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SHORT COMMUNICATION

NOTES ON THE TAXONOMY AND DISTRIBUTION OF TWO ENDEMIC AND THREATENED DIPTEROCARP TREES FROM THE WESTERN GHATS OF KERALA, INDIA

M.S. Sanil, V.B. Sreekumar, K.A. Sreejith, A.J. Robi & T.K. Nirmesh

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NOTES ON THE TAXONOMY AND DISTRIBUTION OF TWO ENDEMIC AND THREATENED DIPTEROCARP TREES FROM THE WESTERN GHATS OF KERALA, INDIA

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Abstract: *Hopea glabra* Wight & Arn. and *Hopea utilis* (Bedd.) Bole are two little-known highly threatened endemic dipterocarps distributed in evergreen forests of the Western Ghats. Although literature surveys and herbarium records show occurrence of these species in different forest areas of Kerala, the present study could locate *Hopea glabra* from the Silent Valley National Park and *Hopea utilis* from Shankili forests in Kulathupuza range, enabling the portrayal of current distribution, basic ecology covering phenology, species association, regeneration and conservation status along with taxonomic notes.

Keywords: Conservation, Dipterocarpaceae, evergreen forest, *Hopea glabra*, *H. utilis*, threatened species.

The genus *Hopea* Roxb., one of the economically and ecologically dominant genera, belongs to the family Dipterocarpaceae and comprises around 102 species mostly of Indo-malayan in distribution (Mabberley 2008). The genus is widely used in timber and plywood industries, construction purposes include planking, floor boards, shipbuilding, masts and spars, dug-outs and heavy packing cases (Pearson & Brown 1932). The hard solid resin, commonly called rock dammar, derived from *Hopea* species is used as varnish and anti-corrosive coating in boat making and handicrafts (Shiva & Jantan

1998). In India, the genus is represented by 11 species distributed in evergreen forests of the Western Ghats and northeastern India (Janardhanan 1993). Nine species have been reported from the Western Ghats (Nayar et al. 2014) of which seven are highly threatened and endemic to Kerala (Sasidharan 2004). The level of endemism suggests the Western Ghats as one of the centres for evolution and diversification of *Hopea*. The narrow endemic *Hopea canarensis* Hole was relocated from some patch of Kudremukh region after a lapse of about 80 years (Ravikumar & Goraya 1999) and is also reported from Bhagavathi Valley region of Karnataka (Kumar & Kaveriappa 1999). Similarly, *Hopea jacobi* C.E.C. Fisch. has not been collected from its type locality or any other place in the recent past. Hence, this species is presumed to be extinct (Shetty et al. 2002), whereas other species like *Hopea parviflora* Bedd. and *Hopea ponga* (Dennst.) Mabb. are widely distributed in the southern part of the Western Ghats (Pascal 1988). *Hopea glabra* and *Hopea utilis* are two little known highly threatened dipterocarp trees found in evergreen forests of the Western Ghats. Earlier herbarium

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collection records and literature surveys indicate that these two species occur only in the southern part of the Western Ghats and in the present study the current distribution, basic ecology and conservation status along with taxonomic notes are provided.

MATERIAL AND METHODS

Frequent field surveys were carried out during the period from 2013–2016 in Kerala part of the Western Ghats and specimens of *Hopea glabra* and *Hopea utilis* were collected, identified using relevant literature (Gamble 1915; Saldanha 1984; Janardhanan 1993; Sasidharan 2004) and also compared with specimens from different herbaria (BSI, CALI, DD, E, FRLH, HIFP, K, MH). All voucher specimens are deposited in the herbarium of the Kerala Forest Research Institute (KFRI).

RESULTS AND DISCUSSION

The descriptions of the species with notes on their distribution, phenology, ecological aspects, details of specimens examined and conservation status along with colour photographs to facilitate accurate identification are given below.

