

Lesser Known Climbing Species Endemic to Agasthyamala Biosphere Reserve (ABR) of the Kerala Region

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Abstract

Floristic analysis of the Agasthyamala Biosphere Reserve (ABR) in Kerala region elucidated four lesser known climbing shrubs found to occur in isolated pockets of the biosphere reserve. Interestingly, these taxa are found to be 'narrow endemics' and has not so far been reported from elsewhere other than the ABR territory of the Kerala region. Details are highlighted herewith illustrations.

Keywords: Agasthyamala Biosphere Reserve (ABR), Endemic climbers

Introduction

"..... I was led to this subject by an interesting, but short paper by Professor Asa Gray on the movements of the tendrils of some Cucurbitaceous plants. My observations were more than half completed before I learnt that the surprising phenomenon of spontaneous revolutions of the stems and tendrils of climbing plants had been long ago observed by Palm and by Hugo von Mohl, and had subsequently been subject of two memories by Durochet. Nevertheless, I believe that my observations, founded on the examination of above a hundred widely distinct living species, contain sufficient novelty to justify me in publishing them" (Darwin, 1865). This remark on climbing species by Charles Darwin indicates this group of plants has drawn great attention in natural history since centuries ago. The probable pioneers who carried out studies on climbing plants are presumed to be Ludwig H. Palm (1827), Hugo von Mohl (1827), Dutrochet (1843, 1844) and Asa Gray (1858) during the earlier part of the 19th Century. Hugo de Vries (1873) had also made remarkable observations on difference in growth of tendrils and mechanism of movements among twining plants. Although, climbing plants were become curious even earlier during the former half of the

19th Century, it was Charles Darwin (1865) who made the first comprehensive account on this group in the 'Journal of the Linnean Society' titled as 'On the Movements and Habits of Climbing Plants'. Further, Darwin revised his original publication (1865) by including more periodical observations and reproduced the same in series of book forms (Darwin, 1875, 1876, 1882). He classified the climbing plants into different groups in accordance with their climbing adaptations such as twining climbers (*Dioscorea* spp), leaf climbers (*Clematis* spp), tendril bearers (*Vitis* spp), root climbers (*Epipremnum* spp), hook climbers (*Calamus* spp) etc.

On account of ecology of plant communities, climbing species constitute one of the remarkable groups of floristic entities having potential role in various ecosystems. It also constitutes one of the significant components in plant evolution, diversity and abundance (Putz and Mooney, 1991; Schnitzer and Bongers, 2002; Gianoli, 2004; Durán and Gianoli, 2013; Schnitzer *et al.*, 2015). According to one school of thought, the climbing habit was apparently evolved independently in a diverse array of taxonomic groups including the Gymnosperms (Gnetaceae), Monocots

(Arecaceae) and Dicots (Papilionaceae). A climbing species is referred to as a weak stemmed taxon which cannot endure independently at least in its earlier stage of growth and takes supports from other plants or objects to continue its growth and ascending up to enhance the acquisition of solar energy. Availability of proper trellis has much influence in diversity of climbing species in forests (Garbin *et al.*, 2012) and those climbing species fail to come across with suitable trellis often show reduced biomass allocation, morphology, physiology and even reproduction on account of those successfully climbing onto an external support (den Dubbelden & Oosterbeek, 1995; Gianoli 2001, 2003). This has been recorded in natural forests (Putz, 1984; Stansbury *et al.*, 2007), open habitats (Gianoli, 2002; Price & Wilcut, 2007; González-Teuber & Gianoli, 2008) and controlled environments (Puntieri & Pyšek, 1993; Schweitzer & Larson, 1999). Therefore, the location of a climbing taxon with an appropriate trellis is very significant in the life history of climbing plants (Hegarty, 1991). It indicates tropical rainforest communities provide ideal ecological niches for the luxuriant growth and diversity for climbing plants. A few Angiosperm families such as such Dioscoreaceae, Cucurbitaceae and Vitaceae are rather characterized mostly with climbing plants. Gentry (1991) recorded four Angiosperm families, viz. Apocynaceae, Celastraceae, Fabaceae and Rubiaceae, are holding more than 50 climbing species in each of the families. From economic point of view, several climbing plants have much relevance in human life as source of valuable drugs (Curare, Strychnine from *Strychnos* spp.), staple food (Legumes, Yams), fruits (Grapes, Cucurbits), spices (Pepper, Vanilla), commercial raw materials (Canes, Rattans), ornamentals (Jasmins, Morning glories, Bauhinia spp.) etc. Nevertheless, this group of plants especially occurring in the Western Ghats have mostly been ignored and yet to be subjected to systematic investigations and documentation.

