BULL. BOT. SURV. INDIA
Vol. 23, Nos. 3 & 4 : pp. 254-264, 1981

ENDEMIC PRIMITIVE, TEMPERATE ELEMENTS AND THE RELICT VEGETATION OF KUNDAH RANGE, NILGIRIS, TAMIL NADU

B. V. SHETTY* AND K. VIVEKANANTHAN

Botanical Survey of India, Coimbatore

INTRODUCTION

Nilgiris or the Blue Mountains are the meeting ground of three mountain systems of Peninsular India, *viz.*, the Sahyadri, the Southern Ghats and the Eastern Ghats. Kundah range the south-western part of Nilgiris, is very hilly and intersected by deep valleys.

CLIMATE AND RAINFALL

The climate at the hill tops of South India is temperate, the low temperature being due to the high altitude and not due to the latitude. Jayadev (1957), Meher-Homji (1965, 1967, 1969) and Theagarajan (unpub.) have clearly shown that the climate here differs from the typical temperate climate. The Kundah range gets the frontal attack of south-west monsoon and is considered to be one of the most rainy regions of South East Asia and probably of the tropical mountains (Blasco, 1971 a). The mean annual rainfall here often exceeds 5000 mm ; figures of 2000 to 4000 mm in one single month—July or August—are not rare.

SALIENT FEATURES OF THE VEGETATION

The vegetation of this range may be classified under (1) Evergreen stunted forests, locally known as *sholas*, occurring in sheltered sites such as valleys, glens, ravines, hollows and depressions where there is adequate moisture. Champion and Seth (1968) classify them under 'Southern montane wet temperate forests'. (2) 'Southern subtropical hill forests' (Champion and Seth, *l. c.*) are found where the altitude is less than 1600 m. (3) Shrub savannas, generally known as grasslands, cover large tracts on these hill tops. These go by several names such as downs, high level grasslands, montane grasslands and as 'Patanas' in Ceylon. Meher-Homji (1969) pointed out that in many of the so-called grasslands a large number of ligneous elements are found and hence suggested that they should be called shrub savannas. Champion and Seth (*l. c.*) classify them under Southern montane wet grasslands'. (4) 'Southern montane wet scrubs' (Champion and Seth, *l. c.*) are also found in certain degraded places. (5) Swamps and marshes in grasslands filled with peat deposits are noteworthy features of this area. Hooker (1906) pointed out the occurrence of peat bogs in Nilgiris which are of rare occurrence in India. The curious plant *Pleiocraterium verticillare* (Wt. & Arn.) Bremek. (Rubiaceae) is characteristic of these bogs. The other herbaceous plants found are species of *Exacum, Eriocaulon, Lysimachia, Utricularia* and *Xyris*. (6) 'South Indian subtropical hill savannas' (Champion and Seth, *l. c.*) or low level grasslands are also found on few slopes where the altitude is less.

INTERESTING ELEMENTS AND ASPECTS OF THE VEGETATION

The isolated peaks of the Kundah range, where the altitude is high, rainfall is heavy

* Botanical Survey of India, Jodhpur,

and the climate is of a congenial tropical montane type, harbour a large number of rare and endemic plants. Also a large number of plants new to science have been discovered from these hill tops. Another interesting feature is the report of a primitive species, *viz. Youngia nilgiriensis* Babcock from this range. The occurrence of a few temperate and Himalayan elements on the South Indian hill tops, has roused the interest of many phytogeographers and various theories have been put forward to account for their presence there.

ENDEMIC ELEMENTS

The abundance of endemic taxa on South Indian hill tops has been indicated by Blasco (1971 a, b). He has shown that most of the 356 indigenous species found above an altitude of 1,700 m are endemic, and 223 species are known only in the "montane stage" of South India. He has estimated 18 species to be exclusively confined to the Palni hills, 13 to the Anamalai hills and 82 to the Nilgiris and pointed out that the Nilgiris appear to be an important centre of speciation in South India, next only to Travancore and Tirunelveli. There are 28 endemic taxa confined to the Kundah range only which clearly indicates the botanical significance of this small area. This includes 11 taxa not listed by Blasco (1971 a) in his account of the endemic taxa from Nilgiris. The endemic plants of the Kundah range are given below. The locality, altitude and collector's name with field numbers, if any, based on the literature and the collections deposited in the Madras Herbarium (MH) and the Central National Herbarium (CAL) are also furnished.