Hopea glabra (Image 1; Fig. 1)

Wight & Arn., Prodr. 85. 1834; Hook. f., Fl. Brit. India 1: 309. 1874; C.J. Saldanha & E. Rao in Saldanha, Fl. Karnataka 1: 192. 1984; Manilal, Fl. Silent Valley 23. 1988; K.P. Janardh. in B.D. Sharma & Sanjappa, Fl. India 3: 222. 1993; Sasidh. et al. Bot. Stud. Med. Pl. Kerala 22. 1996; Sasidh., Biodiv. Doc. Kerala - Fl. Pl. 44. 2004; AnilKumar et al. Fl. Pathanamthitta 74. 2005; K.P. Janardh. & W. Arisdason in P. Daniel, Fl. Kerala 1: 364. 2005; T.S. Nayar et al. Fl. Pl. Kerala 218. 2006; T.S. Nayar et al. Fl. Plants of the Western Ghats 1: 325. 2014. *Hopea wightiana* Wall. ex Wight & Arn. var. *glabra* (Wight & Arn.) Bedd., Fl. Sylv. t. 96. 1871.

Resinous trees, reaching a height of 20–25 m and trunk of 1.4–1.7 m in girth, buttressed at base. Bark pale brown, 5–6 mm thick, peeling off in irregular flakes; branchlets dark coloured, glabrous. Leaves lanceolate, acute to obtuse at base, obtuse to shortly acuminate at apex, glabrous and rather shining on both surfaces, lamina 4–11x2–4 cm, margin entire, glabrous, coriaceous, lateral nerves about 4–8 pairs, parallel to margins, prominent above, petioles about 0.6–1.3 cm long, stipule small; panicles axillary and terminal, often one to three together, glabrous. Flowers pedicelled, creamy-yellow, c. 5mm long; bracts c. 5mm long, lanceolate, obtuse; bract small; sepals 5, glabrous; petals 5, pubescent, margin

ciliate; stamens 15; anthers orbicular, with appendages about three times longer than anthers; ovary narrowly conical and slightly constricted above the centre; style glabrous with a simple pointed stigma; ovary three loculed, ovules two in each locule. Fruit belly smooth, ovoid or ellipsoid, pointed, c. 1.8cm long, two longer wings about 6.5x1.5 cm, linear-oblong, seven nerved with prominent transverse veins, reddish, glabrous, three smaller ones about 6.8 cm long.

Vernacular names: ‘Puzhupongu’, ‘Ilapongu’, ‘Naithambagam’ (Malayalam); ‘Karaikkongu’ (Tamil).

Flowering: January–March

Fruiting: April–July

Distribution: Endemic to the Western Ghats; herbarium records show that the species is distributed in Trannikudy areas in Idukki, backwaters of Kollam, Thannithode in Pathanamthitta and Silent Valley dam site. In the present survey, however, we could collect this species only from the dam site in Silent Valley National Park.

Ecology: This species is growing mainly along the sides of streams in evergreen forests at an altitude of 900m and the associated species are mainly *Hydnocarpus pentandra* (Buch.-Ham.) Oken, *Palaquium ellipticum* (Dalz.) Baill., *Polyalthia coffeoides* (Thwaites) Hook.f. &