Agasthyamala Biosphere Reserve (ABR)

Western Ghats, the pristine mountain ranges found to occur almost parallel to the Western Coast of the Peninsular India, is the abode of around 7000 species of Angiosperms including several endemics (Nair *et al.*, 2014). Agasthyamala Biosphere Reserve is located at the southern part of the Western Ghats between the latitudes 8° 8' to 9° 10' N and longitudes 76° 52' to 77° 34' which cover an area of 3,500.36 km²; of which 1828 km²

is in Kerala and 1672.36 km² is in Tamilnadu. The Agasthyamala Biosphere Reserve (ABR) was established in 2001 and recently the International Coordinating Council of the Man and the Biosphere (MAB) Programme of UNESCO added the Agasthyamala Biosphere Reserve as one of the 20 sites to the World Network of Biosphere Reserves during its meeting held at the capital of Peru in South America on 18th and 19th of March, 2016 [http://www.unesco.org/new/en/media-services/single-view/news/20_sites_added_to_unescos_world_network_of_biosphere_reserve/#.V63ogZh97NN - accessed on 12/08/2016]

The highest point in this region is 1868m above sea level referred to as 'Agastyarkoodam'. The Agasthyamala Biosphere Reserve is composed of three Wildlife Sanctuaries viz., Neyyar, Peppara and Shendurney and their adjoining areas of Achencoil, Thenmala, Konni, Punalur, Thiruvananthapuram Divisions and Agasthyavanam Special Division in Kerala. Kalakkad-Mundanthurra Tiger Reserve (KMTR) spread over in Tirunelveli and Kanyakumari Districts of the Tamilnadu State have also been included as part of the ABR. Kalakkad-Mundanthurra Tiger Reserve (KMTR) was established in 1988 which cover an area of 818 km² and around 400 km² core area of KMTR has been proposed as a National Park in relation with the Tiger Project. According to the United Nations Educational and Cultural Organisation [UNESCO], the ABR is known to host approximately 2254 species of higher plants including 400 endemic taxa [http://www.unesco.org/new/en/media-services/single-view/news/20_sites_added_to_unescos_world_network_of_biosphere_reserve/#.V63ogZh97NN - accessed on 12/08/2016]. It highlights the region as 'hot spot' for plant diversity. Agasthyamala Biosphere Reserve is considered to be a unique genetic reservoir of several cultigens and their wild proto types especially of cardamom, jamune, nutmeg, pepper and plantain.

Materials and Methods

As part of the preparation of the endemic flora of the Southern Western Ghats, extensive and intensive plant explorations have been carried out at different parts of the Agasthyamala Biosphere Reserve and procured herbarium specimens along with field notes. Taxonomic identification and nomenclature updates were carried out in consultation with standard floras and herbaria.

Plant specimens were processed by following standard herbarium techniques and housed at the Kerala University Botanical Herbarium (KUBH). Perusal of several literature and consultation of different herbaria (MH, TBGT, CALI, and RHT) for critical scrutiny on endemism of the ABR revealed occurrence of four lesser known climbing species. Interestingly, it is found that these species are confined to the occurrence within the Agasthyamala Biosphere Reserve and has not been collected or reported from elsewhere other than type localities. Being lesser known endemic climbers, detailed taxonomic accounts of the taxa based on recent collections with illustrations is given below.

