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Original Research Article

Morpho-ecotypes of endemic flowering plants from Achankovil Shear Zone in Agasthyamalai Biosphere Reserve, Western Ghats, Kerala

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Abstract: As part of the floristic exploration in Achankovil forest of Southern Western Ghats, we sighted the morphologically changed, locally adapted specimens of some endemic plants species. Data concerning about these ecotypes such as morphology, distribution and prominent variation from its types specimens are presented in this paper. Critical examination of the plant specimens and comparison with the earlier literature confirmed that these specimens are the result of co evolution realize by the edaphic effects of Achankovil Shear zone.

Keywords: Achankovil, Shear zone, Endemic, Ecotypes.

Introduction

The term 'ecotype' was introduced in the 1920's by the Swedish Scientist G. Turesson. An ecotype is an intra specific subdivision in a group of similar populations within one and the same plant species that are adapted to certain climatic, edaphic or cenotic conditions and that have developed or changed its morphology, physiology, biochemistry and other features. The ecotypic composition of a species becomes more varied as its geographical range and ecological amplitude increase. There are three main causes for the formations of ecotypes are distinguished viz., climatic, edaphic and biotypic.

Achankovil shear zone (AKSZ) is considered to mark the terrene boundary between Madurai Granulite Block towards the north and Kerala Khondalite Belt towards the south, which is the remnant of the Mozambic belts in the Gondwana by Dissanayake and Chandrajith (1999). This Shear zone has a typical tropical humid climate and temperature varies from 18-31° C. The soil is mainly lateritic and red loamy. Both South-West and North-East monsoons bring rain to this area. Numerous streams take their origin from this forest area and nourish the land. Topographically, Achankovil forest division has prominent natural features, majestic hills with undulating surrounding plains, with diverse flora and fauna. Achankovil shear zone is the repository of many endemic, rare, endangered and threatened plants species. Reason for the high percentage of endemism and rarity in Western Ghats have been reported due to multiple physical, climatological and geological changes that might have occurred during the evolution of the flora. The altitudinal variation of 700- 2010 M, highest air humidity, slightly lower temperature, and conducive geographical conditions viz; Achankovil Shear zone (AKSZ) Achankovil river and the Ariyankavu gap are some of the favourable factors that contribute resons for the co evolution of the plants. During this study, number of morpho-ecotypes enumerated from the study area. Of which 8 endemic plant taxa preferred for the elaborate analysis.

Materials and Methods

The study area is situated in southern Western Ghats, Kerala part of Agasthyamalai biosphere reserve, about 40 KM east of the Punalur and 30 KM west of the Shenkottai, Tamil Nadu. The tract lies within 9º to 9º 15" North Longitude and 77 º to 77º16' 09" East latitude. The study spot comprises 256 km^2 of the tropical evergreen forests to montane grass land. The altitude ranges varies from 700- 2010 M from MSL. Flowering twigs were collected during the period 2009-2012 and taxonomically identified using the publications of Gamble and Fischer (1915-1936), Ramachandran and Nair (1988) and Sasidharan (2013). The identity of the plants species collected was confirmed by referring the herbaria of Kerala Forest Research Institute, JNTBGRI and Calicut University. The occurrence and distribution of endemic species were verified and analysed with the help of standard publications of Ahammedullah and Nayar (1986), Sukumaran and Raj (2008) and IUCN Red List category (2012).

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The voucher specimens were deposited in CMS College herbarium.

Results

Types and ecotypes of 8 endemic plant taxa from the shear zone considered in the present study, and categorize them in to morphologically varied leaf form, flower colour, floral parts and fruit morphology.