OXALIDACEAE

1. **Biophytum polyphyllum** Munro in Wt., Ill. 1 : 162. 1840; Gamble, Fl. Pres. Madras 1 : 95. 1957 (repr. ed.).

Perennial woody herbs; flowers yellow; found in grasslands at an altitude of 1,900-2,200 m.

Above Sispara *Gamble* 20599; Thaishola, *Barnes* 159; Carrington to Kinnakurrai *Shetty* 34304, 37686. (MH; no specimen in CAL).

BALSAMINACEAE

2. **Impatiens denisonii** Bedd. in Madr. Journ. Sci. ser. 3. 1 : 41. 1864. Gamble, Fl. Pres. Madras 1 : 99. 1957 (repr. ed.).

Scapigerous herbs; flowers pink; on wet rocks at 900-1,500 m alt.

Sispara ghat, *Beddome s. n.*—acc. no. 7340, 7345. (MH).

3. **I. laticornis** C. E. C. Fischer in Kew Bull. 1930 : 154. 1930 & Gamble, Fl. Pres. Madras 3 : 1294. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 84. 2 : t. 59. 1932.

Scapigerous herbs; flowers white with yellow or orange hairs, or pink with magenta hairs; on wet rocks and on tree trunks in shady places, 2,100 m-2,400 m alt.

Kundahs *Barnes* 397, *s. n.*-acc. no. 78053. (MH).

4. **I. neo-barnesii** C. E. C. Fischer in Kew Bull. 1930 : 330. 1930 & Gamble, Fl. Pres. Madras 3 : 1294. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 86. 2 : t. 62. 1932. *I. barnesii sensu* C. E. C. Fischer in Kew Bull. 1930 : 153. 1930. *non* Hook. f. 1909.

Epiphyte; flowers cream or nearly white; on moss covered tree trunks in wet *sholas* at *c.* 2,000 m alt.

Kundah (Barnes). (No specimen in MH).

5. **I. nilgirica** C. E. C. Fischer in Kew Bull. 1931 : 41. 1931 & Gamble, Fl. Pres.

ras 3 : 1294. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 84. 2 : t. 60. 1932.

Scapigerous herbs; flowers light to dark pink or pinkish red; amidst grass on wet rocks at *c.* 2,100 m alt.

Kundah range *Barnes s. n.*—acc. no. 78052; Avalanche to Makurti peak *Barnes* 370. (MH).

RUTACEAE

6. **Melicope indica** Wt. Ic. 3(4) : 1. t. 1051. 1846; Gamble, Fl. Pres. Madras 1 : 106. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 99. 1932.

Trees; flowers greenish pale yellow; in *sholas* near streams at 2,000-2,300 m alt.

Peninsula Indiae orientalis, *Wight* 565; Sispara *Beddome s. n.*—acc. no. 7918; *Lawson s. n.*—acc. no. 7911, 7914, 7916; Avalanche *Lawson s. n.*—acc. no. 7919; *Gamble* 13437, 20566; *Vivekananthan* 40624; Lakkadi, *Shetty* 34108; Mudimund *Ellis* 37872. (MH).

Shetty 34108 has been collected after about 80 years.

AQUIFOLIACEAE

7. **Ilex gardneriana** Wt., Ic. 4(1) : 9. t. 1217. 1848; 1875; Gamble, Fl. Pres. Madras 1 : 144. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 109. 1932.

Large shrubs or small trees; flowers greenish yellow; near streams at *c.* 1,800 m alt.

Sispara ghat *Wight s. n.*—acc. no. 9783. (CAL; no specimen in MH).

ROSACEAE

Photinia serratifolia (Desf.) Kalkm. var. **tomentosa** (Gamble) Vivek. & Shetty *comb. nov. P. lindleyana* Wt. & Arn. var. *tomentosa* Gamble, Fl. Pres. Madras 445. 1919 (1 : 315. 1957, repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 201. 1932.

Small trees; flowers white; in *sholas* at 2,000-2,200 m alt.