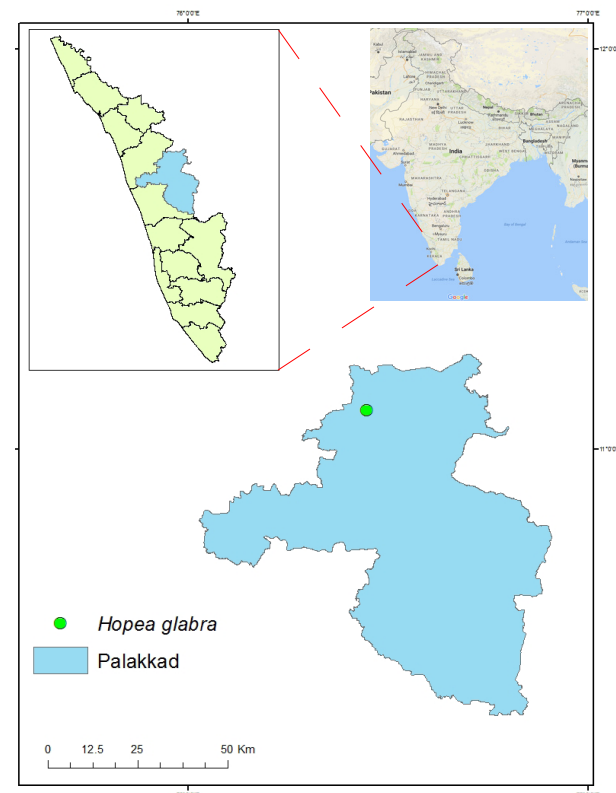


Figure 1. Location map of *Hopea glabra*

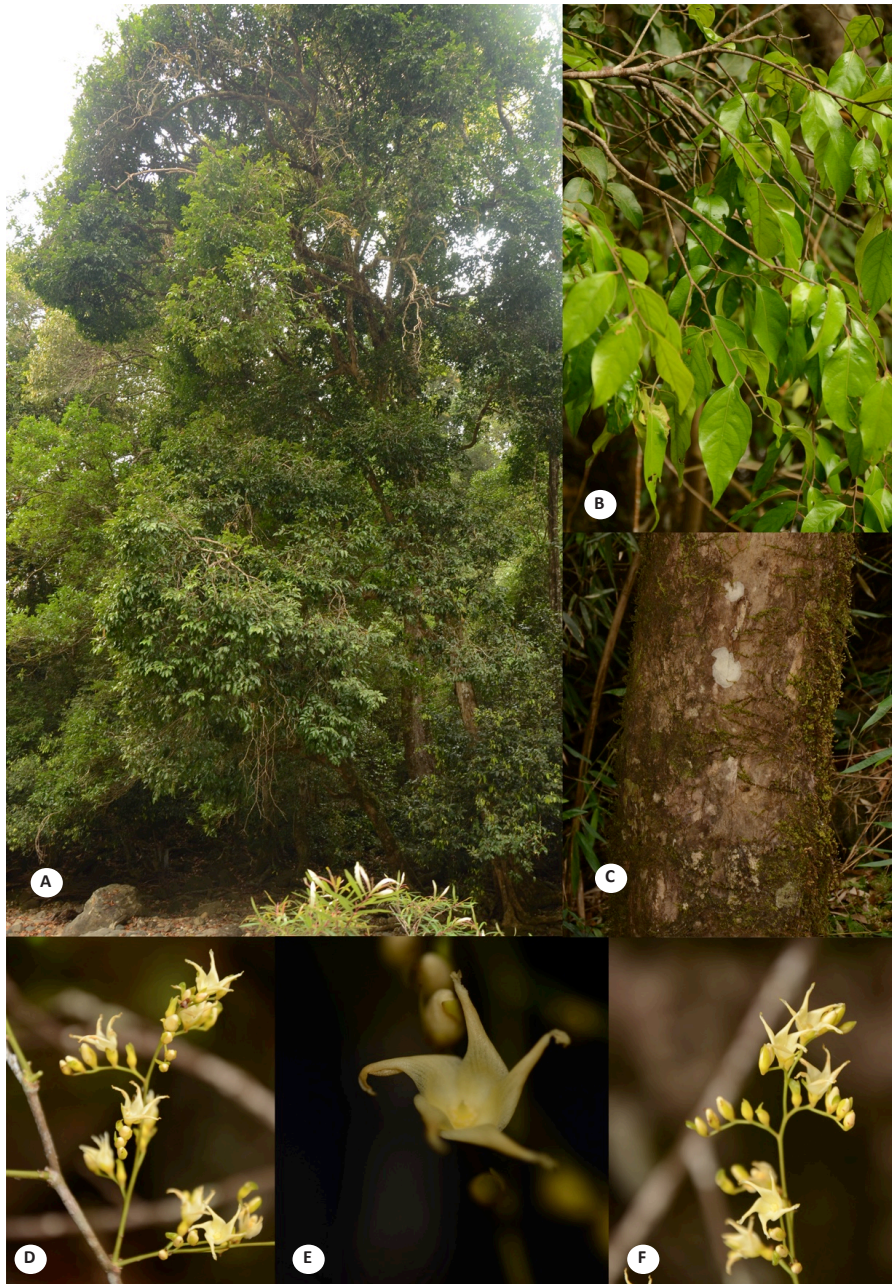


Image 1. *Hopea glabra* Wight & Arn.
 A - habit; B - leafy twig; C - bark;
 D & F - inflorescence; E - single flower

