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Author Affiliation:
[1]Department of Botany, St. Joseph's College, Trichy – 620 002, Tamil Nadu, India
[2]The Rapinat Herbarium and Centre for Molecular Systematics, St. Joseph's College (Autonomous), Tiruchirappalli, Tamil Nadu, India
[3]University College of Science, Osmania University, Saifabad, 500 004, Hyderabad, Telangana State, India
[4]Department of Botany, Madura College, Madurai – 625 011, Tamil Nadu, India

[*]**Corresponding author**
Department of Botany, St. Joseph's College, Trichy – 620 002, Tamil Nadu,
India
Email: jktagore@gmail.com

Contact List

Johny Kumar Tagore	jktagore@gmail.com
Raja P	raja.plantbiology@gmail.com
Sebastian Soosairaj	pspsoosai@yahoo.co.in
Venkat Ramana M	venkat.botany@gmail.com
Jansirani P	jansishankar@gmail.com

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Status assessment of the two Acanthaceae species strictly endemic to Saddle Peak National Park of Andaman and Nicobar Islands, India

Johny Kumar Tagore[1*], Raja P[2], Sebastian Soosairaj[1], Venkat Ramana M[3], Jansirani P[4]

ABSTRACT

The paper showcases the up-to-date distribution and IUCN threat status evaluation of *Justicia andamanica* Vasudeva Rao and *Staurogyne andamanica* Ramana et al. (Acanthaceae), which are strictly endemic to Saddle Peak National Park, North Andaman. Field study data reveals that both these species are classified as critically endangered as per 2001 IUCN Red List Categories and Criteria.

Keywords: *Justicia andamanica*, *Staurogyne andamanica*, Critically Endangered, Status Assessment, IUCN, Saddle Peak National Park.

1. INTRODUCTION

Endemism plays a crucial role in determining a region's hotspot status. Endemic species are exclusively found within specific geographic areas, making them particularly vulnerable to the threat of extinction (Myers et al., 2000). The uniqueness of taxa within an area is often measured through endemism, making it a vital factor in prioritizing locations for conservation efforts (Myers et al., 2000). Moreover, the confinement of a species to a solitary habitat makes it highly susceptible to environmental and climate changes.

To safeguard endemic species, it is crucial to have a comprehensive understanding of their distribution and conservation status. Unfortunately, most floristic databases lack this vital information regarding these species' whereabouts and protection. Moreover, numerous species rely on outdated research data without recent fieldwork. Consequently, only a handful of studies have investigated the population numbers and current status of certain endemic plants of India (Bagathsingh and Benniamin, 2021; Baig et al., 2014; Muthumperumal et al., 2020; Panda, 2013; Pethe et al., 2015; Purohit et al., 2020; Rao et al., 2010; Rao et al., 2011; Rao et al., 2012; Tagore et al., 2015; Tagore et al., 2016).

Numerous taxa worldwide face significant threats from habitat loss, exploitation, biological invasions, industrialization, pollution and accelerated climate change. Consequently, many species face the risk of extinction, rendering plant biodiversity conservation challenging due to the scarcity of data available to assess each species' threat status (Brummitt et al., 2008).

The study area

The Islands of Andaman and Nicobar form the most extensive archipelago system in the Bay of Bengal and are popularly known as the 'Emerald Isles'. The Andaman Islands span approximately 8,249 km² with a coastline of 1,962 km, forming an arc that stretches approximately 912 km from north to south, with a maximum width of 57 km. These islands are located in the Indo-Burma Biodiversity Hotspot and were formed through the convergence and merging of continental fragments. The Andaman group of islands covers a land area of about 6,408 km², with a length of 467 km and a width of 52 km.

