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Full Length Research Paper

Population Studies of Wild Edible Fruit Tree Species in Kodagu

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Abstract

Non Timber Forest Products (NTFP's) play a vital role in livelihood of people in and around the forests. Several wild edible fruit yielding tree species in forests are being over exploited due to their economic returns in the global market. The present investigation on population status of wild edible fruit tree species was carried out in two vegetation types of Kodagu *viz.,* evergreen and moist deciduous. The results revealed that the species richness, diversity of wild edible tree species and families was more in case of evergreen vegetation. Wild edible fruit tree species were more similar than other species between different vegetation types. *Syzygium cuminii* was the dominant species in both vegetation types. There was no significant difference between the density of wild edible and other tree species in both vegetation types. The size class distribution showed inverse 'J' shape when the lower girth class of 30 cm gbh is masked. When the regeneration pattern is considered, no fluctuation was observed in all regeneration classes in evergreen vegetation. But, more regenerates of wild edible and other tree species was observed in class I and Class II compared to class III and Class IV of moist deciduous vegetation.

Key words: *NTFPs, Wild edible fruit tree, evergreen, Moist-deciduous, IVI Regeneration.*

Introduction

In the past, policy makers, forest economists and foresters have viewed forests primarily as a source of national revenue with timber as the dominant product (Tewari, 1994). However, in an era of fast-declining old-growth forests, great significance is attached now a days to NTFP's besides timber. The range of such products range from exudates (gums, resins and latex), canes, fruits, flowers, seeds, seed derivatives, entire plants, leaves, root or stem bark, fungi, meat and by-products from game animals, animals for the pet trade, micro-organisms and insects (Panayotou and Ashton, 1992; Tewari, 1994).

A scientific study of wild fruits is important for the potential sources which could be utilized at the time of scarcity or during normal days or cultivated as a source of food material for an ever increasing population. Fruits have satisfactory edible proteins with high quality so that we can use them in food industries and as nutrition. Fruits are generally high in fiber, water, vitamin C and sugars. From ancient time edible wild fruits played a very vital part in supplementing the diet of the people. Many people in rural areas still use them extensively as a supplement to their basic food requirement; some are preserved for use during periods of scarcity. Of the total floristic wealth of about 15,000 species of angiosperms available in India, about 1,000 species fall into the wild edible plant category either in the form of fruits, tubers, vegetables *etc*. Many of the wild edible plants and fruit species are rich in nutrients (Arora and Pandey, 1996). This plant wealth is being used in various forms only by tribals and natives of the area.

But it is a pity that the rich plant wealth is vanishing rapidly due to various factors mainly human activities. As a result, there is ecological imbalance resulting depletion in the wealth of wild plants including the wild edible fruit plants day by day (Jamir, 1996). There are few studies and documents available on diversity and population status of these trees plants. Therefore, the present study investigation entitled "Population studies of wild edible fruit tree species in Kodagu" was carried out to know the diversity, population status and other issues in the study area.

Material and Method

Study area

The study was carried out in the natural forests i.e., moist deciduous and evergreen vegetation types of Virajpet Taluk in Kodagu district which is located in the central part of Western Ghats. The Western Ghats is one among the eight hottest hotspots of biodiversity and is home for several plant species which yield edible fruits and vegetables. Kodagu, one of the smallest districts in Karnataka is in the central part of Western Ghats that has 73 per cent of its landscape under tree cover (Moppert, 2000). It is situated mainly on the eastern slopes of the mountain range, extends between $11^{\circ}\ 56^{'} – 12^{\circ}\ 52^{'}$ N and $75^{\circ}\ 22^{'} - 76^{\circ}\ 11^{'}$ E. The average annual rainfall is about 2725mm. The mean temperature of the coldest month in the study area ranges between 16°C and 23°C, rainfall between 2000 and 5000 mm per year with four dry months. The diversity of forested ecosystems and associated biodiversity has contributed to identify Kodagu as micro hotspot of biodiversity.

Selection of study sites

Based on the preliminary studies, Thithimathi village in moist deciduous vegetation and B. Shettigere village in evergreen vegetation were chosen for the present investigation.