Thomson, *Vateria indica* L., *Ancistrocladus heyneanus* Wall. ex Graham, etc. Only six mature individuals were noted in the dam site and found as a second layer species. Natural regeneration of this species is very low. The poor survival of seedlings might be the reason for the decline in growth of this population, which needs further investigation.

Specimens examined: India, Kerala, Palakkad District: Silent Valley National Park, 08.i.1929, E.V. Pillai 48222 (DD!); Idukki District: Trannikudy, 02.x.1972, B.D. Sharma 42390 (MH!); Kollam District: Kollam Backwater, 23.xii.1979, C.N. Mohanan 65023 (MH!); Palakkad

District: Silent Valley Dam site, 10.xii.1980, N.G. Nair & N. Sasidharan 1879 (KFRI!); 25.v.1982, T. Sabu 10611 (CALI!); 25.x.1982, T. Sabu 10859 (CALI!); Attapadi R.F., Silent Valley, 12.ii.1984, B.R. Ramesh 05611 (HIFP!); 05612 (HIFP!); Attapadi R.F., Silent Valley, 01.v.1984, B.R. Ramesh 05613 (HIFP!); 24213 (HIFP!); Silent Valley, Valiyaparathode, 16.vi.1984, T. Sabu 11455 (CALI!); Silent Valley, 13.xii.1994, N. Sasidharan 5476 (FRLH); Silent Valley dam site, 04.xii.2015, V.B. Sreekumar & M.S. Sanil 12868 (KFRI!); Silent Valley dam site, 25.v.2016, M.S. Sanil & T.K. Nirmesh 12929 (KFRI!); s. loc., s.d., Wight 360 K (K000700758, image); s.loc., s.d., s.coll.,

s.n.,K (K000700759, image); s.loc., s.d., Wight 360 E (E00017505; E00017506; E00001537; image).

Notes: The species is Endangered as per the IUCN Red List of Threatened Species (Ashton 1998a). Previously, several authors have reported this species from different localities of Western Ghats (Saldanha 1984; Janardhanan 1993). Anilkumar et al. (2005) in the flora of Pathanamthitta mentioned its distribution in Thannithode area, but we couldn't locate the same from that particular locality. Only a few trees were found along the riverside of Kunthipuzha, near the dam site. This species is treated as an unresolved name in the Plant list (www.plantlist.org) and but *Hopea glabra* Wight & Arn. is a well resolved species, closely related to *Hopea canarensis* and *Hopea racophloea* according to *matK* and *trnL-trnF* intergenic spacer DNA sequence data (Sanil et al. in preparation). This species differs from *Hopea racophloea* in the larger number of veins and the absence of domatia, glabrous calyx lobes and reduced fruit wings, and from *Hopea canarensis* by their reduced leaf size, acute leaf base, absence of domatia and reduced fruit wings.

Hopea utilis (Image 2; Fig. 2)

(Bedd.) Bole, Kew Bull. 6: 146. 1951; K.P. Janardh. in B.D. Sharma & Sanjappa, Fl. India 3: 234. 1993; Gopalan & Henry, Endemic Pl. Agasthiyamala 250. 2000; K.P. Janardh. & W. Arisdason in P. Daniel, Fl. Kerala 1: 367. 2005; T.S. Nayar et al. Fl. Pl. Kerala 219. 2006; V.S. Manickam et al. Fl. Tirunelveli Hills 1: 103. 2008; T.S. Nayar et al. Fl. Plants of the Western Ghats 1: 327. 2014. *Balanocarpus utilis* Beddome, Fl. Sylv. S. India Manual: 237 bis 1872; Gamble, Fl. Pres. Madras 84. 1915. *Hopea longifolia* Dyer in Hook. f. FBI 1: 309. 1874.