In 1979, the Saddle Peak forests (Figure 1) were designated as a National Park. The Saddle Peak National Park covers a total area of 32.4 km² and is situated in the Diglipur forest division of North Andaman. This park is classified under Category II of IUCN protected area categories (Stolton et al., 2013), where trekking is allowed by the Forest Department with prior permission. The climate in the area is generally oceanic, characterized by temperature fluctuations that range from 20 to 30°C. Heavy rainfall occurs from June to October. Numerous indigenous species live in Saddle Peak National Park's tropical and deciduous forests. Champion and Seth, (1968) called this Southern Hilltop Evergreen Forest (1A / C3).

Figure 1 Study Area: Saddle Peak National Park

2. ASSESSMENT

Acanthaceae is estimated to have about 2500 species distributed in approximately 250 genera globally. The Andaman Islands has about 18 genera and 38 species (Pandey and Diwakar, 2008). The species taken for the present study - *Justicia andamanica* and *Staurogyne andamanica* – are exclusively endemic to the Saddle Peak National Park. The population status and distribution of *Justicia andamanica* and *Staurogyne andamanica* were carried out in and around Saddle Peak National Park. Geographical coordinates were recorded using GPS. The species were evaluated as per IUCN Red List criteria, v.3.1 (IUCN, 2012).

The area of occupancy (AOO) for the study in Saddle Peak National Park was determined using the IUCN sampling methodology from 2011. To achieve this, the entire study region was divided into 70 grids, each covering an area of 4 km² with 2 km cell-width. These grids were then numbered to facilitate easy identification of their locations (Figure 2). The Minimum Convex Polygon method was utilized to calculate the range size, estimating the species' Extent of Occurrence (EOO). Additionally, the species' Area of Occupancy (AOO) within the grid was examined, considering terrain features and altitude. Following this, formal thresholds based on population size and geographic ranges were applied to categorize the EOO and AOO values.

