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POPULATION STRUCTURE AND COMMUNITY CHARACTERISTICS OF *MESUA FERREA* (L.) IN EASTERN GHATS OF ANDHRA PRADESH, INDIA

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ABSTRACT
The present investigation deals with the community structure, species composition of the forest fragments which are dominated by the Mesua ferrea species. The species Mesua ferrea distributed in two forest fragments, phytosociological studies were carried out using 500 M Line transect in these locations. In the present study, a total of 105 species belongings to 92 genera and 59 families were reported. Among these, Rubiaceae family ranks the maximum number of genera (7). Based on the Raunkiears life forms, minimum number of species (2) were reported for nanophenerophytes and maximum number of species (39) for hemicryptophytes. In this forest maximum number of species (245) comes under the category of 6 to 10 meters height and minimum number of plants belongs to the category of 0-5 meters. DBH values of plant populations of this forest indicate that maximum number of species (80) belongs to the category of50-60 cms. Only 3 plants were reported in the diameter class of 90-119 cms.

KEYWORDS: Population structure, Mesua ferrea, Uppa forest, Eastern Ghats.

INTRODUCTION
Mesua ferrea L is a species of Clusiaceae family which grows up to height of 100ft. It is a national tree and native plant of Srilanka. The wood is very hard and strong, *Mesua ferrea* is occasionally used in traditional medicine. It has antimicrobial, anti-inflammatory, antipyretic activity. The oil has antimicrobial and anti-helminthic activity. Seed oil is good medicine for rheumatic disorders. In ancient Ayurvedic literature the plant was recommended for treating piles, dysentery. The plant grows throughout India, in evergreen forests occures up to 1500mts altitude. *Mesua ferrea* is reported (Venkaiah.2003) in Eastern Ghats of Andhra Pradesh near Uppa village, Hukumpeta mandal of Visakhapatnam district. The plant is distributed widely in Assam, Orissa, Western Ghats and Eastern Ghats .So for there is no report and further studies on this plant from Andhra Pradesh. *Mesua ferrea* is distributed only in Hukumpeta region of Andhra Pradesh. In the present Study an attempt was made on the population structure of *Mesua ferrea* Hukumpeta region of Eastern Ghats. *Mesua ferrea* is commonly called as Uppachettu and this species is dominant in this region so forest is called as uppa forest. Uppa forest located at 5km away from Hukumpeta. Inside the forest 5-6 evergreen trees are flowering with luxurious growth of Pteridophytes especially the plant *Cyathea* which is entered in Red data book. Sun light is penetrating inside the forest here and there only. In this forest along with *Mesua ferrea* rare pteridophytes and interesting plants like *Adiantum caudatum, Ageratina adinophora, Anodendron paniculatum, Aristolochia tagala, Blechnum orientale, Centella asiatica, Clerodendron fragrens, Coffea arabica, Curculigo orchioides, Cyathea gigantea, Cyclea peltata, Equisetum debile, Ficus ariculata, Ficus palmate, Glycosmis pentaphylla, Gnetum ula, Hydrocotyle sibthorpioides, Lasia spinosa, Lygodium flexiosum, Mallotus philippensis, Mangifera indica, Marchantia sps, Melastoma malabathricum, Michalia champaka, Ophiorrhiza hirsutula, Ophiorriza chandrasekharanii, Oxalis corniculata, Peparomia dindigulensis, Pilea melastomoides, Pleopeltis pallida, Pseudathria viscid, Pteris vittata, Rotala rotundifolia, Rubus ellipticus, Saraca ashoca, Selaginella involucrata, Wahlenbergia eracta* and *Wattakaka volubilis* are grown in this forest. In the present investigation, studies were made on the population structure and community composition in the Uppa forest near Hukumpata of Visakhapatnam district.

MATERIAL AND METHODS
Uppa forest located between 820 49"E and 180 16" N latitudes, uppa forest spread in two patches, one part is spreads 2 to 3km area and another part spreads 1to 2km area. The canopy is dominated by *Mesua ferrea* plants. In the present study 500 M transect was used for collection of data. Along the transect line quadrate of 5x 5m were made at 5m interval. A total of 5 transects were taken in two patches of Uppa forest were used for

collection of data in two parts of the forest. Plants presents in the quadrate samples were counted and diameter (CBH) of all plants present in all quadrates was measured to estimate the different diameter classes in the Uppa forest of Paderu division.