Sampling methodology

Stratified random sampling was followed in the present investigation. In each vegetation types 20 quadrates of 20m X 20m size with 0.01 per cent sampling intensity, were laid out randomly for tree enumeration. Within these 20m X 20m plots, 2m X 2m sub plots were laid in all the four corners for assessing regeneration. All trees above 30 cm gbh were identified and measured for girth and height of the trees.

Results and Discussion

Persual of the results presented in fig. 1 reveals that the evergreen forests were having higher species and family richness than the moist deciduous vegetation for the wild edible and also for the other species. This shows that the evergreen vegetation type has more number of wild edible species than the moist deciduous vegetation type. Shannon's diversity index value of both wild edible fruit tree species and families was high in natural forests of evergreen vegetation compared to that of moist deciduous vegetation (Fig. 2). Also, the diversity value for associated species was high in evergreen vegetation compared to moist-deciduous vegetation. The Shannon's diversity value of families of associated species was same in both evergreen and moist-deciduous vegetation (Fig. 2). It may be due to the fact that the numbers of species representing in different families are more due to dominance of certain species belonging to particular family in evergreen vegetation. This could be because of favorable conditions prevailing in the evergreen forests and coupled with high competition leading to speciation. Elouard (2000) has reported average species richness and Shannon diversity in moist deciduous varied from 33 to 39 and 4.29 respectively compared to medium elevation evergreen vegetation types 90-126 and 4.84 respectively in Kodagu and also endemic species are abundant in evergreen forests of W-Ghats (Ramesh and Pascal, 1997).

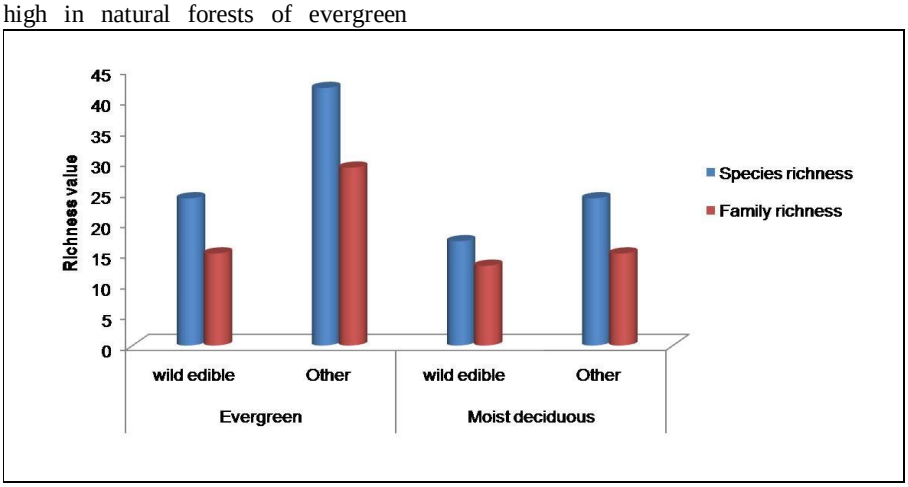

Fig. 1: Species richness of wild edible trees species and other tree species in evergreen and moist deciduous vegetation

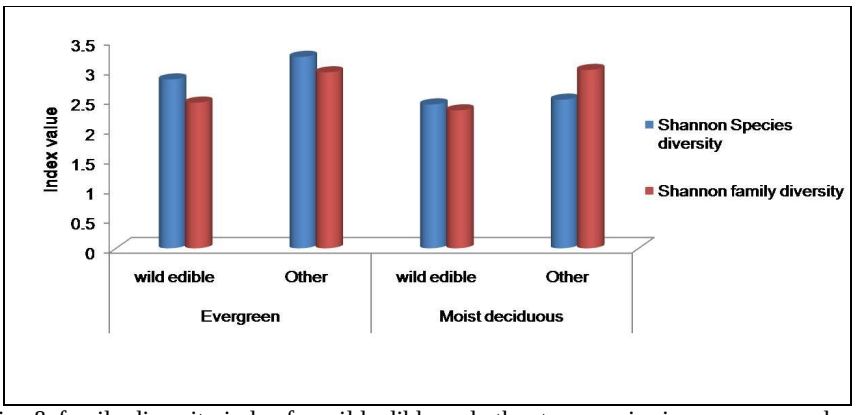

Fig. 2: Shannon's species & family diversity index for wild edible and other tree species in evergreen and moist deciduous vegetation