Taxonomic descriptions

1. ***Calamus shendurunii*** Anto, Renuka & Sreek., *Rheedea* 11: 37. 2001.

Large climbing shrub, Clustering, stem 15-25 m long, with sheaths up to 2 cm diameter, without sheaths up to 1.5 cm diameter; nodes ventricose with sheathing petiole, internodes 10-25 cm long. Leaves ecirrate, 1 m long; sheath dark green, shining, spiny; spines 1-4, scattered, with bulbous base, apex black, 1 cm long; knee conspicuous, devoid of spines; flagellum up to 2 m long; petiole 20-25 cm long, armed on both sides, spines recurved; rachis channeled on the dorsal side, ridges spiny; spines 1 cm long, sturdy, bulbous based; leaflets 25-35 x 2.5-3, regularly arranged, long acuminate; mid vein setose ventrally, setae up to 1 cm long, lateral and mid veins setose dorsally towards the tip, setae up to 0.5 cm long, apical leaflets basally united. Inflorescence flagellate, up to 2 m long, partial inflorescence 3-4, up to 20 cm long, slender; primary sheaths closely sheathing, bristles on the mouth, secondary sheath sparingly spiny; rachillae to 5 cm long. Fruit globose, 1 x 1.8 cm, stalk to 2 mm long, scales in 25 vertical rows, pale green, without any border, shiny, shallowly channelled along the middle; endosperm ruminant.

Habitat: evergreen forest

Flowering & fruiting: September-June

Distribution: India (Kerala), Endemic to the Shendurany sanctuary of ABR

Status: Known only from type locality within the ABR territory (Shendurany Wildlife Sanctuary).

Specimen examined: India, Kerala, Kollam, Shendurany WLS, 45 m, 28/04/2014, R. Jagadeesan 9144 (KUBH)

Note: *Calamus* species are good raw materials for the cottage industries for making furniture, baskets, walking-sticks, umbrellas etc. *Calamus shendurunii* is a promising rattan species for the cottage industry.

2. ***Grewia palodensis*** Santhosh, Khan, Binu & Almeida, *Rheedea* 11: 41. 2001.

Lianas; branchlets brown, stellate-tomentose. Leaves simple, alternate; lamina 8-12 x 4-6 cm, broadly elliptic or oblong, rounded-obtuse at base, abruptly acuminate at apex, crenate-serrate along margin, thin-coriaceous, stellately pubescent, sparsely so above and along the nerves beneath; basally 3-nerved, conspicuous; petiole 0.7-1 cm long, stellate-pubescent; stipules 0.5-0.6 cm long, linear, caducous. Inflorescence axillary and terminal, many-flowered umbellate cymes; peduncles 1-3 together, 3-4.5 cm long, stellate-pubescent; bracts 0.5-0.6 cm long, linear, channeled, puberulent; pedicels 0.8-1.2 cm long in flower, to 2 cm long in fruits. Flowers 0.8-1 cm across. Sepals 5, narrowly oblong-lanceolate, 1.5-1.8 x 0.3 cm, light grayish, reflexed and curled, longitudinally ribbed, stellately-tomentose without, and pubescent at the base within. Petals 5, linear-oblong, narrow, 0.5-0.6 cm long, obtuse-apiculate at apex, base densely appressed pilose, gland to 0.2 cm. Androgynophore distinctly 4-grooved, to 2.5 mm, stellate-hairy discoid glands at base. Stamens 5-10 mm long; filaments glabrous; anthers 2-celled. Ovary globose, villous, to 1 mm long, 4-locular with 1 ovule in each locule; style 0.6-0.7 cm long, puberulent 1/3 from the base; stigma shallowly 4-5 grooved. Drupe deeply 2-partite, lobes emarginate, 1.5-2 cm wide, black at maturity, sparsely stellate-hairy; pyrenes 2-per lobe, glabrous.