Peninsula Indiae orientalis *Wight* 922; Sispara, *Gamble* 14473; *Lawson s. n.*—acc. no. 19533, 19534; Bangitappal *Beddome s. n.*—acc. no. 19503; *Gamble* 20638; *Shetty* 34161; Lakkadi, *Vivekananthan* 40394; Avalanche *Vivekananthan* 40652. (CAL & MH).

Shetty 34161 was collected from the type locality after about 80 years. For nomenclature of *P. lindleyana* Wt. & Arn. refer to Kalkman in *Blumea* 21 : 424-426. 1974.

MELASTOMATACEAE

9. **Memecylon flavescens** Gamble in Kew Bull. 1919 : 226. 1919 & Fl. Pres. Madras 1 : 355. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 232. 1932.

Trees or large shrubs; flowers pale blue; in *sholas* near streams at 2,000-2,300 m alt.

Kundahs *Gamble* 20581; Avalanche *Vivekananthan* 40623. (MH; no specimen in CAL).

Vivekananthan 40623 was collected from the type locality after a lapse of about 83 years.

10. **M. sisparense** Gamble in Kew Bull. 1919 : 227. 1919 & Fl. Pres. Madras 1 : 356. 1957 (repr. ed.).

Large shrubs or small trees; flowers blue; in *sholas* at *c.* 1,500 m alt.

Sispara ghat *Lawson* s. *n.*—acc. no. 21565. (MH).

RUBIACEAE

11. **Hedyotis hirsutissima** Bedd. in Madr.

Journ. Sci. ser. 3. 1 : 49. 1864 & Ic. Pl. Ind. Or. 1. t. 2. 1874; 1880. *Oldenlandia hirsutissima* (Bedd.) O. Ktze., Rev. Gen. 292. 1891; Gamble, Fl. Pres. Madras 2 : 422. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 274. 1932.

Shrubs; in crevices of rocks, in grasslands at 2,000-2,300 m alt.

Nilgiris, *Beddome s. n.*—acc. no. 24377, 24380, 24381; Kundah mountains, *Beddome s. n.*—acc. no. 24382; Bangitappal and Sispara, *Lawson s. n.*—acc. no. 24378; *Shetty* 37518. (MH).

Note : *Shetty* 37518 has been collected after about 80 years, from the type locality.

12. **H. sisaparensis** Gage in Journ. As. Soc. Beng. (n. s.) 1 : 244. 1905. *Oldenlandia sisaparensis* (Gage) Gamble, Fl. Pres. Madras 599. 1921 (2 : 422. 1957, repr. ed.).

Undershrubs; flowers greenish white; at *c.* 2,200 m alt.

Above Sispara, *Gamble*. (No specimen in MH).

13. **Lasianthus ciliatus** Wt. in Calc. Journ. Nat. Hist. 6 : 509. 1846; Gamble, Fl. Pres. Madras 2 : 456. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 292. 1932.

Stout shrubs; flowers white; in *sholas* at *c.* 2,200 m alt.

Sispara *Wight s. n.*—acc. no. 26409; *Beddome s. n.*—acc. no. 26410, 26411; *Lawson s. n.*—acc. no. 26407; *Gamble* 20575. (MH).

14. **Pavetta hohenackeri** Bremek. in Fedde, Repert. 37 : 98. 1934; Fischer in Gamble, Fl. Pres. Madras 3 : 1300. 1957 (repr. ed.). Glabrous shrubs; flowers greenish white.

Sispara, *Hohenacker*. (No specimen in MH).

ASTERACEAE

15. **Helichrysum wightii** Clarke ex Hook. f., Fl. Brit. India 3 : 291. 1881; Gamble, Fl. Pres. Madras 2 : 492. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 336. 1932.

Herbs with woody rootstock; florets yellow; in grasslands at *c.* 2,200 m alt.

Between Bangitappal and Sispara *Lawson & Gamble s. n.*—acc. no. 27950, 27773. (MH).

16. **Myriactis wightii** DC. var. **bellidioides** Hook. f., Fl. Brit. Ind. 3 : 247, 1881; Gamble, Fl. Pres. Madras 2 : 478. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 319. 1932.

Scapigerous herbs; florets white; in grasslands at 2,200-2,300 m alt.

Nilgiris, *Schmid s. n.*—acc. no. 227205; *King s. n.*—acc. no. 227214; Bangihalla *Shetty* 34125. (CAL & MH).