The similarity between evergreen and moist deciduous vegetation with respect to the wild edible population was comparatively low (Table 1). Thus, each vegetation type is having similar species composition upto 50 per cent in other words evergreen vegetation types share larger sets of species within themselves than the moist deciduous vegetation. There was more dissimilarity in vegetation types with respect to the other species and only 10 per cent species was common to each other. There was more proportion of *Syzygium cuminii* may be due to species preference and disturbance by human interventions in this vegetation type. Uthaiah (1994) reported that out of 25 families the important ones as a source of food to tribals and animals are Apocynaceae, Anacardiaceae, Euphorbiaceae, Moraceae, Sapotaceae, Sapindaceae have more species which contribute food tribals and animals.

Table 1: Similarity (β-diversity) between natural forests of evergreen and moist-deciduous vegetation.

	Moist deciduous	
Evergreen	Wild edible fruit tree species	Associated tree species
	0.51	0.93

The results presented in fig. 3 indicates that proportion of *Olea dioica* individuals topped in evergreen vegetation followed by *Syzygium cuminii, Aporosa lindleyana, Artocarpus hirsutus* and *Mimusops elengi.* In moist deciduous vegetation, *Syzygium cuminii* had higher proportion of individuals as in evergreen vegetation (Fig 4). In moist deciduous vegetation, *Syzygium cuminii* had higher proportion of individuals as in evergreen vegetation. But, some of the wild edible fruit species viz., *Grewia tiliifolia, Mangifera indica, Dillenia pentagyna, Flacourtia indica, Phyllanthus emblica, Terminalia bellirica, Gmelina arborea, Meyna laxiflora, Careya arborea, Randia spinosa, Cordia dicotama, Schleichera oleosa and Terminalia chebula*. *Syzygium cuminii* were found to be occurring in both the vegetation types but there is a clear distinction between the species occurring in two different vegetation types for the wild edible species. There are many studies on exhaustive collection of some specific species like *Garcinia gummi-gutta* (Shahabuddin and Prasad, 2001and Rai and Uhl, 2004). In case of *Phyllanthus emblica*, the most widely studied species across the country, a number of studies have reported low seedling in intensively harvested areas compared to areas subjected to lower extraction pressures (Koliyal, 1997; Padmini *et al*., 2001; Prasad, 2001).