Data Analysis

The main purpose of the Phytosociological analysis is to understand floristic, vegetation characteristics, to estimate the species richness and diversity which is existing in the study area. Vegetation data were quantitatively analyzed for density, frequency and abundance using standard methodologies (Curtis & Mclntosh 1950) and (Mueller- Dombois & Ellenberg 1974). For calculation of frequency, density and abundance the following formulas have to be used

$$\text{Density} = \frac{\text{Total number of Individuals in all sampling units}}{\text{Total number of sampling units studied}}$$

$$\text{Frequency} = \frac{\text{Number of sampling units in which species occur x 100}}{\text{Total number of sampling units}}$$

Basal area: It is the area occupied by the base of a tree, is considered as a good indicator of the size, volume or weight of a tree. It provides information on the proportion or dominance of the larger and smaller trees in an ecosystem and is one of the most important parameters in estimating the standing biomass in an area.

Basal area = $Cbh2/4\pi$

Where Cbh = Circumference of the tree at breast height.

Important value index (IVI)

The total picture of the relative ecological important and the sociological structure of a given plant species in any community can't be obtained by relative parameters (Relative Frequency, Relative Density, Relative Dominance, etc.,) singly, which give individual clues, although the quantitative value of each such parameter has its own importance. Frequency gives an idea as to how a species is dispersed in the area but we will not get an idea about its number or the area covered. Density on the other hand gives the numerical strength and nothing about the spread or cover. Dominance gives the basal cover only. In order to express the dominance and ecological success of any species with a single value, the concept of important value index have been developed. This index utilizes three characteristics, viz., Relative Frequency, Relative Density and Relative Dominance. On the basis of these analytical quantitative character values, the idea of obtaining a statistical quantity was proposed in order to have a really overall picture of the ecological importance of the species with respect to the community structure, for which the percentage value of Relative Frequency, Relative Density and Relative Dominance are added together. This value out of 300 is called Important Value Index (IVI). It thus incorporate three important parameters that measures of productivity and diversity of every species therefore.

IVI= Relative Density + Relative Frequency+ Relative Dominance

$$\text{Relative density} = \frac{\text{Density value of species X100}}{\text{Sum of density value of all species}}$$

$$\text{Relative frequency} = \frac{\text{Frequency value of species x 100}}{\text{Sum of frequency value of all species}}$$

$$\text{Relative dominance} = \frac{\text{Total basal area of the species x 100}}{\text{Total basal area of all species}}$$

Species richness (Species diversity): Species diversity richness is an expression of community structure. It is described as the number of species present in a sample or habitat per unit area. They are certain indices that can bring them to a similar scale. The simplest species richness index is based on the total number of species and the total number of individuals in a given sample or habitat, higher the value greater the species richness. The more different species present the more diverse the community and is generally considered healthier. Richness tends to increase over area, larger areas will harbors more different species probably because of larger variety of micro habitats and resources. Additionally, sampling over a large area increases the chance of find in rare species.

On the other hand, evenness is a measure of how similar the abundances of different species are categories are in a community. Evenness is ranged from zero. When the evenness is close to one, it indicates that each species categories consist of almost same number of individuals. However, when the abundances of species are very dissimilar (Some rare and some common) then the value increases. The commonly used biodiversity index is Shannon–Wiener index and that of dominance index is Simpson's index.

Simpson's Index (1949)

Species dominance is measured by using this index

$$Cd = \sum(ni/N)^2$$

ni = Total number of individuals of each species

N = Total number of individuals of all species

Shannon – wiener Index (1963)

$$H = \sum(ni/N)\log(ni/N)$$

ni = Total number of individuals belonging to ith species

N = Total number of individuals in the sample.

Identification of specimens

After plant collection from the study sites the specimens were identified by comparing with the authentic certified specimens at the Andhra University herbarium,

Department of Botany and Central National Herbarium (CAL) Howrah (for some grasses). Later these identifications were checked again at the regional herbarium and in the laboratory with help of floras, Monographs and other relevant literature and the correct name was provided to each plant. Each plant was critically studied and identified using the 'Flora of British India' (Hooker.1872-1897); 'Flora of Presidency of Madras'(Gamble. 1915-1936); 'Forest flora of Andhra Pradesh' (Reddy *et al.* 1991); 'Flora of Andhra Pradesh' (Pullaiah & Chennaiah 1997).

RESULTS AND DISCUSSION

Uppa forest is dominated by *Mesua ferrea* plant species. Total no. of species present in the forest was identified. Table-1 shows the statistics of the vascular plants in the Mesua forest. In the present study, 59 families were reported with 92 genera and 105 species. Out of these, Rubiaceae family ranks the maximum number of genera(7) and species (8), followed by Rutaceae family with 6 genera and 7 species, Asteraceae family with 6 genera and six species. enispermaceae family with genera and 4 species and the Asclepiadaceae family with 3 genera and 3 species, while remaining families with 2 genera and 2 species and most of the family with one genera and one species (Table-1).