Morphological variation in leaf:

Nervilia plicata (Andr.) Schltr. in Engl., Bot. Jahrb. Syst. 45: 403. 1911 (Fig1:A 2)
Synonyms: *Arethusa plicata* Andr., *Pogonia plicata* (Roxb.) Lindl., *Nervilia discolor* (Blume) Schltr., *Pogonia biflora* Wight and *Nervilia biflora* (Wight) Schltr.
Family: Orchidaceae
Distribution: Endemic to Asia

Fig. 1: Types and its ecotypes: A 1 & A 2:- *Nervilia plicata*, B1 &B 2:- *Anaphyllum beddomei*, C1 & C 2:- A*naphyllum wightii*, D1 & D 2:- *Hibiscus lobatus.*

Fig. 1: Types and its ecotypes cont. E1 &E 2:- *Xanthophyllum arnottianum*, F1& F2:- *Satyrium nepalense*, G1&G 2:- *Hydnocarpus pentandra*, H1 & H2:- *Eugenia mooniana.*

Table 1: Prominent morphological differences between *Nervilia plicata* and its leafy ecotype (Fig 1: A 1)

Character	*Nervilia plicata*	Ecotype of N.plicata
Leaf colour	Green	Green
Leaf tip	Acute	Rounded

Anaphyllum beddomei Engl., Planzenreich. Arac.Lasioid. 26. 1911 (Fig1:B 2)
Family: Araceae
Distribution: Southern Western Ghats

Table 2: Prominent morphological differences between *Anaphyllum beddomei* and its leafy ecotype (Fig 1: B 1)

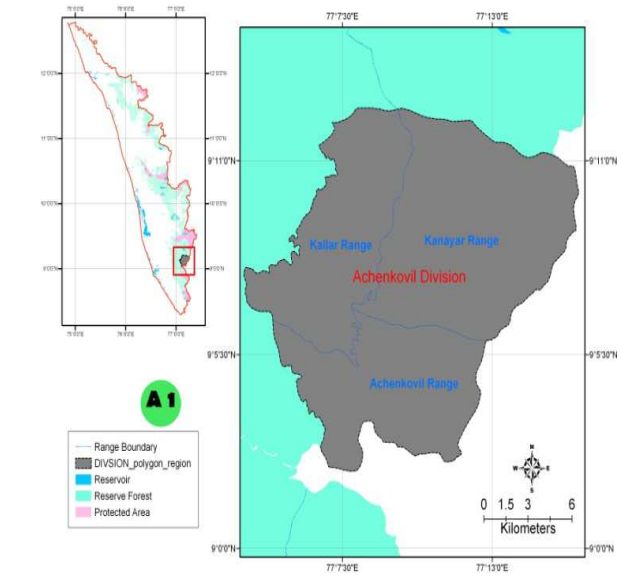
Character	*Anaphyllum beddomei*	Ecotype of *A. beddomei*
colour	Dark Green	Pale green
Lamina	3-sect, middle lobe pinnately lobed	Middle lobe do not dissected
Peduncle	As long as petiole	Double larger than petiole

Morphological variation in floral parts
***Anaphyllum wightii* Schott**, Gen. Aroid. t. 83. 1858 (Fig 1: C 1)
Family: Araceae
Distribution: Southern Western Ghats

Table 3: Prominent morphological differences between *Anaphyllum wightii* and its petiolar ecotype (Fig 1: C 2)

Character	*Anaphyllum wightii*	Ecotype of *A. wightii*
Spathe	Single spathe	Double spathe
Colour of inner spathe	White in centre,purple in corner	White in colour

Hibiscus lobatus (Murr.) O. Ktze., Rev. Gen. Pl. 2: 19. 1898 (Fig 1: D 1)
Synonyms: *Solandra lobata* Murr. And *Hibiscus solandra* L' Herit.
Family: Malvaceae
Distribution: Paleotropics