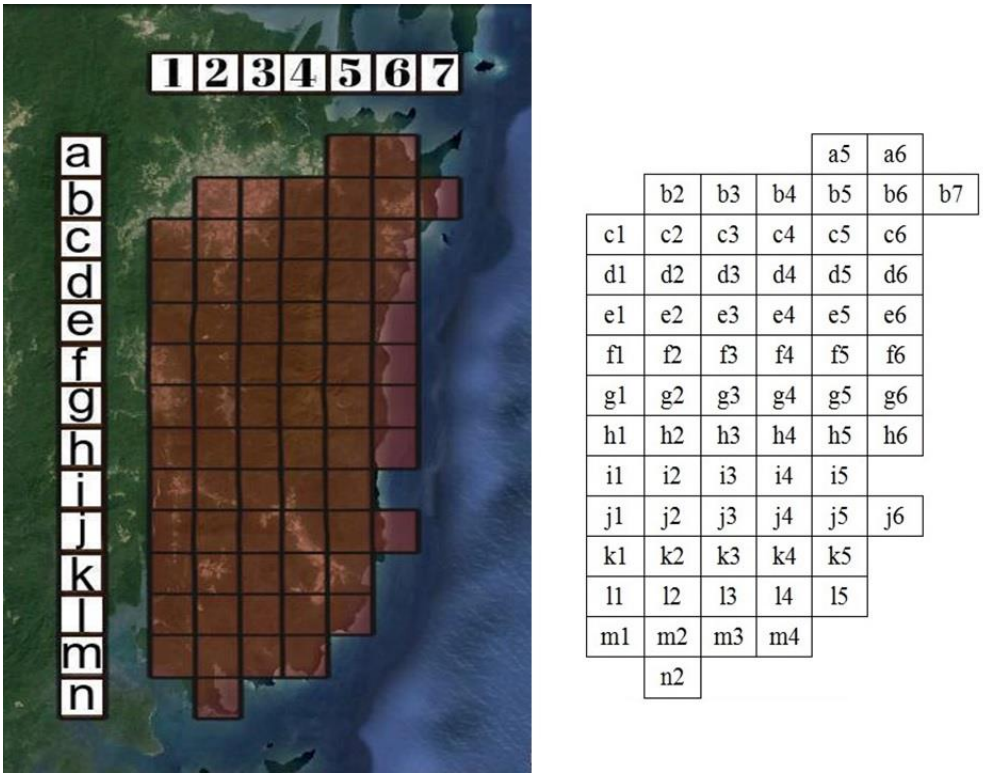


Figure 2 Study Area Grid Map

***Justicia andamanica* (Vasudeva Rao) Vasudeva Rao in JETB 18(1): 249. 1994. *Rostellularia andamanica* Vasud. in JETB 6(3): 719. 1985 (Figure 3)**.

Soboliferous herbs. *Stems* thin (0.8–1.2 mm diam.), 20–35 cm tall, ribbed or striate (obscurely bisulcate) marked with white cystoliths, especially near the nodes, branched, rarely simple. Lower internodes are considerably elongated (2.5–4 cm long); nodes are swollen with a glabrescent-setulose annulus between the petioles; lower nodes are barren due to early abscission of leaves. *Leaves* opposite, linear-lanceolate to lanceolate, 1.2–6.0 × 0.2–0.9 cm, margin shallowly distantly, crenate strigose, acute at both ends, decurrent on short petiole below, chartaceous; upper surface with prominently raised transverse lines of cystoliths, midrib presented, strigose, lateral veins invisible, very sparsely strigose on lamina; lower cover with veins raised and strigose especially on veins, sparsely on lamina; lateral nerves (4–) 5–6 pairs, arcuate ascending; petiole short 1–1.8 mm long, channelled above (due to decurrent lamina) and strigose on margins.

Inflorescence terminal, solitary spikes, 1–4 cm long peduncle, axis quadrangular, strigose, with flowers 2–3 mm apart. Floral *bracts* acicular-linear, membranous margin up to half length, strigose on back of midrib and margins, 5–6 mm long, 0.3–0.5 mm wide; bracteoles 2, similar to bracts but thinner. *Calyx* partite to base, lobes sub-equal, four well-developed lobes linear or lanceolate, acuminate, 5–8 mm long. 0.7 mm broad, membranous up to 2/3 length, strigose on margin and back of midrib, one lobe reduced filiform, hairy, *ca*. 1.5 mm long. *Corolla* bilabiate, imbricate, widening from a narrow base, purplish-pink, 0.7–0.9 cm long, 0.4 cm broad; upper lip emarginate at the apex with a glabrous stylar canal; lower lip obovate, palate, 3-lobed at peak, lobes rounded, (sometimes lateral lobes emarginate), mid lobe pubescent-glabrescent at apex outside.

Stamens 2, staminodes 0; anthers *ca*. 1.5 mm long, 2-thecae, thecae placed at unequal levels upper muticus, lower with white appendage (spurred); free part of filament flat, 3–5 mm long, decurrent below, densely pubescent at base. *Ovary* oblong-cylindric, surrounded by a cup-like torus at the base, 1–3 mm long, pubescent at apex, 2-loculed; style filiform, 3–6 mm long, pubescent at the bottom, stigma simple. *Capsules* elliptic-oblong, smooth except for pubescence at apex, shortly apiculate, 4-seeded (2 in each locule), *ca*. 6 mm long. 1.5–2 mm broad. *Seeds* oblong, acute at apex, *ca*. 1 mm long, 0.7 mm broad, reticulate.

Flowering & Fruiting

April–June.

Habitat & Ecology

Rare in inland forests at an altitude of 400–650 m.

Grids present with
d4, e4, f4, g3, g4 & g5.