Table-1: Statistics of vascular plants of *Mesua ferrea* forest

Family	Genus : Species	Family	Genus : Species
Adiantaceae	2 : 4	Melastomaceae	1 : 1
Anacardiaceae	1 : 1	Meliaceae	1 : 1
Apiaceae	2 : 2	Menispermaceae	4 : 4
Apocynaceae	2 : 2	Mimosaceae	1 : 1
Araceae	2 : 2	Moraceae	1 : 4
Araliaceae	1 : 1	Musaceae	1 : 1
Aristolochiaceae	1 : 1	Orchidaceae	1 : 1
Asclepiadaceae	3 : 3	oxalidaceae	1 : 1
Asteraceae	6 : 6	Piperaceae	2 : 2
Blechnaceae	1 : 1	Poaceae	1 : 1
Caesalpiniaceae	2 : 2	Polygonaceae	1 : 1
Campanulaceae	1 : 1	Polypodiaceae	1 : 1
Clusiaceae	1 : 1	Pteridaceae	1 : 1
Commelinaceae	2 : 2	Ranunculaceae	1 : 1
Convolvulaceae	1 : 1	Rhamnaceae	1 : 1
Cyatheaceae	1 : 1	Rosaceae	1 : 1
Dilleniaceae	1 : 1	Rubiaceae	7 : 8
Dioscoriaceae	1 : 3	Rutaceae	6 : 7
Equisetaceae.	1 : 1	Sapindaceae	1 : 1
Euphorbiaceae	1 : 1	Schizaceae	1 : 1
Fabaceae	2 : 2	Scrophulariaceae	1 : 1
Gentianaceae	1 : 1	Selaginellaceae	1 : 1
Gnetaceae	1 : 1	Smilacaceae	1 : 1
Hypoxidaceae	1 : 1	Solanaceae	1 : 3
Lamiaceae	2 : 2	Tiliaceae	1 : 1
Lythraceae	1 : 1	Ulmaceae	1 : 1
Magnoliaceae	1 : 1	Urticaceae	1 : 1
Malphigiaceae	1 : 1	Verbenaceae	3 : 3
Malvaceae	2 : 4	Zizngiberaceae	1 : 1
Marchantiaceae	1 : 1		

The se plant populations were classified based on the Ranunkiears lifeform classifications systems. These are megaphanerophytes, meso, micro, nano, chamae, hemi and geocryptophytes. Fig.1 shows the composition of the various species in the Uppa forest canopy. In this study, minimum number of species, only 2 species were reported for nanophenerophytes, maximum number of species were reported for hemicryptophytes(39) followed by chamaephytes(34) and microphenerophytes were 13 and remaining 3 groups were less than 13 species plant species were segregated based on their height, different classes(5) from 0-25 meter were made.

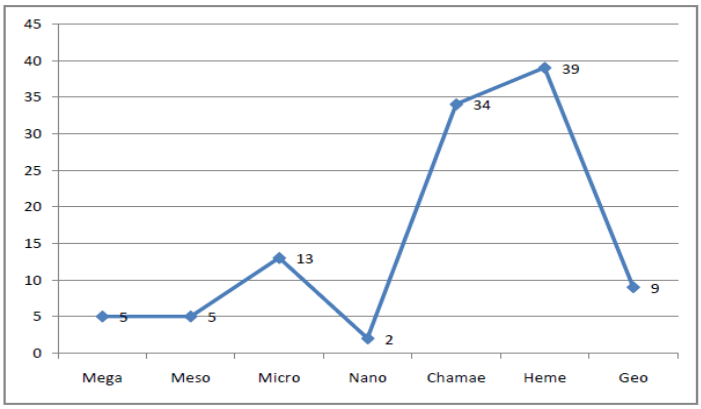

Fig. 1- Life forms

Fig. 2 shows that maximum number of species (245) were belongs to 6 to 10 meter height category followed by 45 species belongs to 11-15 meter category. Minimum number of plant species belongs to 0-5 meter height category.