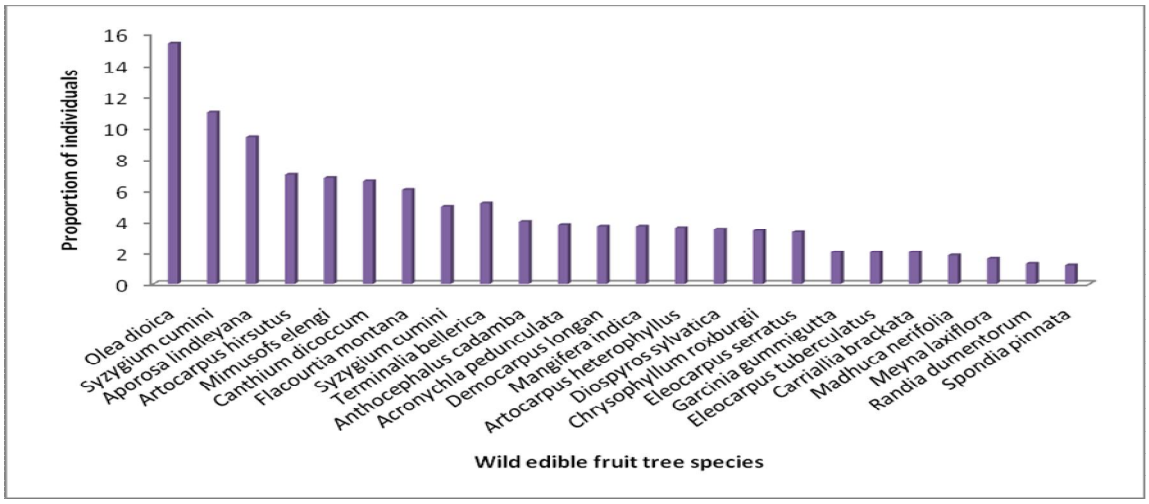

Fig. 3: Proportion of wild edible fruit tree species in evergreen vegetation

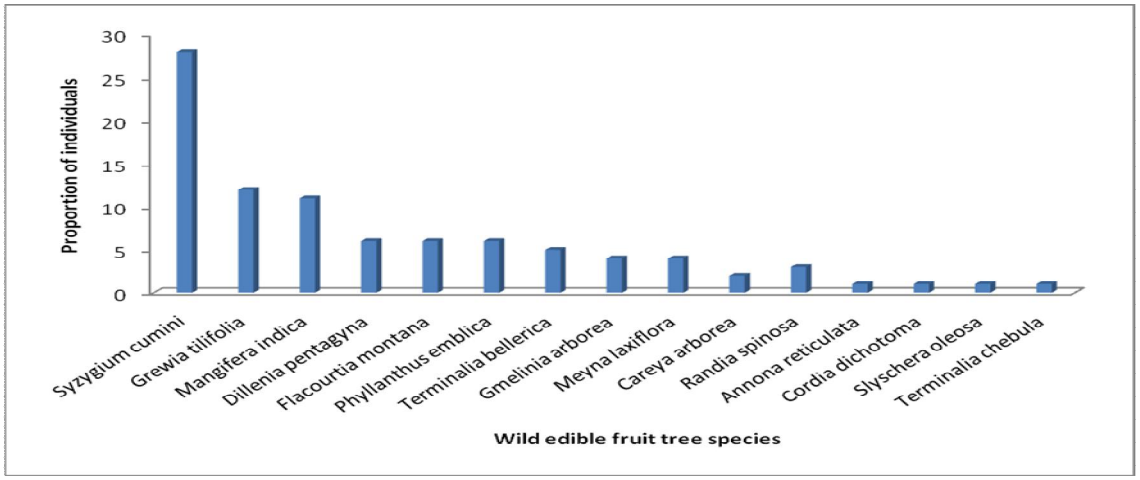

Fig. 4: Proportion of wild edible fruit tree species in moist deciduous vegetation

In wild edible fruit tree species, *Syzygium cuminii* topped the list for the IVI of growing stock in moist deciduous vegetation and *Artocarpus hirsutus* in evergreen vegetation (Table 2). The larger basal area along with density and frequency contributed for dominance of these wild edible fruit tree species. It was also reported by Jamir (1996) that *Syzygium cuminii*, *Phyllanthus emblica* and *Mangifera* species are one of the important dominant wild edible fruit tree species in evergreen vegetation of Nagaland.

Persual of the result presented in table 3 reveals that, in evergreen vegetation, *Apodytes beddomei* had more IVI value followed by *Holigarna nigra*, *Schefflera racemosa*, *Chionanthus malabaricus*, *Memecylon umbellatum*, *Euonymus indicus*, *Xanthophyllum flavescens*, *Turpinia malabarica*, *Symplocos cochinchinensis* and *Canarium strictum*. Of these, *Apodytes beddomei*, *Holigarna nigra* and *Schefflera racemosa* species maintain the upper strata while the rest come up in the middle and lower strata that has less spatial distribution pattern compared to top canopy species which could be the probable reason for less relative density, relative frequency and relative dominance that ultimately contributed to the lower IVI value. In particular, it is good to maintain more IVI for some endemic tree species viz., *Euonymus indicus* (Ramesh and Pascal, 1997).

When the dominant species in moist deciduous vegetation, were considered, *Terminalia tomentosa* occupied the top position with maximum IVI value of 79.92. Other major species of moist deciduous vegetation but with comparatively low IVI value were *Lagerstroemia microcarpa* (27.44) followed by *Stereospermum chelanoides* (22.74), *Annogeisus latifolia* (20.82), *Pterocarpus marsupium* (18.54), *Mytragyna parviflora* (17.48), *Vitex altisima* (13.60), *Tectona grandis* (13.53), and *Terminalia paniculata* (12.54) and *Butea monosperma* (9.96).

Persual of the table 4 and 5 reveals that in both vegetation types the density was high for associated species than the wild edible fruit tree species with no significant difference. Similarly the basal area of wild edible fruit tree species was less compared to associated species with no significant difference in the both the vegetation types. The reduction in stem density of woody plants has been recorded as a result of anthropogenic disturbance in many tropical forest areas (Bhuyan *et al.*, 2003).