A medium-sized tree with a straight clear bole of 16–30 m and a girth of 1.3–1.9 m. Bark smooth, pale brown, often with greyish patches; young shoots pubescent, branches and branchlets terete. Leaves 11.5–17.5 x 3–5 cm, simple, alternate, linear-lanceolate, rounded or acutely attenuate at base, obtuse or subacute at apex, entire or slightly undulate; lateral nerves 10–12 pairs, oblique, tertiary nerves parallel, prominent on both surfaces, their axils often glandular; petioles about 1.2cm long; stipule minute, deciduous. Panicles racemes, solitary or fascicled. Flowers yellowish-white, shortly pedicelled, 6–8 mm. Calyx lobes slightly connate at base, snowy white outside, two outer ones slightly longer, ovate, more or less obtuse, thickened, three inner suborbicular, often mucronate, thin along the margin. Petals 5, yellowish-white, oblong, obtuse, entire

or crenulate at apex, pubescent. Stamens 15, adnate to corolla base, filaments dilated at base, subulate, anther suborbicular, extended by the apicular awn, which is three times the length of the anther. Ovary ovate, superior, pubescent, three-loculed; ovules two in each locule; style short, cylindrical; stigmas thick. Fruit belly globose, apiculate, 2.5cm in diameter, enclosed at the base of the thickened and accrescent sepals which attain 2.5cm in length and spread horizontally.

Vernacular names: 'Karan kongu', 'Black kongu' (Malayalam).

Flowering: April–June

Fruiting: July–September

Distribution and status: Endemic to southern Western Ghats, it is assessed as Endangered on the IUCN Red List (Ashton 1998b)

Ecology: The species is highly restricted to hill slopes close to streams and rivers in the West coast tropical evergreen and semi evergreen forests of Tamil Nadu (Tirunelveli) and Kerala. Presently, only one population is located in the Kulathupuzha forest range in Thiruvananthapuram forest Division. Only four mature trees were found along the banks of Shankili River at an altitude of 400m. The associated species