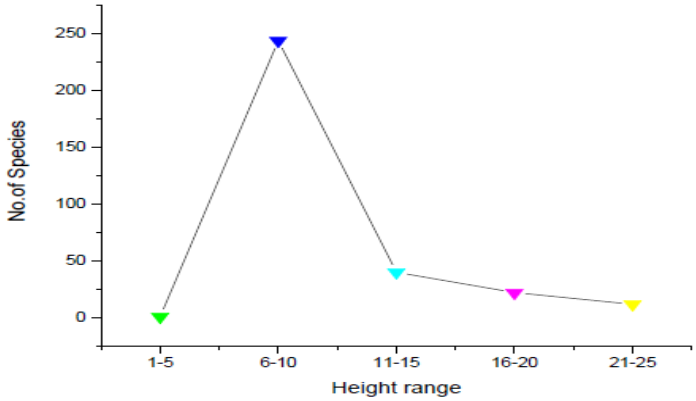

Fig.-2: Plant height range at uppa forest

During the period of investigation, DBH of the plant species were taken and DBH values were place in different groups between 30 to 120cm. Fig. 3 show the DBH value of plant populations in the Uppa forest. Maximum number of species (80) belongs to the category of 50 - 69 cm, below 30 cm diameter calss 78 plant species were recorded and in the 30-49 diameter class 72 species were reported, only 27 plant species were reported in 70-89 diameter class,58 plant species were observed in above 120 cm diameter class and only 3 plant species were presented in the 90-119 cm diameter class. Table 2 shows the phytosociological attributes of tree species at Uppa forest. Transect data reveals the presence of plant species in the quadrates. A total of 317 species were reported, out of which *Mesua ferrea dominates* the forest. Maximum 238 *Mesua ferrea* species were observed in all quadrates, while remaining species were less than 18 only. Fig-4 shows the cluster analysis of the plant species in Uppa forest only one plant species (*Mesua ferrea*) is separated from the remaining group of plants.