Habitat: Sacred groves

Flowering & fruiting: May-October

Distribution: India (Kerala), Endemic to the type locality

Status: Two populations have been located within the ABR territory. The type locality of the species is a sacred groove near Palode and later it has been located from Bonacadu region.

Specimen examined: India, Kerala, Trivandrum, Palode 75-100 m, 21/06/16, R. Jagadeesan 9137 (KUBH).

Note: Some of the *Grewia* fruits are edible. Some species are with mild antibiotic properties used in folk medicines to cure stomach upset and some skin and intestinal infections. The species is rather lesser known and yet to be screened for confirming its medicinal property.

3. **Jasminum agasthyamalanum** Sabeena, Asmitha, Mulani, Santhosh & Sibin, Indian J. Forestry 30: 123. 2007.

Jasminum calophyllum sensu Mohanan & Sivad., Fl. Agasthyamala 429. 2002.

Climbing shrubs; stem cylindrical, solid, glabrous. Leaves trifoliolate, opposite, terminal leaflet ovate-elliptic, 5.5-7 x 3-3.5 cm, rounded at base, acuminate at apex, entire at margin, membranous, glabrous; lateral nerves 6-8 pairs, obscure, midrib impressed above, raised beneath; lateral leaflets ovate, 4.5-6 x 2-3 cm, rounded, obtuse or rarely subequal at the base, acuminate at the apex; petiole to 3.5 cm long, rounded, glabrous; petiolule to 2 cm long, bent near the apex. Inflorescence a short axillary cyme, usually 1-3 together from the node, to 5 cm long, with 3-5 flowers. Flowers white, to 2.5 cm across, fragrant. Calyx glabrous, 5-toothed, to 3 mm long. Corolla tube 3 cm long; lobes 6, to 1.2 x 0.6 cm, elliptic-oblong, acute at apex, obscurely nerved. Stamens 2; anthers apiculate, to 0.7 cm long, rounded at base. Ovary cylindrical, glabrous; style to 3 cm long, slender, glabrous; stigma bifid, verrucose. Berry ovoid, single or often paired; seed 1 in each lobe.

Habitat: Evergreen forest & Montane sholas

Flowering & fruiting: August-March

Distribution: India (Kerala), Endemic to the ABR

Status: A single population with a few individual plants has so far been located from the type locality within the ABR territory.

Specimen examined: India, Kerala, Trivandrum, Athirumala, 1100 m, 05/03/2016, R. Jagadeesan 9027 (KUBH)

Note: The species exhibits potential ornamental value with large, fragrant, white flowers with ample possibilities in floriculture.

The population size is very less in type locality and required to be conserved under *ex-situ* means.

4. **Salacia agasthiamalana** Udayan, Regy Yohannan & Pradeep, Edinburgh J. Bot. 69: 2012.

Scandent bushy shrubs to climber; branchlets lenticellate, blackish. Leaves 5-6.5 x 2-3.5 cm, elliptic, acute, acuminate or rounded-retuse at apex, acute or cuneate at base, coriaceous, margin serrate in young leaves become crenate in mature leaves, venation reticulodromous; petiole 0.5-0.7 cm long. Flowers 2-8, cauliflorous umbelliform cyme in dense fascicles from axillary or extra-axillary branches; pedicel 0.4-0.6 cm long. Sepals 5, oblong, brown, c. 0.1 cm long, much shorter than the petals, margins fimbriate. Petals 5, elliptic, 0.2 x 0.15 cm, green with a tinge of yellow when young but orange tinged towards the upper margins in older flowers. Disk green when young but with a faint orange tinge towards the base at maturity, 0.05 x 0.1 cm, conical, tapering to a short style. Anthers 3, rarely 4, discoid, creamywhite with brown tinge; filament slightly tri-radiate, creamy-white when young but yellowish with an orange tinge later. Ovary superior, 3-loculed; ovules 1 in each locule; stigma simple umbonate, pale green. Berry globose, smooth, 4-6 cm across, orange-red; seeds slightly plano-convex, 1.5-2 x 1-1.5 cm.

