

## SPECIES RICHNESS AND DENSITY OF GROUND HERBS IN KARAİKAL, EAST COAST, UNION TERRITORY OF PONDICHERRY, SOUTH INDIA

K. KADAVUL and S. JAGATHEESWARI

Department of Plant Science, K.M.Centre for Post-Graduate Studies, Lawspet, Pondicherry-605 008, India.  
E-mail: kadavul2004@yahoo.com

Ground flora species diversity, density and species richness curve were studied in Karaikal region, on the East coast of Union territory of Pondicherry. A total of 135 ground flora species in 117 genera, 42 families and 13 831 individuals were inventoried in nine 0.01 ha plots. The most speciose (46 species) plot was recognized as Keezhakasakudy (KE), and the least (14) was in Neravy (NR). The most individualized (3284) plot represented in Nehru nagar while the minimum (1012) was in Varichikudy (VR). Of the 135 species (77 ; 57% ) belong to herbaceous, only 6 species (5%) as thorny taxa. Number of medicinal herbs are also exploited because of clearing of lands for construction of industries and institutions. Biodiversity analysis of ground flora of Karaikal will be useful in wild vegetation management and conservation program, because of substantial ground was disturbed by anthropogenic activities. It is essential to prevent further expansion of uncultivated lands as construction areas as the protection of existing ground flora here is crucial for biological conservation of the species.

**Keywords :** Conservation management; Diversity; Ground flora; Karaikal.

### Introduction

Most biodiversity studies in tropical forests have been concentrated on woody species, the under storey shrubs, under shrubs, herbaceous climbers, herbs etc. were rarely included in such inventories. Working with good herbs instead of trees may be an advantage in that it requires less time to obtain large samples of individuals of species. Ground herbs are therefore likely to be more sensitive to desiccation and the condition which may be found to be critical for their distribution, will only be important for trees when seedlings establish<sup>1</sup>. The relationships between canopy trees and ground flora in a tropical rain forest in Singapore have been studied<sup>2</sup>. The density of crop plants and ground flora plays a crucial role in the outcome of competition between them. It has been reported that dense crop has a something effect on ground flora<sup>3</sup>.

Information on ground flora species is needed because of its potential usefulness in understanding the relative extent of plant biodiversity across the tropics and its implication for conservation and management. In peninsular India a few quantitative biodiversity inventories of understorey plants are available from the forests of Anamalai Western Ghats<sup>4</sup>. The principal objective of the study is to determine the extent of ground species richness, density, and little physicochemical analysis such as carbon, nitrogen, phosphorous, water holding capacity etc in the Karaikal region, east coast, UT of Pondicherry, South India.

### Materials and Methods

The present investigation on ground flora analysis was conducted in Karaikal region (Union Territory of Pondicherry) lies between 10° 49' and 11° 01' North latitude and between 79° 43' and 79° 52' East longitude is above 150 km farther south of Pondicherry, isolated with the Tanjore district of Tamil Nadu; bounded on the east by the Bay of Bengal (Fig. 1). The region is spread an area of 161 sq. km north of Nagapattinam and 9 km south of Tharangambadi (Fig. 2). The mean annual number of annual rainfall for five years (1996-2000) was 1499.4mm. The temperature ranges from 19.6°C (Nov-Jan) to 37.7°C (Apr-Aug) while the relative humidity was ranged between 65% (June) to 94% (Nov) for the same period.

Fieldwork was carried at nine localities of Karaikal and its nearby areas such as Kovilpathu (KL), Nehru nagar (NN), Keezhakasakudy (KE), Kasakudymedu (KS), Kottucherry (KT), Varichikudy (VR), Neravy (NR), Thirumalayayanpattinam (TP) and Thirunallar (TN) during Feb-May 2002. At each locality 10x10m square quadrat was laid of which sub divide into 10 segments (1x10m) as workable units. The number of species, the number of individuals of each species, number of climbers and thorny taxa were noted. Mostly, fertile voucher specimens were collected, if not possible, vegetative twigs were collected for species identification. The species were identified by using the Flora of Presidency of Madras vols.1-3<sup>6</sup>, An

Fig. 1. Map showing the Karaikal region UT of Pondicherry- south India.

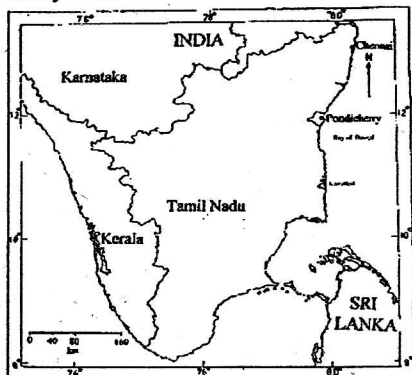


Fig. 2. Detailed map showing the location of study areas in Karaikal UT of Pondicherry, and its adjacent regions.