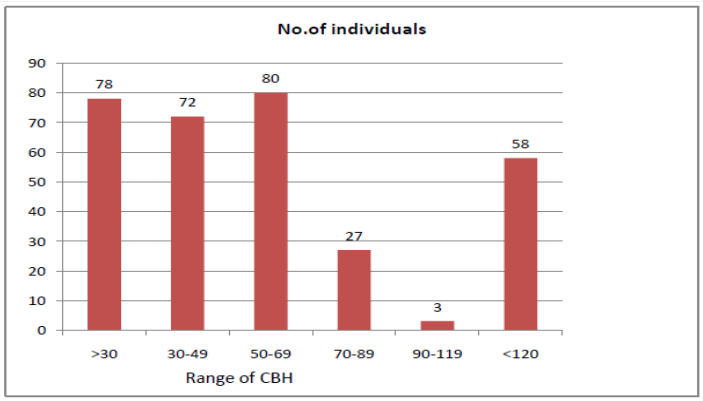

Fig.-3: Circumferences of the plant populations in the uppa forest

Table.-2: Phytosociological attributes of Tree species at Uppa forest

Tree species	No.of Individual	TOI	TNI	F	D	Do	RF	Rd	Rdo	IVI	ni/N	Simpson ∑(ni/N)2	ln ni/N	ni/N*ln ni/N
Pterocarpus integrifolia	3	2	3	40	0.600	473.627	4.167	0.946	0.678	5.791	0.009	0.0001	-4.66029	-0.0441
Atlantia monophylla	1	1	1	20	0.200	84.096	2.083	0.315	0.120	2.519	0.003	0.0000	-5.7589	-0.0182
Canthium dicoccum	1	1	1	20	0.200	28.742	2.083	0.315	0.041	2.440	0.003	0.0000	-5.7589	-0.0182
Cassia fistula	4	2	4	40	0.800	254.797	4.167	1.262	0.365	5.793	0.013	0.0002	-4.37261	-0.0552
Cipadessa buccifera	1	1	1	20	0.200	28.742	2.083	0.315	0.041	2.440	0.003	0.0000	-5.7589	-0.0182
Cyathea gigantea	1	1	1	20	0.200	114.968	2.083	0.315	0.165	2.563	0.003	0.0000	-5.7589	-0.0182
Dillenia aurea	1	1	1	20	0.200	45.860	2.083	0.315	0.066	2.464	0.003	0.0000	-5.7589	-0.0182
Ficus auriculata	1	1	1	20	0.200	484.395	2.083	0.315	0.694	3.092	0.003	0.0000	-5.7589	-0.0182
Ficus benghalensis	4	2	4	40	0.800	6490.764	4.167	1.262	9.293	14.721	0.013	0.0002	-4.37261	-0.0552
Ficus heterophylla	1	1	1	20	0.200	484.395	2.083	0.315	0.694	3.092	0.003	0.0000	-5.7589	-0.0182
Ficus palmata	1	1	1	20	0.200	179.638	2.083	0.315	0.257	2.656	0.003	0.0000	-5.7589	-0.0182
Ficus religiosa	5	3	5	60	1.000	11677.866	6.250	1.577	16.719	24.546	0.016	0.0002	-4.14946	-0.0654
Gamphostemma parviflorum	1	1	1	20	0.200	286.624	2.083	0.315	0.410	2.809	0.003	0.0000	-5.7589	-0.0182
Mangifera indica	11	3	11	60	2.200	16067.695	6.250	3.470	23.004	32.724	0.035	0.0012	-3.36101	-0.1166
Mesua ferrea	238	5	238	100	47.600	16683.798	10.417	75.079	23.886	109.381	0.751	0.5637	-0.28663	-0.2152
Michelia champaca	18	5	18	100	3.600	15143.830	10.417	5.678	21.681	37.776	0.057	0.0032	-2.86853	-0.1629
Murraya koenigii	5	5	5	100	1.000	155.334	10.417	1.577	0.222	12.216	0.016	0.0002	-4.14946	-0.0654
Murraya paniculata	5	3	5	60	1.000	171.218	6.250	1.577	0.245	8.072	0.016	0.0002	-4.14946	-0.0654
Naringi crenulata	3	2	3	40	0.600	204.877	4.167	0.946	0.293	5.406	0.009	0.0001	-4.66029	-0.0441
Premna tomentosa	2	1	2	20	0.400	176.135	2.083	0.631	0.252	2.966	0.006	0.0000	-5.06575	-0.0320
Saraca asoca	6	2	6	40	1.200	245.701	4.167	1.893	0.352	6.411	0.019	0.0004	-3.96714	-0.0751
Schleichera oleosa	1	1	1	20	0.200	143.810	2.083	0.315	0.206	2.605	0.003	0.0000	-5.7589	-0.0182
Trema orientalis	1	1	1	20	0.200	84.096	2.083	0.315	0.120	2.519	0.003	0.0000	-5.7589	-0.0182
Zanthoxylum armatum	1	1	1	20	0.200	60.211	2.083	0.315	0.086	2.485	0.003	0.0000	-5.7589	-0.0182
Ziziphus maritiana	1	1	1	20	0.200	76.513	2.083	0.315	0.110	2.508	0.003	0.0000	-5.7589	-0.0182
Grand Total	**317**		**317**	**960**	**63.400**	**69847.731**	**100**	**100**	**100**	**300**				

Fig.-4 : H I E R A R C H I C A L C L U S T E R A N A L Y S I S *

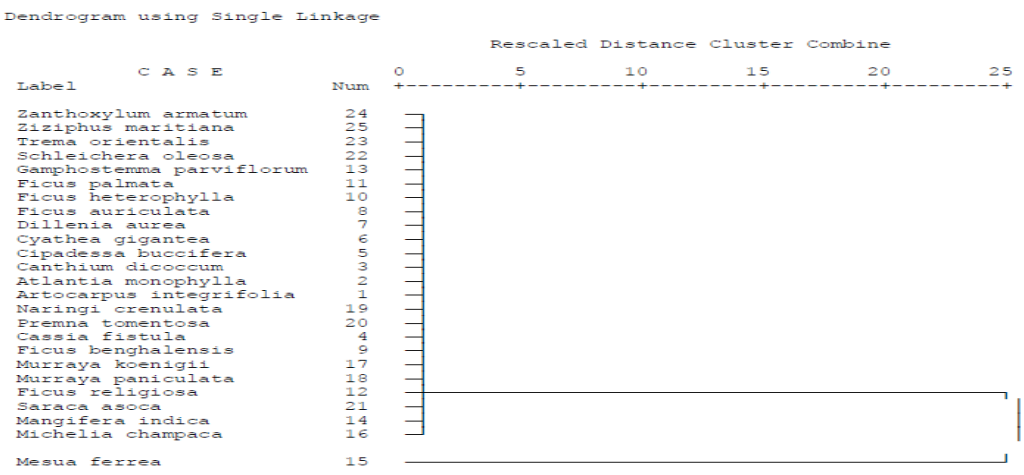

Fig.-4: h i e r a r c h i c a l c l u s t e r a n a l y s i s *

CONCLUSIONS

This forest is dominated by *Mesua ferrea* species, in these two forest fragment regions seeds able to germinate slowly, survive and then develop into seedlings and small plants. Mortality rate in these fragments is 10 to 30%, but germination rate is minimum in other regions, seedlings may die within a short span of time. Mortality rate is 100%. Generally seeds are germinating slowly and survive then develop into adult plants. This may be due to low temperature, feeble sunlight, soil moisture, running perennial streams which are present inside the forest promotes the germination, survival and growth of these plants.

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