

Phytogeography of the Andaman–Nicobar Islands with special reference to *Hornstedtia fenzlii* (Kurz) K. Schum.

‘The forest in its pristine glory, if found anywhere in Southeast Asia, it is in the Andaman Islands.’ This comment by H. G. Champion, who had scrutinized the vegetation and phytogeography of the Indo-Malayan region during the later part of the 19th century, signifies the floristic wealth of the Andaman–Nicobar Islands, but that still remain insufficiently known to modern science in terms of floristic evaluation and bioprospecting of many lesser known endemic species. The uniqueness of insular floristic diversity and geographical affinities of the Andaman–Nicobar Islands is illustrated here on account of the recent discovery of *Hornstedtia fenzlii* (Kurz) K. Schum. from the Mount Harriet hill ranges of the South Andaman Island. *H. fenzlii* (Kurz) K. Schum. is the honey bee repellent plant species exclusively used by the Shompen tribes of the Great Nicobar Island for honey collection from the comb of wild bees. It was known as an endemic taxon to a few southernmost islands of the Nicobar group and its recent discovery from the Andaman Islands has significant phytogeographical importance (Figure 1).

Insular floristic evaluation has always been innovating with significant contributions essentially to the studies on evolution and phytogeography. The origin and development of an insular flora primarily depends on various attributes like geological origin of the island, geographical location and area of the island, possible sources of immigration of plant species to the island and structural variations within the island. Usually the islands range from off-shore islands, archipelagos to distant oceanic islands. Geologically, the origin of an island could be principally demarcated into either as a ‘continental island’ or as an ‘oceanic island’. The former refers to a part of a continent or a major land mass in the remote past while the latter refers to a land mass which emerged out from the sea and does not possess any continental connections. Continental islands and oceanic islands are two extremes in the formation of islands and there are many intermediate forms between these two extremities. According to geological origin of the islands, generally, the insular

floras have been recognized under two categories such as ‘continental island flora’ and ‘oceanic island flora’. The former would have a floristic composition mostly of taxa characteristics of the parent land mass while the latter would constitute a floristic composition predominantly derived from entirely different sources.

The Andaman and Nicobar Archipelago in the Bay of Bengal, once dreaded as the islands of disaster and death, are geologically recognized as the continuation of Arakan–Yoma mountain ranges of the Myanmar to the Moluccas Island of the Indonesia. These islands have been isolated from the main continental land masses during the time of ‘continental drift’, probably during the Early Tertiary or Late Cretaceous period¹. Therefore, the biological organisms of the Andaman–Nicobar Archipelago are undoubt-

edly ‘continental’ in origin and have evolved into the present status from a totally balanced continental biosystem through evolution over millions of years. Hence, the present status of the insular biosystem could be referred to as a ‘sub-continental biosystem’. The insular ecosystems in different islands of the archipelago provide ideal ecological niches for the luxuriant growth of different plant communities with a remarkable range of variations from its relatives occurring in the major continental landmasses and many of them are on the way of becoming new taxa.

The relative floristic evaluation of the Andaman and Nicobar archipelago with that of other major landmasses nearer and far-off exposes intriguing phytogeographical affinities of this region. Geologically, the Andaman–Nicobar Islands are considered as the emergent



Figure 1. a, *Hornstedtia fenzlii* – Habit. b, Young flower of *H. fenzlii*. c, Mature flower of *H. fenzlii*.