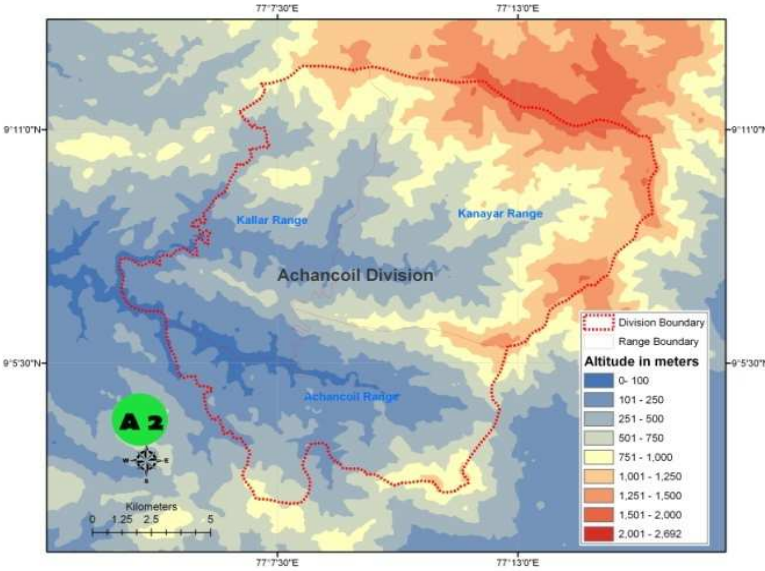


Fig.2: Maps of the study area A1: Boundary of Achankovil forest Division, A 2: Elevational map of Achankovil Shear Zone.

Table 4: Prominent morphological differences between *Hibiscus lobatus* and ecotype (Fig1:D 2)

Character	*Hibiscus lobatus*	Ecotype of *H. lobatus*
Petals	5	4
Stamens	Filaments separate combined in to tube	Filaments very compressed

Morphological variation in flower colour
Xanthophyllum arnottianum Wight, Illustr. 1: 50. t.23. 1840 (Fig 1: E 1)
Synonyms: *Xanthophyllum flavescens* sensu Bennett and *Xanthophyllum angustifolium* Wight.
Family: Polygalaceae
Distribution: Western Ghats

Table 5: Prominent morphological differences between *Xanthophyllum arnottianum* and its ecotype (Fig 1: E 2)

Character	*Xanthophyllum arnottianum*	Ecotype of *X. arnottianum*
Flower colour	White	Yellow
Stamens	8, free	6, filaments joined at base

Satyrium nepalense D. Don, Prodr. Fl. Nepal. 26: 1825 (Fig 1: F 1)
Synonym: *Satyrium neilgherrensis* Wight ex Fyson
Family: Orchidaceae
Distribution: Endemic to Asia

Table 6: Prominent morphological differences between Satyrium nepalense and its ecotype (Fig 1: F 2)

Character	*Satyrium nepalense*	Ecotype of *S. nepalense*
Flower colour	Pink	White
Racemes	Long up to 35 cm	Short up to 20 cm

Morphological variation in fruit
Hydnocarpus pentandra (Buch.-Ham.) Oken, Allg. Naturf. 3: 1381. 1841 (Fig 1:G 1)
Synonyms: *Chilmoria pentandra* Buch.-Ham., *Hydnocarpus laurifolia* (Dennst.) Sleum. and *Hydnocarpus wightiana* Blume.
Family: Flacourtiaceae
Distribution: Western Ghats

Table 7: Prominent morphological differences between *Hydnocarpus pentandra* and its ecotype (Fig 1: G 2)

Character	*Hydnocarpus pentandra*	Ecotype of *H. pentandra*
Fruit	Outer surface of berry is smooth	Rough with uneven in nature
Seeds	angular	rounded

Eugenia mooniana Wight, Ic. t. 551. 1842 & Illustr. 2: 13. 1850 (Fig 1: H 1)
Synonym: *Eugenia thwaitesii* Duthie
Family: Myrataceae
Distribution: Indo Sri Lankan Linkage taxa

Table 8: Prominent morphological differences between Eugenia mooniana and its ecotype (Fig 1: H 2)

Character	*Eugenia mooniana*	Ecotype of *E. mooniana*
Fruit	Smooth, without lenticels	Lenticels present
Size	2 cm in diameter	4 cm in diameter

Discussion

The development of an ecotype is a lengthy process. If an ecotype has progressive characteristics, which permit it to extend the range of range of the species, it may give rise to a new species, and consequently an ecotype is one of the stages in the process of speciation. Endemic species of any geographical region throw light on the biogeography of the area, centres of speciation, areas of extinction and adaptive evolution of the flora. High rate of morpho-ecotypes as described above is yet to be reported from any other part of the Western Ghats. When we compare the plant wealth of the Western Ghats with Achankovil shear zone, the reason for occurrence of morphological ecotypes in Achankovil area is might be due to the effect of the bed shear stress coefficient within the Achankovil Shear Zone. Because all other factors viz; physical, chemical and climatological dynamics are common in the system. In this context, the present study has great relevance as it calls the attention of all concerned with the stringent conservation and in depth study in the floristic diversity of Achankovil Shear Zone.

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