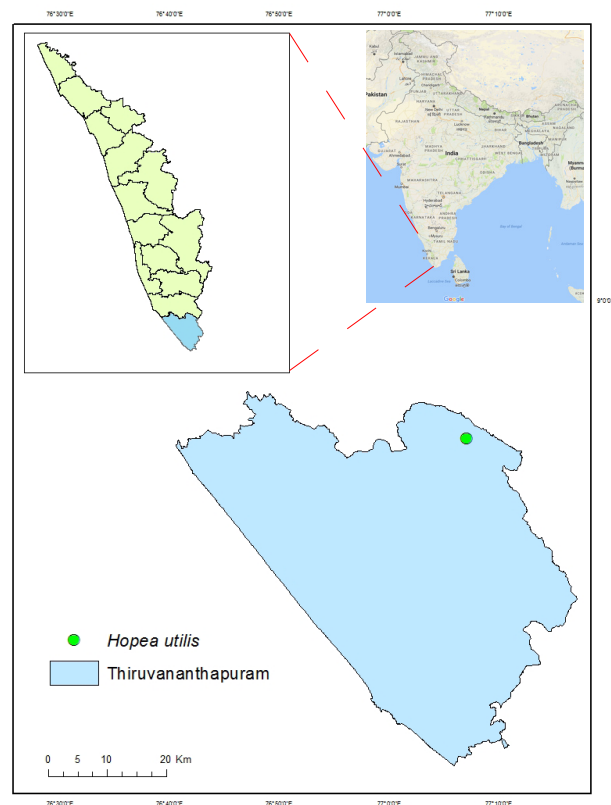


Figure 2. Location map of *Hopea utilis*

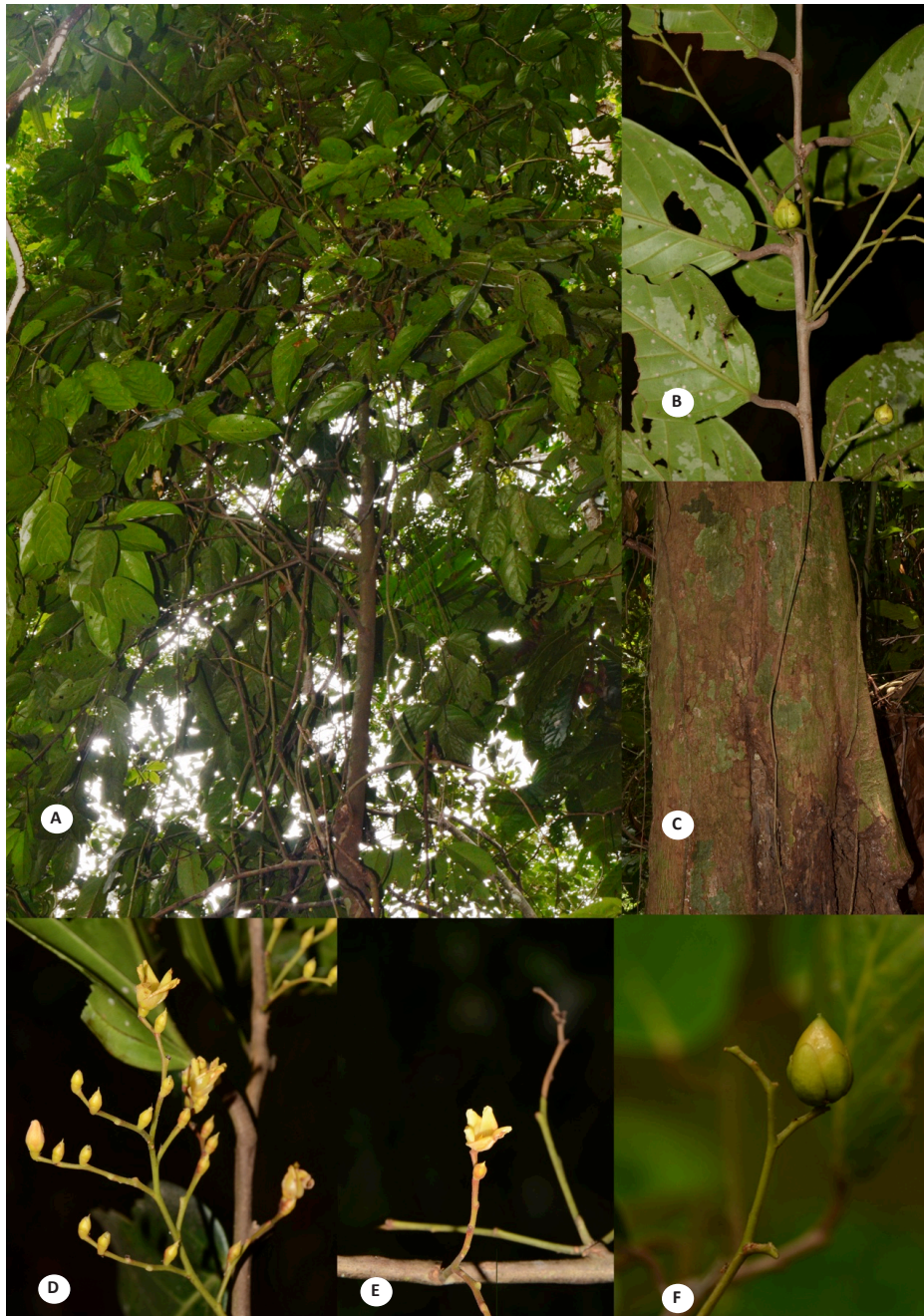


Image 2. *Hopea utilis* (Bedd.) Bole
 A - habit; B & F - fruit; C - bark;
 D - inflorescence; E - single flower

are *Dipterocarpus indicus* Bedd., *Palaquium ellipticum* (Dalz.) Baill., *Sageraea thwaitesii* Hook. f. & Thomson and *Vateria indica* L. etc., sparse flowering, abnormal flower fall, poor seed setting, heavy immature fruit fall, low regeneration and poor survival of seedling make it rare.