peaks of a submerged mountainous range in continuation with the Arakan–Yoma Mountain ranges of the Myanmar². Hooker³ classified Myanmar and Andaman group of Islands together and Malay Peninsula from Kedah to Singapore together with Nicobar group of islands in the eighth and ninth positions in his phytogeographic division of India. The floristic evaluation supports this geological finding by exhibiting maximum affinities of the Andaman flora towards the floristic region of Myanmar and northeast India in the north, Thailand and Malay Peninsula in the east and also link with Malaysian floras like Indonesia, Philippines, etc. However, the Nicobar flora predominantly demonstrates maximum affinities towards Malaysian floras rather than southeast Asian elements. Takhtajan⁴ classified Andaman group of islands as a province under Indo-Chinese region and Nicobar group under Malaysian region of the Indo-Malaysian subkingdom within Palaeotropical kingdom. Another conspicuous floristic affinity of this insular region towards the Western Ghats of peninsular India, even though these regions are widely separated by the Bay of Bengal, is very much fascinating in phytogeographical studies. Melville⁵ suggests that the islands in the Indian Ocean were formerly fractions of Gondwana continent during the Palaeozoic and Mesozoic periods. The Western Ghats of peninsular India and the Andaman–Nicobar Islands have remarkable similarities in climatological features and distribution of floristic elements even up to generic level. The disjunct distribution of several floristic elements at specific level such as *Clidion nitidum* Thw., *Polyalthia rufescens* Hook. F & Thoms., *Salacia reticulata* Wt., *Podocarpus wallichianus* (Presl.) O. Ktze, etc. from Andaman Islands to Western Ghats through Sri Lanka is very much informative and fascinating in phytogeography as well as geological studies. It is estimated that over 15 species of Orchidaceae members have common distribution in these regions. *Bentinckia* Berry ex Roxb., an endemic palm genus is confined to the Western Ghats as well as Nicobar Islands exhibiting two endemic species, such as *B. condapanna* A. Berry at Southern Western Ghats and *B. nicobarica* (Kurz) Becc. at Katchal Island of the Nicobar group. Rao and Chakraborti⁶ also highlighted the floristic affinities of the littoral species of Andaman–Nicobar Islands

towards Indo-African, Indo-Pacific and Indo-Malaysian regions which undoubtedly hallmark its Gondwanaland connections in the remote past.

The most fascinating theme in phytogeographical studies on Andaman and Nicobar Islands is the dissimilarity between these two groups in distribution of several common plant species. Genera like *Dipterocarpus* Gaertn., *Pterocarpus* Jacq., *Coelogyne* Lindl., *Habenaria* Willd., etc. are found only in the islands of Andaman group while certain genera like *Cyathea* Sm., *Cyrtandra* Forst., *Rhopaloblade* Scheff., *Stemonurus* Bl., *Kibara* Endl., *Bentinckia* A. Berry, etc. are confined to Nicobar group of islands and do not extend their distribution to Andaman Islands. *Areca triandra* Roxb., one of the wild relatives of *Areca catechu* L. is common in many islands of the Andaman group while this taxon is totally absent in Nicobar group of islands. The Great Nicobar Island, popularly known as Campbell Bay, the southernmost island in this archipelago, demonstrates outstanding dissimilarity with Andaman group of islands even at family level. Several families well represented among the Andaman group of Islands such as Dipterocarpaceae, Polygalaceae, Simaroubaceae, etc. are totally absent in the Great Nicobar Island. The geological clarification of this dissimilarity owing to the separation between the Andaman and Nicobar groups might have occurred earlier than their respective separation from the Myanmar in the north and Sumatra in the south. According to Sewell⁷, these two groups of islands have been separated during the Triassic period of the Palaeozoic era and according to Renvoize⁷ the separation of Andaman–Nicobar archipelago from their continental landmasses of the Myanmar and Indonesia occurred in the Cretaceous which firmly supports this finding. According to another school of thought, the Andaman and Nicobar groups of islands are the emergent peaks of two different ranges of mountain systems. Wild populations of popular cultivars like *Cocos nucifera* L. and *Piper betle* L. are found growing in some islands of both groups^{8–10}; however wild population of *A. catechu* L. is found only in Nicobar group of islands^{8,11}. The apparent wild occurrence of these popular cultivars in several uninhabited islands over a century ago suggests an interesting argument in phytogeographical studies on Andaman

and Nicobar Islands as these islands might be a centre of origin of these species. Detailed and critical floristic analysis of the Andaman–Nicobar Islands demonstrates that about 52% of the angiosperm species are common to both Andaman and Nicobar groups of islands¹². The floristic province of Andaman–Nicobar Islands known to host 2428 angiosperm species which include 294 endemic taxa within the limited geographical area of 8249 sq. km, indicating the high degree of diversity and most fragile ecological equilibrium¹². However, the Andaman–Nicobar Islands are undoubtedly ‘continental’ in origin and hence the degree of endemism is rather less than other ‘oceanic’ islands which are estimated as 9.5% only. Nayar¹³ recognized 25 microcentres of endemism in India based on the endemic patterns; of which the Andaman and Nicobar groups of islands are the two centres of micro-endemism in the Bay of Bengal. The insular plant diversity of the Andaman–Nicobar Islands shall be recognized under three different categories such as ‘alpha diversity’ or the variations within the local sites, ‘beta diversity’ or variations between different localities and ‘gamma diversity’ or variations among the taxa between widely separated regions. From taxonomical and phytogeographical points of view, the flora of the Andaman and Nicobar Islands are known to host 42% of Malaysian and southeast Asian elements which do not have natural occurrence in the Indian subcontinent and designates this region as a transitional zone between Indian flora and Malaysian flora in phytogeography¹⁴.

