajig forest in Middle Andaman as new distribution sites for the endemic tree species, *Pubistylus andamanensis*, where they are found restricted in numbers. Approximately 25 individual plants have been located collectively in the newly recognized sites. This species was previously documented in five different localities from the Little Andaman Islands and North Andaman Islands (collection from five different localities in the Interview Islands has been considered as a single location). Of these five localities, it has been able to relocate from only one site in the Little Andamans. The EOO and AOO have exhibited a gradual decrease, attributed to their limited distribution, potential habitat loss, and declining population. It has been noted that several of the areas where the species occurs are currently under threat from various biotic pressures. Following the guidelines of the IUCN Red List, this endemic tree species has been assessed globally as Endangered [EN/B1+2ab (i,ii,iv,v); D1].

The species has been conserved *ex-situ* in the Dhanikhari Experimental Gardencum Arboretum of Botanical Survey of India (BSI), Andaman and Nicobar Islands, with a view to multiplying and reintroducing the species in its natural habitats. Furthermore, BSI educates the local settlers about the importance of conserving the biodiversity of the Islands.

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