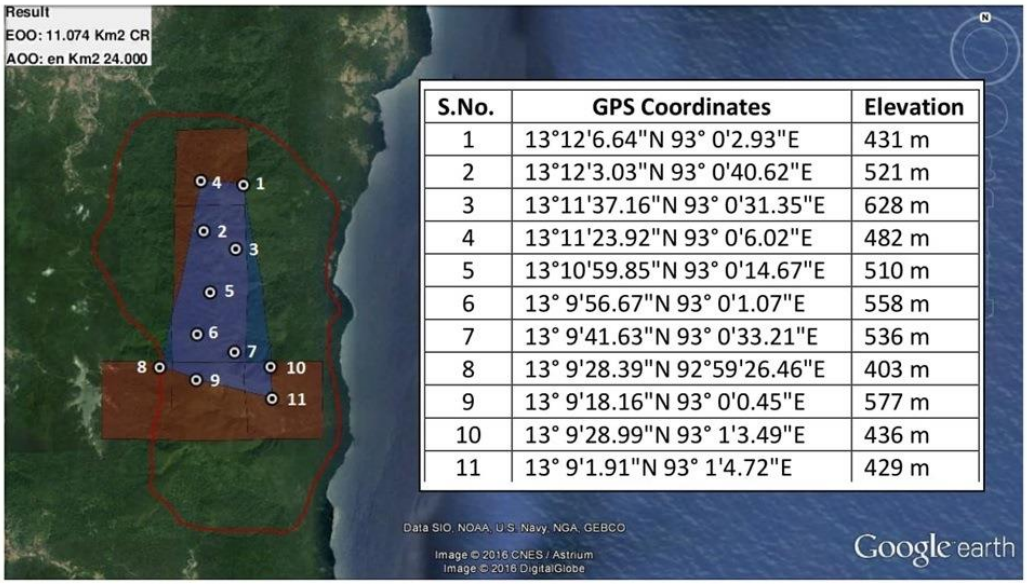
Figure 3 *Justicia andamanica* – Herbarium, Habitat and Flower

Threat Assessment
The conservation status of this species was evaluated using the IUCN Red List Criteria Version 3.1 (IUCN, 2012) from periodic field observations. Based on research, this species meets criteria B1 for Critically Endangered (Figure 4).

Criterion B1
This species was primarily seen at 400–650m altitudes. This species is found disbursed only at the Saddle Peak range (sub criterion a). The population has been steadily decreasing due to the constant tourism and trekking activities (sub criterion b), which have been detrimental to the quality of habitats (iii) and the construction and reclamation of a dam on the Kalpong River. The EOO calculated is about 11 km2 as this EOO estimate is less than 100 km2, which makes the species qualify for the category Critically Endangered. Therefore, based on the assessment using the IUCN Criteria, *Justicia andamanica* has been classified as Critically Endangered [B1ab(iii)].

***Staurogyne andamanica* Ramana, Sanjappa, Venu & Chorghe in Kew Bull. 69: 9506. 2014 (Figure 5)**
Tiny herbs with a woody rootstock, standing 3–5 cm high. The stem is short and covered in appressed hairs, typically unbranched but occasionally branching. Leaves form rosettes close to the ground, arranged opposite each other and, more significantly, measuring 2–3 cm long and 1–1.5 cm wide. They have an ovate, truncate, or rounded base, with entire margins and a subacute apex. The upper surface of the leaves is green, while the lower surface appears pale, both bearing hairs along the nerves.

There are 5–6 pairs of lateral nerves join above, forming an intramarginal loop. Branches display smaller leaves, about 1–1.5 cm long and 0.4–0.8 cm wide, with petioles measuring 2–5 mm long, covered in rusty villous. The inflorescence consists of a terminal spiciform thyrse, approximately 1.5–2 cm long, bearing 3–6 flowers. It is densely covered in two types of hairs: long, white multi-cellular hairs and spreading short gland-tipped colourless hairs. The flowers are pale pink, measuring 8–10 mm long, with pedicels up to 3 mm long, covered in fur. Lower bracts are alternate, elliptic-obovate, measuring 5–6 mm long and 1.5–2 mm wide, with indistinct lateral nerves and hairy margins.