H. fenzlii (Kurz) K. Schum. was thought to be endemic to the Nicobar group of islands, until its recent discovery from Mount Harriet hill ranges of South Andamans. According to available data, this species has already been recorded from Car Nicobar Island, Katchal Island, Nancowary Island and the Great Nicobar Island of the Nicobar group of islands. In our recent exploration of Andaman and Nicobar Islands in search of insect repellent species used by the various insular aborigines we located a few natural populations of *H. fenzlii* (Kurz) K. Schum. from the Mount Harriet hill ranges of South Andamans. The Mount Harriet hill ranges have some of the highest peaks in the Andaman group of islands and dense cover of evergreen and semievergreen forests. The topography

varies from steep slopes to undulating terrain. These hill ranges have five principal peaks such as Mt Koyob (459 m), Mt Hest (425 m), Mt Harriet (422 m), Mt Goodridge (376 m) and Mt Carpenter (346 m). The Mt Harriet National Park presently demarcated an area of 46.6 sq. km between the lat. 11°42'5"N and 11°51'45"N and long. between 92°43'41"E and 92°48'13"E. There is a proposal to increase the area of the park by 25.55 sq. km including Mt Harriet peak and adjacent area. The species occurs in the evergreen forests along with palms and screw pines. The exploration carried out in Great Nicobar Island, Nancowary Island, Katchal Island and South Andaman Island recorded the fact that the maximum frequency of distribution of this species is in Great Nicobar Island. The frequency of distribution decreases towards north in Nancowary and Katchal Islands and the distribution is found only in three localities at Mount Harriet at an altitude range of 150–200 m. The extended distribution of this species from Nicobar to Andaman group of islands has great significance in phytogeography of the Andaman–Nicobar Islands.

Great Nicobar, the southernmost island in this archipelago, is the dwelling place of the Shompens. Shompens are one of the most primitive offshoots of the mongoloid race believed to have migrated from the Malayan Peninsula to this island in the remote past. This seminomadic tribal group whose population is presently less than one hundred lives in thick tropical evergreen forests of the Great Nicobar Island. They are totally unaware of agriculture and mostly depend on forest products for their livelihood. Unlike mongoloids, they are slightly dark in complexion with wavy to curly hair. The favourite food of Shompens is the fruit of screw pines (*Pandanus lerrum* Jones ex Fontane var. *andamanensium* (Kurz) B.C. Stone) and honey from wild bees. The tropical rain forests occurring in the Great Nicobar Island are the last

stronghold of several Malaysian floristic elements within the Indian territory as well as several lesser known endemics with remarkable economic value. *H. fenizlii* (Kurz) K. Schum. (*Amomum fenizlii* Kurz) of the Zingiberaceae family has remarkable significance from ethnobotanical, economical and taxonomical points of view. This taxon is an endemic species exclusively used by the Shompens as a bee repellent source for their honey collection. They chew the plant parts and spit out the sap filled in the mouth as coarse spray on the bee hives which tranquilizes the honey bees and protect the Shompens from bee stings. Chemical characterization studies on this species revealed interesting findings on its insect-repellent properties.

Chemical characterization on essential oils of the species proved that *H. fenizlii* has effective 'repelling' or 'tranquilizing' property towards insects. The essential oil has a pungent odour and is extracted both from rhizome and leaves demonstrating significant quantitative and qualitative variations. The rhizome oil (0.2%) is yellowish while the leaf oil (0.4%) is colourless. Qualitative analysis by gas chromatography of rhizome and leaf oils was done and the main constituents were identified (eugenol, linalool, methyl chavicol, geraniol, α -pinene and β -pinene). Twenty four essential oils including p-cymene, linalool and eugenol have proved to be effective repellents against worker bees and mosquitoes¹⁵.

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