Habitat: Shola margins

Flowering & fruiting: September-July

Distribution: India (Kerala), Endemic to the ABR

Status: There are two populations of the species were located from two different localities, viz Pongalappara and Chemungi Hills, within the ABR territory

Specimen examined: India, Kerala, Trivandrum, Chemunji 1200 m, 11/03/2015, R. Jagadeesan 8099 (KUBH).

Note: *Salacia agasthiamalana* is allied to *S. oblonga*. *Salacia oblonga* has proven medicinal property against acute glycemia in patients with type-2 diabetes. *Salacia agasthiamalana* is rather lesser known and yet to be screened for confirming its medicinal property.

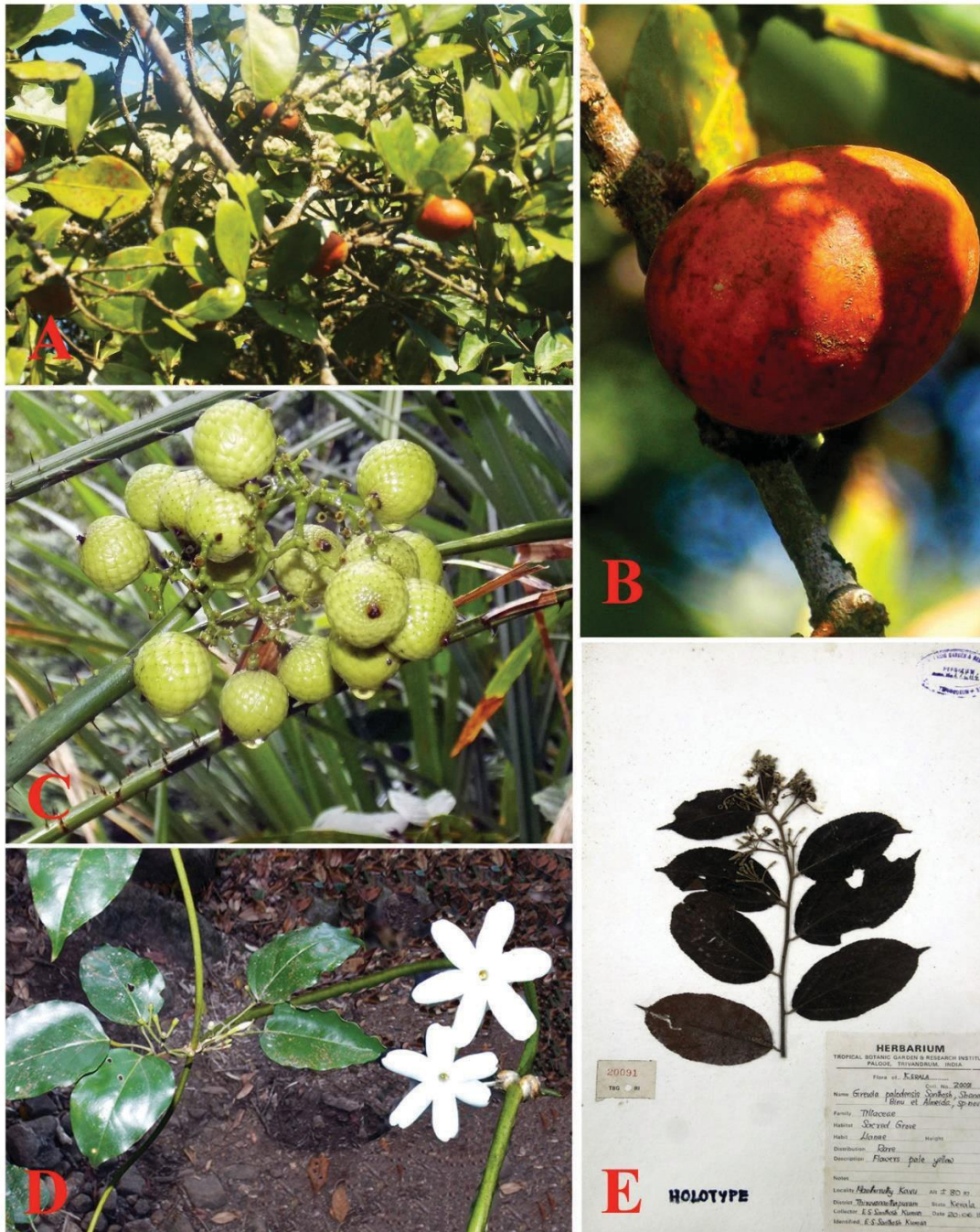


Fig. A. *Salacia agasthiamalana*- habit
 B. *Salacia agasthiamalana*- single fruit
 C. *Calamus shendurunii* - fruits D. *Jasminum agasthyamalayanum*- flowers
 E. *Grewia palodensis* – type material from Manthuruthy sacred groove near Palode.

Discussion

According to published literature, there are 335 climbing species have so far been recorded from the Agasthyamala Biosphere Reserve (Mohanana, 1984; Mohanana and Henry, 1994; Nayar, 1996; Sasidharan, 1997; Gopalan and Henry, 2000; Mohanana and M Sivasadan, 2002) and found 75 taxa are being endemic to the Western Ghats during our investigation. Curiously, it is recorded that four endemics in this group are strictly confined to the occurrence within the premises demarcated for Agasthyamala Biosphere Reserve and hitherto has not been recorded from elsewhere. Plant diversity management in tropical rainforest ecosystems certainly have complex framework in order to exercise the optimal balance between conservation of nature and advancing human sustainable living. Only by declaration of a region as 'biosphere reserve' never fulfil the entire concept of conservation. Evidently, the lesser known rare species characterized with small gene pools in isolated pockets require to have special *ex-situ* conservation methodology such as field gene bank, protocol