Note: The species was first described by Beddome (1872) under the genus *Balanocarpus* due the absence of winged fruits. Later, Bole transferred *Balanocarpus utilis* to *Hopea utilis*. Except *Hopea utilis* and *Hopea*

erosa, all other Indian members of genus *Hopea* possess winged fruits.

Specimen examined: India, Tamil Nadu, Tirunelveli District: Tinnevely, s.d., R.H. Beddome 142 (K!); Mundanthurai Forest Bungalow near, 17.vii.1978, K.A. Shankarnarayan 05657 (HIFP!); 05658 (HIFP!); 05659 (HIFP!); Karayar Tank West point, 25.iii.1992, B.R. Ramesh & D. De Franceschi 05660 (HIFP!); 05661 (HIFP!); Servar Reservoir, Papanasam R.F., 25.xi.1993, B.R. Ramesh, D.De Franceschi & Pham Bach Viet 05662

(HIFP!); Servalar Reservoir-Kodamadi, 04.i.1998, B.R. Ramesh 05664 (HIFP!); Mundanthurai near Servalar bridge, Kalakad-Mundanthurai WLS, 05.xii.2007, N. Ayyappan & B.R. Ramesh 05663 (HIFP!); 05665 (HIFP!); 05666 (HIFP!); Thiravettan paarai Servalar, KMTR, 30.iv.2008, Selva Singh & P. Richard 24714 (HIFP!). Kerala: Thiruvananthapuram District: Shankili, 20.vii.2014, M.S. Sanil & V.B. Sreekumar 12939 & 12940 (KFRI!); Shankili, 18.x.2016, M.S. Sanil & T.K. Nirmesh 13024 (KFRI!); Shankili, 16.xii.2016, M.S. Sanil & A.J. Robi 13023 (KFRI!).

In Western Ghats, dipterocarps are represented with 16 species under five genera viz., *Dipterocarpus*, *Hopea*, *Shorea*, *Vateria* and *Vatica*, out of these, 10 species are endemic and 12 species are facing risk of extinction (KFRI 1978; FAO 1985; Sasidharan 2004). Most of these have the flagship tree-species-architecture of the low elevation evergreen forests and distribution has broken down into due to selective logging in the past. According to Pascal (1988) and Meher-Homji (1979, 1996) the dipterocarps dominant lowland evergreen vegetation formations are the most depleted forest type in the southwestern coast of peninsular India owing to increasing human density and occupation. The current study reveals that limited population, less number of mature individuals, irregularity along with sparse flowering, low fruit setting, heavy immature fruit falls, recalcitrant nature of seeds, poor regeneration and survival make it rare. Sasidharan (2017) reported that most of the dipterocarps, viz., *Hopea erosa*, *Hopea jacobii*, *Hopea racophloea* and *Vateria macrocarpa*, are only known from limited localities and their high degree of habitat specificity make them rare. Similarly, Swarupanandan et al. (2013) studied population biology of *Dipterocarpus* and also supported the habitat specificity of this group. According to Stiling (2011) the species that exhibit high degree of habitat specificity are prone to extinction. In order to maintain a viable population there should be a minimum number of mature individuals in a particular population. Many Indian dipterocarps fail to attain this minimum number (Kumar & Kaveriappa 1999; present observation), which in turn result in loss of genetic diversity through inbreeding depression (Swarupanandan et al. 2013). Moreover, some of the Malesian dipterocarps show reproductive constraints like flowering irregularities (Appanah 1993). The infrequency of reproductive incompatibility and embryonic mortality are the main reasons for low fruit set and heavy fruit falls respectively (Chan 1981; Swarupanandan et al. 2013).