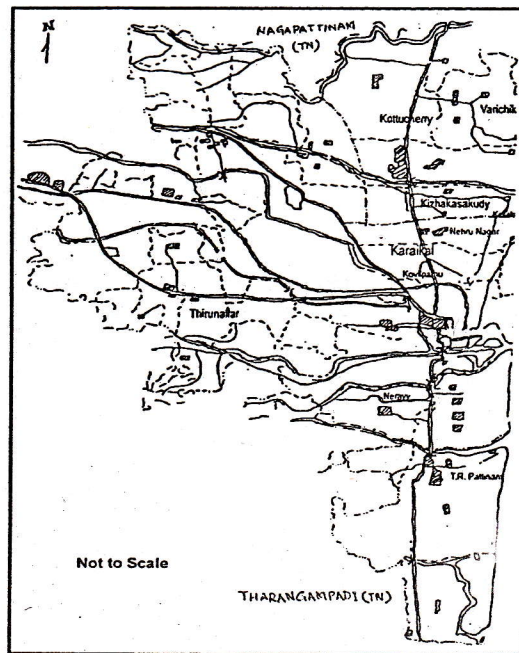


Fig.3. Density and IVI for Nine Study Plots.

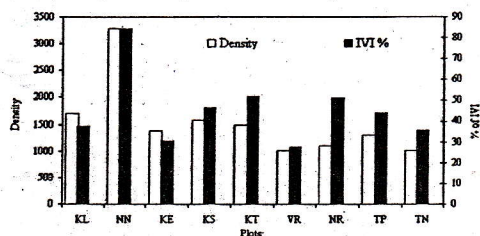
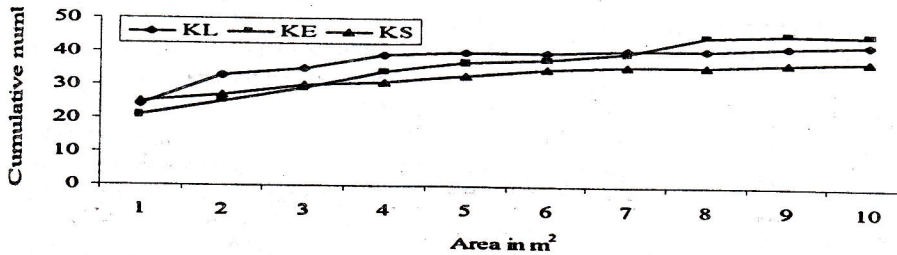


Table I. Consolidated results of all ground flora species represented in nine 10x10m square plots distributed one in each of Karaikal and its nearby region.

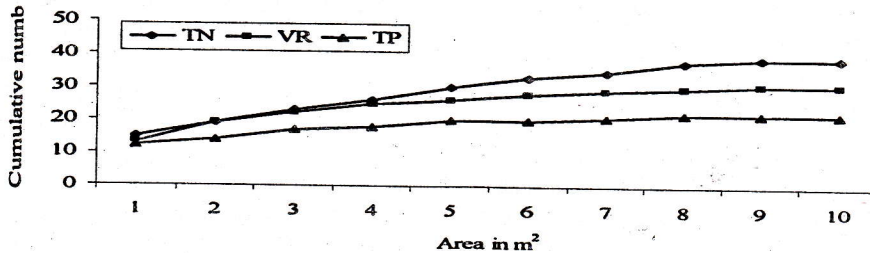
Sl. No.	Variable	Plots Name									Total for nine 10x10m square plots
		KL	NN	KE	KS	KT	VR	NR	TP	TN	
1.	Species richness	43	36	46	38	33	31	14	22	39	135
2.	Number of genera	39	31	44	37	33	30	14	20	36	117
3.	Number of families	22	19	24	18	21	20	10	14	22	42
4.	Diversity indices Shannon index (H')	4.15	3.77	4.68	4.23	4.03	4.25	3.26	3.47	4.15	-
5.	Number of climber species	2	2	4	1	3	2	0	1	2	8
6.	Density of climbers	2	5	22	2	40	6	0	47	8	132
7.	Number of thorny species (individuals, in parenthesis)	1(2)	2(337)	1(1)	2(3)	1(1)	0	1(325)	0	3(31)	6(700)
8.	Number of grass species (individuals, in parenthesis)	5(307)	8(1069)	11(437)	12(816)	5(165)	1(74)	2(180)	3(109)	5(225)	27(3382)
9.	Number of shrub species (individuals in parenthesis)	5(109)	3(224)	3(23)	4(97)	2(273)	4(278)	3(203)	2(120)	2(56)	7(1383)
10.	Number of herb species (individuals in parenthesis)	26(1268)	21(1649)	23(806)	19(676)	22(1013)	24(654)	8(391)	16(1034)	23(678)	77(8169)
11.	Number of tree species in sapling stage (individuals in parenthesis)	4(8)	0	4(49)	0	0	0	0	0	4(8)	10(65)
12.	Total number of individuals in each plot	1696	3284	1338	1594	1492	1012	1099	1310	1006	13831