standardization for tissue culture mass multiplication, cryo bank preservation etc for their conservation other than *in-situ* protocol. According to Drury (1974) "A rare species is one that occurs in widely separated small sub-populations so that, interbreeding between in the sub-populations is seriously affected or reduced or restricted to a single population". Endemic species are more vulnerable to extinction than more widespread species because of their limited geographic ranges and thus have become one of the most effective surrogates for identifying conservation priorities (Myers *et al.*, 2000) seemingly very logic from conservation point of view. Range in geographical distribution of a species becoming shrunken owing to reasons like isolation, catastrophic events, alterations in special ecological micro-niches, endemism, barriers in natural regeneration, anthropogenic interventions etc will subsequently leading to endangerment and extinction of taxon unless until special measures to be taken for their *ex-situ* conservation other than *in-situ*. According to Bustard (1971) "a species is endangered when its numbers are consistently being depleted more rapidly that they can reproduce themselves, absolute number may not be relevant to its threatened status, since large populations can be reduced catastrophically by adverse factors". This definition seemingly much relevant to the present conditions prevalent in ABR and hence adequate measures have to be taken for the *ex-situ* conservation of these lesser known endemic

climbing species with limited populations in natural habitats.

Acknowledgements

The authors (RJ & AGP) are thankful to HoD, Department of Botany, University of Kerala, Kariyavattom, Thiruvananthapuram for encouragements. The author (SPM) record his sincere thanks to the Director, JNTBGRI, Palode, Thiruvananthapuram for encouragements.

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Received: 8.5.2016

Revised and Accepted: 7.8.2