Generally, seeds of *Hopea* are recalcitrant and short-lived in nature and they will germinate immediately

after attaining maturity (Sasaki 1980; Yap 1981). These seeds, however, are mature during the monsoon season and may have a chance to be swept away. Regeneration and survival status of dipterocarps are comparatively low (Sukesh & Chandrashekar 2011). The present observation shows that *Hopea glabra* and *Hopea utilis* exhibited comparatively lesser regeneration and seedling survival among genus *Hopea* in Kerala. Hence, urgent attention is required to understand population structure, pattern of genetic variation, and developing propagation protocols for planning immediate restoration practices. As a first step towards this, we have collected a few seeds of *Hopea utilis* from Shankili forests. Seedlings were raised in the nursery, kept in a mist chamber for four to five weeks and planted at the KFRI Arboretum at Peechi.

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-- M.S. Sanil, V.B. Sreekumar, K.A. Sreejith, A.J. Robi & T.K. Nirmesh, Pp. 11033–11039

Phenology and seed germination of the Indian Screw Tree *Helicteres isora* L. (Malvales: Malvaceae)
-- Mariappan Muthukumar, Thirupathi Senthil Kumar & Mandali Venkateswara Rao, Pp. 11040–11044

Additions to the sea snail fauna (Mollusca: Gastropoda: Opisthobranchia) of Lakshadweep Islands, India
-- B.K. Sneha Chandran, R. Ravinesh & A. Biju Kumar, Pp. 11045–11053

Preliminary checklist of springtails (Arthropoda: Collembola) of Uttar Pradesh, India
-- Ramesh Singh Yadav, Pp. 11054–11059

A new species of zygaenid moth *Elcysma ziroensis* (Lepidoptera: Zygaenidae: Chalcosiinae) from India
-- Punyo Chada, Monsoon Jyoti Gogoi & James John Young, Pp. 11060–11066

Dragonflies and damselflies of University of North Bengal campus, West Bengal, India with new distribution record of *Agrion nairi* Nair & Subramanian, 2014
-- Aaratrik Pal, Pp. 11067–11073

A first record of the Bentfin Devil Ray *Mobula thurstoni* (Lloyd, 1908) (Myliobatiformes: Mobulidae) from the Indian EEZ of the Andaman Sea
-- Swapnil Shivdas Shirke, M. Nashad, Monalisha Devi Sukham & H.D. Pradeep, Pp. 11074–11080

First records of the Indo-Pacific Finless Porpoise *Neophocaena phocaenoides* (G. Cuvier, 1829) (Cetartiodactyla: Phocoenidae) from Sri Lanka
-- Ranil P. Nanayakkara, Thomas A. Jefferson & Sandaruwan Abayaratne, Pp. 11081–11084

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Largest fungal fruit body from India
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-- Rachamalla Shyamsundar, Kante Krishna Prasad & Chelmala Srinivasulu, Pp. 11087–11094

First record of migratory Grey-necked Bunting *Emberiza buchanani* Blyth, 1844 (Aves: Passeriformes: Emberizidae) as a winter visitor in Tiruchirappalli District, Tamil Nadu, India
-- T. Siva & P. Neelanarayanan, Pp. 11095–11096

New distribution records of Elegant Water Shrew *Nectogale elegans* Milne-Edwards, 1870 (Mammalia: Eulipotyphla: Soricidae) from the western Himalaya, Uttarakhand, India
-- Aashna Sharma, Vandana Rajput, Vineet K. Dubey, Aavika Dhand, Shagun Thakur, J.A. Johnson, S. Sathyakumar & K. Sivakumar, Pp. 11097–11099

The persistence of the Striped Hyena *Hyaena hyaena* Linnaeus, 1758 (Mammalia: Carnivora: Hyaenidae) as a predator of Olive Ridley Sea Turtle *Lepidochelys olivacea* Eschscholtz, 1829 (Reptilia: Testudines: Cheloniidae) eggs
-- Divya Karnad, Pp. 11100–11102

Book Review

Book review: A Photographic Guide -- Endemic Woody Plants of The Western Ghats
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