It is a remarkable variety that connects *Myriactis* Less. and *Lagenifera* Cass. The differentiation between *Myriactis* and *Lagenifera* is narrowed by the existence of this variety with scapigerous habit and with short beaked achenes.

17. **Senecio kundaicus** C. E. C. Fischer in Kew Bull. 1940 : 45. 1940.

Herbs; florets yellow; in grasslands.

Kundahs, *Mayuranathan*. (No specimen in MH).

18. **S. lawsoni** Gamble in Kew Bull. 1920 : 342. 1920 & Fl. Pres. Madras 2 : 507. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 348. 1932.

Herbs; florets yellow; in grasslands at 2,000-2,300 m alt.

Bangitappal *Lawson s. n.*—acc. no. 28689; between Avalanche and Sispara, *Lawson s. n.* —acc. no. 28550; Sispara *Shetty* 37514; Bangihalla, *Shetty* 37560; *Vivekananthan* 43021 (MH).

Shetty 37514 & 37560 have been collected after about 85 years.

19. **Youngia nilgiriensis** Babcock in Kew Bull. 1939 : 662. 1940.

Herbs; florets yellow; in grasslands at *c.* 2,060 m alt.

Sispara, *Gamble*. (No specimen in MH).

MYRSINACEAE

20. **Embelia gardneriana** Wt. Ic. 4(1) : 7. t. 1208. 1848; Gamble, Fl. Pres. Madras 2 : 529. 1957 (repr. ed.).

Climbing shrubs; flowers white; at *c.* 1,600 m alt.

Sispara ghat, *Lawson s. n.*—acc. no. 29451; *Gamble* 13430. (CAL & MH).

SYMPLOCACEAE

21. **Symplocos microphylla** Wt. Ic. 4(1) : 10. t. 1232. 1848; Bedd., For. Man. Bot. 150. 1872; Gamble, Fl. Pres. Madras 2 : 551. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 382. 1932.

Trees; flowers cream-yellow; in *sholas* at 2,000-2,300 m alt.

Peninsula Indiae orientalis, *Wight s. n.*—acc. no. 284249; Kudiakad *Gamble* 20586; Sispara, *Beddome s. n.*—acc. no. 30630; *Lawson s. n.*—acc. no. 30601; Upper Bhavani to Bangihalla, *Shetty* 37493; *Vivekananthan*, 40696. (CAL. & MH).

ACANTHACEAE

22. **Andrographis lawsoni** Gamble in Kew Bull. 1923 : 375. 1923 & Fl. Pres. Madras 2 : 736. 1957 (repr. ed.).

Low undershrubs; flowers dark brownish purple; in grasslands at 2,000-2,300 m alt.

Nilgiris, *Anon* acc. no. 38184; Sispara, *Lawson s. n.*—acc. no. 38092; Bangitappal, *Lawson s. n.*—acc. no. 38097, 38098; Upper Bhavani to Bangihalla, *Shetty* 37484; Bangihalla to Bangitappal, *Vivekananthan* 43004; Mudimundu, *Ellis* 34821, 43409.

23. **Mackenziea violacea** (Bedd.) Bremek. in Verh. Nederl. Wet. Nat. sect. 2. 41 (1) : 182. 1944. *Strobilanthes violaceus* Bedd. Ic. Pl. Ind. Or. 1 : 48. t. 205. 1874; Gamble, Fl. Pres. Madras 2 : 732. 1957 (repr. ed.); Fyson, Fl. South Ind. Hill St. 1 : 452. 1932.

Large shrubs; flowers blue-purple; in grasslands at 2,100-2,200 m alt.

Sispara ghat. *Beddome s. n.*—acc. no. 37962; Sispara, *Lawson* & *Gamble s. n.*—acc. no. 37913, 37914; Bangitappal, *Lawson s. n.* —acc. no. 37915, 37916. (MH).

24. **Thunbergia wightiana** T. Anders. in Journ. Linn. Soc. 9 : 448. 1867; Gamble, Fl. Pres. Madras 2 : 708. 1957 (repr. ed.).

Large climbers; flowers blue; at *c.* 1,500 m alt.