S.No.	GPS Coordinates	Elevation
1	13°12'6.64"N 93° 0'2.93"E	431 m
2	13°12'3.03"N 93° 0'40.62"E	521 m
3	13°11'37.16"N 93° 0'31.35"E	628 m
4	13°11'23.92"N 93° 0'6.02"E	482 m
5	13°10'59.85"N 93° 0'14.67"E	510 m
6	13° 9'56.67"N 93° 0'1.07"E	558 m
7	13° 9'41.63"N 93° 0'33.21"E	536 m
8	13° 9'28.39"N 92°59'26.46"E	403 m
9	13° 9'18.16"N 93° 0'0.45"E	577 m
10	13° 9'28.99"N 93° 1'3.49"E	436 m
11	13° 9'1.91"N 93° 1'4.72"E	429 m

Figure 4 Location Map; Study Area; Minimum Convex Polygon – EOO: 11 km^2; AOO: 24 km^2; Number of GPS Locations: 11

Upper bracts are narrowly oblanceolate, narrowed at the base, and either acute or distinctly apiculate at the apex, sometimes awned. They are covered in long spreading and short gland-tipped multi-cellular hairs, measuring 3.5–4 mm long. Two bracteoles are present, measuring 3–4 mm long, linear-lanceolate, and shorter than the calyx, also with hairs. The *Calyx* possesses five lobes of unequal size (1+2+2) with acute tips and glandular hairs. The posterior lobe measures 6.5–7 mm in length and 0.5–0.7 mm in width, exhibiting an oblong-lanceolate shape. Conversely, the anterior pair is 5–5.5 mm long and 0.3 mm wide, characterized by a linear-lanceolate appearance, while the lateral pair measures 4–4.5 mm in length and 0.1 mm in width, displaying a linear shape. The Corolla is 5–6.5 mm long, possessing a ventricose structure and prominent veins.

Externally, it is covered in hairs and consists of five patent and unequal lobes that are suborbicular in shape. The lobes are also hairy on the outside. The flower contains four stamens, which are didynamous and inserted near the base of the corolla tube. The stamens are included and have 1.7–3 mm long filaments. The filaments are broad and flap-like, featuring a clearly visible vein running through them. They are translucent, noticeably hairy, and have a brief bifurcation at their tips. The stamens carry anthers on wide connectives, with the anthers measuring around 0.5 mm in length. When in bloom, the anthers separate and are almost equal in size. On one side, they exhibit a pinkish hue and are minutely hairy, having muticous bases and dehiscing through pores.

Additionally, a staminode is present, measuring approximately 0.5 mm in length. The *ovary* measures approximately 1 mm long, displaying an ovoid-oblong shape and a short stalk at the base. It is smooth (glabrous) and contains 15–20 ovules arranged in two rows from the base to near the apex. The style is 3–4 mm long, smooth (glabrous), and possesses a two-lobed stigma, with one lobe being longer at about 0.7 mm, simple in shape, and the shorter lobe measuring around 0.2 mm, notched at the apex. The capsule is ovoid-oblong, about 2 mm long, and remains enclosed within the persistent calyx. It is smooth (glabrous) and contains 15–20 seeds.

Flowering

January–February.

Habitat & Ecology

This species is typically found growing in open scrub forests with moderate slopes, often near dry water passages and disseminated rocks, primarily in loamy soils. Its preferred altitude range is around 225 meters.

Grids present with

e2.

Figure 5 *Staurogyne andamanica* – Habitat, Inflorescences and Flower

Threat Assessment

The population of this species was found in a single place, where about 10–15 individuals were seen. The species' conservation status was regularly observed per the IUCN Red List Criteria Version 3.1 (IUCN, 2012). This criterion assesses the species' risk of extinction based on its population size, range, habitat and threats. Criteria B2, C2 and D make this species Critically Endangered. B1 cannot be approximated because the EOO must forecast at least 3 sites (Figure 6).