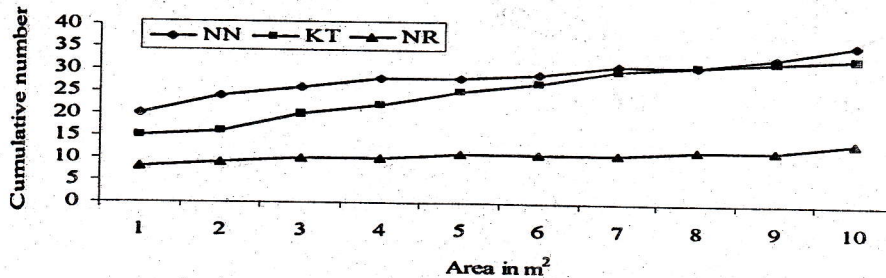
**Fig.4.** Species-area curve for the three 10 x 10 m square plots, KL, KE and KS of Karaikal region.



**Fig.5.** Species-area curve for the three 10 x 10 m square plots, TN, VR and TP of Karaikal region.



**Fig.6.** Species-area curve for the three 10 x 10 m square plots, NN, KT and NR of Karaikal region.



Excursion Flora of Central Tamil Nadu India<sup>7</sup>, Illustration on the flora of Tamil Nadu Carnatic<sup>8</sup> and Further Illustration on the flora of Tamil Nadu Carnatic<sup>9</sup>. Voucher specimens are deposited in the herbarium of K.M. Center for PG studies, Pondicherry.

**Result and Discussion**

A total of 135 ground flora that belonged to 117 genera and 42 families were enumerated in nine 0.01 ha plots at various places of Karaikal and its surrounding areas. The species richness ranged from 14 at Neravy (NR) to the maximum of 46 at Keezhakasakudy (KE). In addition density, diversity of climbers, thorny species, grasses, shrubs, herbs etc are provided in a consolidated Table 1. The variation in species richness and abundance of stand density between the plots is largely due to variation in edaphic factors and anthropogenic

interferences. The diversity of ground flora, 135 species, of this region is greater than ground herbs diversity in Amazan Ecuador, where 96 species in 1 ha plot<sup>10</sup>; 92 species at Batu Apoi forest Brunei<sup>11</sup>, but nearly equal 121 species in 0.75 ha in evergreen low land rain forest at Brunei<sup>12</sup> and 79 species at Agumbe, Karnataka, Central western Ghats India (ms), 79 species at Capiera Ecuador<sup>13</sup> and 59 species at Singapore<sup>2</sup>. The diversity –Shannon index was ranged 3.26 to 4.68. The obtained diversity index is greater than the under storey plants of Varagalair, Western Ghats, India (H' 2.43)<sup>4</sup>.

The total density 13,831 individuals were recorded in 0.09 ha (mean 1537/0.01ha) which is comparable to Poulsen and Balselve<sup>10</sup> as they reported 10,960 individuals on 1 ha plot, 8743 at Borneo and 9431 individuals at Brunei<sup>12</sup>. The highest density 8619 individuals (mean 907.7/ 0.01h) was recorded in these sampling plots which is greater than the study as he reported 6264 individuals herbaceous plants in 1 ha plot at low land forest in north west Borneo<sup>1</sup>.



The importance value index was greatest (84.4%) in the plot Nehru nagar (NN) and the least value (28.1%) at Varichikudi (VR) (Fig.3) The species-area curve of the study exhibited that the species accumulation is almost unstabilized (Fig.4-6.) as that of Anamalais, Karnataka, western Ghats India<sup>4</sup>. The species richness curves of the both observed and estimated attained asymptote at various scales.