Nilgiris, *Wight s. n.*—acc no. 37119; Sispara ghat, *Beddome s. n.*—acc. no. 37118. (MH).

EUPHORBIACEAE

25. **Glochidion sisparense** Gamble, Fl. Pres. Madras 1307. 1925 (2 : 914. 1957, repr.

ed.). *G. arboreum* Hook. f., Fl. Brit. India 5 : 316. 1887 *p. p., non* Wt.

Trees ; flowers green ; at *c.* 1,500 m alt.

Sispara, *Gamble*. (No specimen in MH).

26. **Reidia fimbriata** Wt. Ic. 5(2) : 28. t. 1904. f. 1. 1852 ; Gamble, Fl. Pres. Madras 2 : 904. 1957 (repr. ed.). *Phyllanthus fimbriatus* Muell.-Arg. in Linnaea 32 : 47. 1863.

Glabrous shrubs ; flowers red ; in evergreen forests at *c.* 2000 m alt.

Sispara ghat, *Beddome s. n.*—acc. no. 46930 ; *Gamble* 20602 ; Carrington to Kinnakurrai, *Shetty* 34273. (CAL. & MH).

ORCHIDACEAE

27. **Liparis biloba** Wt. Ic. 5(1) : 4. t. 1633. 1851 ; Gamble, Fl. Pres. Madras, 3 : 986. 1957 (repr. ed.).

Terrestrial herb ; flowers purple ; at *c.* 1,380 m alt.

Kollimund, *Vivekananthan & Rao* 47227. (MH).

ARACEAE

28. **Arisaema translucens** C. E. C. Fischer in Kew Bull. 1933 : 344. 1933 & Fl. Pres. Madras 3 : 1308. 1957 (repr. ed.).

Herb ; spadix green with faint purple lines ; at *c.* 1,600 m alt.

Thaishola, *Barnes* 333, 336. (MH).

In addition, the following 27 taxa reported to be endemic to the Nilgiris in general (Blasco, 1971 a) are also found in the Kundah range.

BALSAMINACEAE

Impatiens beddomei Hook. f.

I. orchiodes Bedd.

I. tenella Heyne ex Wt. & Arn.

PAPILIONACEAE

Crotalaria barbata Grah. ex Wt. & Arn.

C. formosa Grah. ex Wt. & Arn.

ROSACEAE

Rubus rugosus Sm. var. **thwaitesii** Focke.

MELASTOMATACEAE

Sonerila elegans Wt.

APIACEAE

Heracleum hookerianum Wt. & Arn.

CAPRIFOLIACEAE

Viburnum hebanthum Wt. & Arn.

ASTERACEAE

Anaphalis neelgerryana (Sch.-Bip. ex DC.) DC.

A. notoniana (DC.) DC.

Senecio lessingianus (Wt. & Arn.) Clarke.

S. polycephalus (DC.) Clarke

ASCLEPIADACEAE

Baeolepis nervosa (Wt. & Arn.) Decne. ex Moq. (*Brachylepis nervosa* Wt. & Arn.).

GENTIANACEAE

Swertia trichotoma (Wt. & Arn. ex Wt.) Wall. ex Clarke.

CONVOLVULACEAE

Argyreia nellygherya Choisy.

ACANTHACEAE

Leptacanthus amabilis (Clarke) Bremek. (*Strobilanthes amabilis* Clarke).

Nilgirianthus papillosus (T. Anders.) Bremek.

(*Strobilanthes papillosus* T. Anders.)

N. wightianus (Nees) Bremek. (*Strobilanthes wightianus* Nees).

Phlebophyllum lanatum (Nees) Bremek. (*Strobilanthes gossypinus* T. Anders.)

Pleocaulus sessilis (Nees) Bremek. (*Strobilanthes sessilis* Nees)

LAMIACEAE

Pogostemon paludosus Benth.

Teucrium wightii Hook. f.

LAURACEAE

Cinnamomum perrottetii Meissn.

ARACEAE

Arisaema tylophorum C. E. C. Fischer

ERIOCAULACEAE

Eriocaulon robustum Steud.