Figure 6 Location Map; Study Area; Minimum Convex Polygon – EOO: 0 km²; AOO: 4 km²; Number of GPS Locations: 1

Criterion B2

This species only occurs at Kalpong dam (subcriterion a). *Staurogyne andamanica*'s 2 km2 grid AOO is 4 km2. The population is noted to steadily decrease (subcriterion b) based on the quality of habitats (iii) the construction and reclamation of the dam on the Kalpong River and the introduction of exotic species such as *Gliricidia* sp., and plantation of commercially important species such as *Terminalia* sp. in the reclamation of the dam construction site and in terms of mature individuals (v). The species qualifies for Critically Endangered based on the estimated population size of less than 10 km2.

Criterion C2

The creation and reclamation of the dam site on the Kalpong River pushes this species to the extreme, causing habitat quality to degrade. 10–15 people were mature.

Criterion D

The species is a candidate for Critically Endangered because it had just ten to fifteen mature individuals during the study period. Therefore, based on the assessment using the IUCN Criteria, *Staurogyne andamanica* has been classified as Critically Endangered [B2ab(iii,v); C2a(i); D].

3. CONCLUSION

The results of the present study assessing the two Acanthaceae species have unequivocally indicated that these species face an alarming threat of extinction and thus qualify for the Critically Endangered (CR) category. This classification highlights the urgent need for conservation efforts to ensure the survival of these species in their native habitats. Given their narrow distribution and limited population sizes, it is essential to closely monitor these species' status and trends. Regular monitoring will allow conservationists and researchers to gather valuable data on population abundance, distribution, and any potential threats they may face. By monitoring these species, we can assess the effectiveness of conservation measures and make informed decisions on adaptive management strategies.

Furthermore, it is highly recommended to undertake further explorations in the nearby habitats. Extensive surveys and assessments of adjacent areas can provide valuable insights into potential additional populations or habitats that these species may occupy. Such explorations may uncover crucial information about their ecological requirements, dispersal capabilities, and potential interactions with other species in the surrounding ecosystems. We can develop targeted conservation strategies by expanding our understanding of these species' habitat preferences, range, and ecological dynamics. This may include measures to protect and restore their native habitats, mitigate threats such as habitat loss or degradation and implement actions to enhance their reproductive success and genetic diversity.

Overall, the critical status of these Acanthaceae species emphasizes the significance of collaborative efforts among researchers, conservation organizations and local communities. By engaging in ongoing monitoring, rigorous research, and habitat exploration, we can enhance our chances of preserving these species and working towards their long-term survival.

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Conflicts of interests

The authors declare that there are no conflicts of interests.

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Ethical approval

The ethical guidelines for plants & plant materials are followed in the study for sample collection & identification.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Bagathsingh C, Benniamin A. Assessment of threat status of the holly fern *Cyrtomium micropterum* (Kunze) Ching (Polypodiopsida: Dryopteridaceae) in India using IUCN Regional guidelines. J Threat Taxa 2021; 13(1):17554–17560. doi: 10.11609/jot.6133.13.1.17554-17560
2. Baig BA, Ramamoorthy D, Wani BA. Population Status and Conservation Prioritization of Some Threatened Medicinal