Of the nine sampling plots *Gynura nitida* (Asteraceae) was represented with highest density (1112 individuals; 8.04%) followed by *Cynodon dactylon* (844; 6.10%) and *Tephrosia purpurea* (692; 5%) while in Anamalais, western Ghats, India as reported *Nilghiranthus barbatus* and *Periana radiceflora* attained maximum density in 1ha plot at Cuyabeno Amazon Ecuador<sup>10</sup>. Density-wise *Ageratum conyzoides*, *Sida cordata*, *Vernonia cinerea* and *Desmodium triflorum* accounted as predominant species >50 individuals in 0.09/ha the aforesaid same species as predominants in Anamalai western Ghats, India while, *Ipomoea harderifolia* as rare species in both study sites.

Family-wise, Poaceae was represented the highest speciose (16 species) among the 42 families in this region followed by Asteraceae (12) Cyperaceae 11, Euphorbiaceae (10) and Fabaceae and Acanthaceae were reported by 7 species in each.; while in western Ghats, India family Acanthaceae had 15 species as the most speciose family<sup>4</sup>, Cyperaceae had 6 species as dominant family in Singapore<sup>2</sup>. Based on density Asteraceae contributed to the maximum (2676) individualized family in the studied sampling plots followed by Poaceae (1897), Cyperaceae (1343), Acanthaceae (1330) and Fabaceae (1234) whereas Acanthaceae recorded as highest density followed by Poaceae and Asteraceae, in western Ghats Karnataka, India<sup>4</sup>.

Biodiversity data analysis of ground flora of Karaikal region would be useful in wild vegetations management, anthropogenic activities and grazing and browsing by cattle exploited conservation management and conservation program because of substantial ground vegetation. These areas have been frequently cleared for construction of buildings, factories and newly erected educational institutions. In recent years, the clearing activities have become increasing scenario. A comprehensive approach to ground flora conservation must therefore incorporate the sustainable management of outside protected areas and this requires an understanding of how human activities have impact on ground flora resource especially on medicinal plants etc. It is essential to prevent further expansion of uncultivated lands as the construction areas and the protection for the existing ground floras are crucial for biological conservation of species.

#### Acknowledgement

The authors gratefully acknowledged to Dr. K. Uma the Director and Dr. A. Pragasam, Head of the Botany Department for the laboratory facilities.

#### References

1. Poulsen A D 1996, Species richness and density of ground herbs within a plot of low land rain forest in northwest Borneo. *Journal of Tropical Ecology* 12 177-190.
2. Turner M I, Tan HTW and Chua K S 1996, Relationship between herb layer and canopy composition in a tropical rainforest successional mosaic in Singapore. *J. Trop. Ecol.* 12 843-851.
3. Sen D N 1979, Ecophysiological studies on weeds of cultivated fields with special reference to bajra (*Pennisetum typoideum* Rich.) and til (*Sesamum indicum* Linn.) crops. Final report US PL-480 project Jodhpur University, Jodhpur. pp. 245.
4. Annaselvam J and Parthasarathy N 1999, Inventories of understory plants in a tropical evergreen forest in Anamalais, Western Ghats, India. *Ecotropica* 5 197-121.
5. Antony C F 1982, The Gazetteer of India. Vol I and II. Union territory of Pondicherry. Vol. I. Directorate of stationary and printing Govt press. Pondicherry. pp. 1-922.
6. Gamble JS 1915-38, *Flora of the Presidency of Madras*. Vol.1-3. (Vol.3 by Fischer, C.E.C.) Adlard and Sons Ltd., London.
7. Matthew K M 1991, *An Excursion Flora of Central Tamil Nadu, India*. Oxford and IBH. Co., New Delhi, India.
8. Matthew K M 1982, *Illustrations on the Flora of Tamil Nadu Carnatic*. vol.2. The Rapinat Herbarium, St. Joseph's College, Tiruchirapalli, India.
9. Matthew K M 1988, *Further illustrations on the Flora of Tamil Nadu Carnatic*. vol.4. The Rapinat Herbarium, St. Joseph's College, Tiruchirapalli, India.
10. Poulsen A D and Balslev H 1991, Abundance and cover of ground herbs in an Amazonian forest. *J. Veg. Sci.* 2 3115-322.
11. Poulsen A D 1996, The herbaceous ground flora of the Batu Apoi forest Reserve, Brunei Darussalam. In: Edwards, D.S., Booth, W. E. and Choy, S.C. (eds). *Tropical rainforest research - current issues*. Pp. 43-57.
12. Poulsen A D and Pendry C A 1995, Inventories of ground herbs at three altitudes on Bukit Belalong, Brunei, Borneo. *Biodiversity Conservation* 4 745-757.
13. Gentry A H and Dodson C 1987, Contribution of non-trees to species richness of a tropical rain forest. *Biotropica*. 19 149-156.