POACEAE

Arundinaria wightiana Nees var. **hispida** Gamble

PRIMITIVE SPECIES

The occurrence of the endemic species, *Youngia nilgiriensis* Babcock (Asteraceae) in the isolated highland of Sispara (2060 m) in the Kundah range is phytogeographically interesting. Most of the species of *Youngia* are concentrated in eastern Asia from southern Siberia and Japan throughout China into Turkistan and the Himalaya region, and hence south-eastern Asia is considered to be the place of origin of the genus (Babcock and Stebbins, 1937). According to Babcock (1939) several factors characterise *Y. nilgiriensis* to be a somewhat primitive species and it may represent the ancestral type from which the section 'Mesomeris' of the genus arose. Its occurrence in an isolated highland, according to him, suggests that it may be an endemic relict. The possibility of a southern origin of a section of the genus *Youngia* is thus indicated. Razi (1955) cites this as an example of a genus which is northern in origin, but appears to have produced at least a section in the south.

TEMPERATE ELEMENTS

The presence of certain temperate elements in the vegetation in Nilgiris and some other South Indian hill tops led many botanists like Hooker and Thomson (1855), Hooker (*l. c.*) and several subsequent workers to stress on the floristic affinity between the South Indian hill tops and the Himalayas, particularly the cool regions of Khasia, Manipur and Naga hills. Studies undertaken in recent years, like those by Theagarajan (*l. c.*) in Nilgiris, Meher-Homji (1965, 1967) and Blasco (1971 b) in some South Indian hill tops, Shetty and Vivekanan-than (1973) in Anaimudi, the highest peak in South India and the present studies have, however, shown that there is a preponderance of tropical elements in the vegetation of South Indian hill tops and that the temperate elements play a comparatively less important role.

The species found in the *sholas* are limited in their distribution to the tropical latitudes. They may be indigenous to the Western Ghats or distributed over the Western Ghats and Ceylon or extend to the Eastern Ghats and over the Indo-Malayan region. At the generic level also, most of the *shola* elements are mainly of tropical stock. However, many of the species found on the fringes of the *sholas* have their distribution extending to the Himalayas or to countries of higher latitude like China, Japan and Korea. The ligneous elements found in the shrub savannas are also mainly of sub-

tropical to temperate stock and have an ecological amplitude wide enough to tide them over the adverse conditions prevailing in the open areas.

Most of the genera of temperate origin occurring on South Indian hill tops, including the Kundahs, are represented by a single or very few species e.g., *Alchemilla indica* Gardn., *Anemone rivularis* Buch.-Ham., *Circaea alpina* Linn., *Dipsacus leschenaultii* Coult., *Gaultheria fragrantissima* Wall., *Geranium nepalense* Sweet, *Mahonia leschenaultii* (Wall. ex Wt.) Takeda, *Myriactis wightii* DC., *Rhododendron nilagiricum* Zenk. etc. van Steenis (1934-1936) observed the same phenomenon in the Malayan mountain flora and pointed out that of the 284 genera of temperate origin, not less than 141 are represented by a single species on the Malayan mountains.

The species common to the South Indian hill tops like Nilgiris and the Himalayas or extending to the other temperate regions are generally the widely distributed species of the genera e.g. *Anemone rivularis* Buch.-Ham., *Berberis tinctoria* Leschen., *Circaea alpina* L., *Gaultheria fragrantissima* Wall., *Geranium nepalense* Sweet, *Hypericum hookerianum* Wt. & Arn., *Lonicera ligustrina* Wall., *Photinia notoniana* Wt. & Arn.; *Potentilla leschenaultiana* Ser. etc. In some cases they have evolved into distinct species or varieties, e.g. *Berberis nilghiriensis* Ahrendt., *Dipsacus leschenaultii* Coult., *Disporum leschenaultianum* D. Don, *Mahonia leschenaultii* (Wall. ex Wt.) Takeda, *Rhododendron nilagiricum* Zenk., *Senecio lawsoni* Gamble, *Vaccinium leschenaultii* Wt. etc.