Plants of Kashmir Himalayas. Int J Appl Biol Pharm Technol 2014; 5(4):1–14.
3. Brummitt N, Bachman SP, Moat J. Applications of the IUCN Red List: Towards a global barometer for plant diversity. Endanger Species Res 2008; 6:127–135.
4. Champion HG, Seth SK. Revised Forest Types of India. Govt. of India Publications, New Delhi 1968.
5. IUCN. Guidelines for Using the IUCN Red List Categories and Criteria, Version 9.0. Prepared by the Standards and Petitions Subcommittee. IUCN, Gland, Switzerland and Cambridge, UK 2011.
6. IUCN. IUCN Red List Categories and Criteria, Version 3.1, Second edition. Gland, Switzerland and Cambridge, UK, IUC N 2012.
7. IUCN. IUCN Red List Categories and Criteria, Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzer land and Cambridge, UK 2001.
8. Muthumperumal C, Balasubramanian P, Rasingam L. An assessment of the conservation status of a presumed extinct tree species *Wendlandia angustifolia* Wight ex. Hook.f. in southern Western Ghats, India. J Threat Taxa 2020; 12(4):1546 8–15474. doi: 10.11609/jott.5148.12. 4.15468-1547
9. Myers N, Mittermeier RA, Mittermeier CG, Fonseca GAB, Kent J. Biodiversity and hotspots for conservation priorities. Nature 2000; 403:853–858. doi: 10.1038/35002501
10. Panda S. Final plea for conservation of *Gaultheria akaensis* Panda & Sanjappa (Ericaceae), an extremely threatened, endemic medicinal plant from Aka Hill in Arunachal Pradesh of eastern Himalaya, India. J Threat Taxa 2013; 5(7):4118–4121. doi: 10.11609/JoTT.o2879.4118-21
11. Pandey RP, Diwakar PG. An Integrated Checklist of Andaman and Nicobar Islands, India. J Econ Taxon Bot 2008; 32(2):403–500.
12. Pethe J, Tillu A, Watve A. Threat status assessment of *Ceropegia anjanerica* Malpure et al. (Magnoliopsida: Gentianales: Apocynaceae) from Anjaneri Hills, Nashik District, Maharashtra, India. J Threat Taxa 2015; 7(3):6965–697 1. doi: 10.11609/JoTT.o3772.6965-71
13. Purohit CS, Kulloli RN, Maina V, Kumar R, Kari B. A little known orchid *Habenaria longicorniculata* (Orchidaceae) from Mount Abu wildlife sanctuary, Rajasthan and its IUCN status. J New Biol Rep 2020; 9(3):299–305.
14. Rao BRP, Babu MVS, Donaldson J. A Reassessment of the Conservation Status of *Cycas beddomei* Dyer (Cycadaceae), an Endemic of the Tirupati–Kadapa hills, Andhra Pradesh, India, and comments on its CITES status. Encephalartos 2010; 102:19 –24.
15. Rao BRP, Babu MVS, Reddy AM, Sunitha S, Narayanaswamy A, Lakshminarayana G, Ahmedullah M. Conservation status of *Hildegardia populifolia* (Roxb.) Schott & Endl. (Malvaceae: Sterculioideae: Sterculieae), an endemic of southern peninsular India. J Threat Taxa 2011; 3(8):2018–2022.
16. Rao BRP, Prasad K, Bheemalingappa M, Naik MC, Ganeshaiah KN, Sanjappa M. Conservation status of *Dendrobium tenuicaule* Hook. f. (Orchidaceae), a Middle Andaman Island endemic, India. J Threat Taxa 2012; 4(15):341 0–3414.
17. Stolton S, Shadie P, Dudley N. IUCN WCPA Best Practice Guidance on Recognising Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area Guidelines Series No. 21, Gland, Switzerland: IUCN 2013.
18. Tagore JK, Soosairaj S, Ramana MV, Rathinam S, Sanjappa M, Ganeshaiah KN. Status assessment of *Centotheca ganeshaiahiana* (Poaceae), an endemic of Saddle Peak National Park, Andaman and Nicobar Islands, India. Asian J Plant Sci Res 2015; 5(11):16-20.
19. Tagore JK, Soosairaj S, Ramana MV, Sanjappa M, Ganeshaiah KN. Status assessment of the Saddlepeak Dewflower (Murdannia saddlepeakensis Ramana & Nandikar: Commelinaceae): An endemic spiderwort plant of Andaman Islands, India. J Threat Taxa 2016; 8(14):9643–9647. doi: 10.116 09/jott.2363.8.14.9643-9647