RELICT VEGETATION

Kundah range mainly consists of vast stretches of grasslands, interrupted by numerous, isolated, compact and sharply well defined small woods known as *sholas* which are the montane variation of the wet evergreen forest. They are distributed all over the range but their composition, and the size and height of the trees vary according to the altitude and the velocity of the wind. Towards Bangitappal, Sispara and in Western Catchment where the altitude is more than 1,900 m the *sholas* are few and smaller with poor stunted trees one to three metres high. But the *sholas* change considerably with the decrease in altitude, there being a gradual increase in the growth of trees until finally they merge with the well defined southern subtropical hill forest. Though these *sholas* show fundamental affinity to the various types of tropical rain forests to which category they belong, they, however, show marked differences in detail from the main group in structure and floristics. The tree species comprising the *sholas* are all evergreen, represented mostly by members of Myrtaceae, Symplocaceae, Icacinaceae, Celastraceae and Lauraceae. Large lianas are quite common. The ground flora consists of a large number of species of Rubiaceae and *Strobilanthes* (*s. l.*), with a great abundance of ferns and mosses. The epiphytic flora which is abundant consists of orchids, ferns, lichens and Bryophytes. However, the total absence of members of Annonaceae, Anacardiaceae, Mimosaceae, Ebenaceae, Dipterocarpaceae, Connaraceae etc., which are characteristic of the tropical rain forests of the adjacent regions is striking. In addition, there is no marked differentiation of canopy layers in *sholas*. It is also very difficult to pinpoint the dominant species in *sholas*; it is only possible to generally indicate the common characteristic species.

The ecological status of the shola-grassland formation which is the characteristic vegetation at the higher altitudes of some South Indian hills like Nilgiris, Palnis, malais, the High Range etc., has been of controversy, the notable contributi

those by Bor (1938), Ranganathan (1938, 1941), Jayadev (*l. c.*), Shankarnarayan (1958), Rege *et al.* (1959), Aslam (1959), Agrawal *et al.* (1961), Meher-Homji (1965, 1967, 1972), Noble (1967), Blasco (1971 a) and Theagarajan (*l. c.*). Shetty and Vivekananthan (*l. c.*) have reviewed the literature on this subject.

According to Bor (*l. c.*) the *shola* forest is a relict of an evergreen climax forest which has been pushed back to its last strong hold by fire and grazing. Theagarajan (*l. c.*) pointed out that the *shola* vegetation is not in a dynamic equilibrium with the climatic conditions since it cannot re-establish itself in the area, if destroyed. He attributes the present restricted occurrence of the once extensive evergreen forests in the Nilgiris to changes in the climate. According to him "the helpless *shola* vegetation is indeed an anachronism in this tract having a precarious existence. It is therefore a relict vegetation". Meher-Homji (1972) pointed out that the *shola* vegetation in itself is in balance with the existing climate; *only when it is disturbed by man* the new micro-climate so created and the degradation of the soil prove deleterious to the regeneration of the forest species which are of a tropical stock and lead to the establishment of grasses, herbs and shrubs.

Paleo-palynological studies undertaken in recent years have thrown some light on the vegetation in the past in Nilgiris. According to Vishnu-Mittre and Gupta (1971) the formation of the *shola* forest commenced about 35,000 years ago (in the late Pleistocene times corresponding to the last glaciation in the Western Himalayas) through the gradual invasion of the grasslands by shrubs and trees, especially *Rhododendron* Gupta (1973) is of the opinion that montane forest gained dominance about 14,000 years B.C. as evidenced the preponderance of pollen of *Gordonia*, *arpus* and *Euonymus*. After this phase the *shola* forest began to decline and there was a corresponding spread of grasslands. The decline of the *shola* forest, it is believed, was largely *due to human interference* and might also have been due to gradual increase in precipitation (Vishnu-Mittre, 1974). The non-regenerating and fast receding *shola* forest, according to Vishnu-Mittre and Gupta (1968), is a dying community and deserves to be more appropriately called a living fossil plant community. Blasco and Thanikaimoni (1974) are of the opinion that at Pykara and Parson's Valley the savanna had existed since the last 3000-4000 years.

The need for preventing further destruction of vegetation here cannot be over-emphasised not only because of its botanical interest in having relict vegetation and a large number of endemic taxa, some of which have not been collected after the type collection, but also because of the importance of the *shola* forests in protecting the sources of water supply to the principal catchment area of Nilgiris, namely Kundahs on which the Kundah-Pykara hydro-electric project and the cultivation of vast areas of land depend.

ACKNOWLEDGEMENT

The authors are thankful to the Director, Botanical Survey of India for providing facilities.

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