The girth class distribution of the species showed inverse 'J' shaped curve when we mask the lower girth class of 30 cm gbh (Fig 5 and 6). In other words there was lack of stems of 30 cm girth class may be due to the recent disturbance in the study area. Though, typical girth class distribution is an inverse 'J' shape curve expected for any forest ecosystem, with respect to wild edible fruit tree species, it is good to have more number of stems under mature classes to bear large number of reproductive material to sustain the population. From the point of conservation, it is very important to emphasize that when population status of wild edible species declines, it might degrade the quality of the habitat of wild edible fruit dependent fauna due to reduction in quantity of available food (Shahabuddin and Prasad, 2004).

Associated species in the study area were more diverse than the wild edible fruits for families and also for the species in both the vegetation types. The regenerating individuals of both wild edible fruit tree species and other associated tree species were represented in more proportion in all the classes and no fluctuation in distribution or representation of regenerating individuals in evergreen vegetation (Fig 7). In spite of the disturbance situations, because of the availability of good ecological niche with moisture and nutrients, regeneration of both wild edible fruit tree species and other species may survive well. Interestingly in moist-deciduous there were more proportion of regenerating individuals in class I and class II and poor regeneration represented by very low proportion of regenerating individuals in class III and class IV (Fig. 7) . The class III and IV mainly indicates the establishment stage but, this poor regeneration in these classes could be akin to the dominance of invasive species mainly *Lantana camara* and *Chromoleana odorata* which comes up in fire affected areas and establish with more space occupancy which later might suppress the native regenerating flora by its allelopathic effect and also physical suppression over the other useful. Devagiri *et al.* (2006) also have reported huge establishment of invasive weed species such as *Lantana camara* and *Chromolaena odorata* under fire affected areas of Rajivgandhi National Park, Nagarahole and their impact on regeneration.

Table 2: Dominant wild edible fruit tree species in evergreen and moist deciduous vegetation

Sl. No.	Evergreen					Moist Deciduous				
	Species	**Rd**	**Rf**	**RD**	**IVI**	**Species**	**Rd**	**Rf**	**RD**	**IVI**
1	*Artocarpus hirsutus*	7.57	9.09	28.1	44.7	*Syzygium cuminii*	27.5	16.36	30	73.9
2	*Olea dioica*	15.5	10.91	5.09	31.5	*Grewia tiliifolia*	12.5	14.54	20	47
3	*Syzygium caryophyllatum*	11.2	6.67	11.1	28.9	*Mangifera indica*	11.3	9.09	19.3	39.7
4	*Canthium dicoccum*	6.77	7.27	10.8	24.9	*Terminalia bellirica*	5	7.27	6.27	18.5
5	*Aporosa lindleyana*	9.16	7.27	3.1	19.6	*Phyllanthus emblica*	5	5.45	1.89	12.3
6	*Mimusops elengi*	7.17	6.67	5.42	19.3	*Meyna laxiflora*	3.75	5.45	0.49	9.7
7	*Syzygium cuminii*	4.78	6.06	5.99	16.8	*Gmelina arborea*	3.75	3.63	2.27	9.65
8	*Terminalia bellirica*	4.78	5.45	6.36	16.6	*Flacourtia indica*	5	3.63	0.87	9.51
9	*Anthocephalus cadamba*	3.19	4.24	4.84	12.3	*Randia spinosa*	2.5	3.63	0.28	6.42
10	*Flacourtia Montana*	5.18	5.45	1.42	12.1	*Careya arboea*	2.5	3.63	0.27	6.41
11	*Mangifera indica*	2.79	3.03	3.2	9.03	*Cordia dichotoma*	1.25	1.81	0.69	3.76
12	*Dimocarpus longan*	2.79	3.64	1.78	8.21	*Schliechera oleosa*	1.25	1.81	0.48	3.55
13	*Acronychia pedunculata*	2.79	4.24	0.94	7.97	*Terminalia chebula*	1.25	1.81	0.19	3.26
14	*Elaeocarpus serratus*	1.99	3.03	2.68	7.7	*Annona reticulate*	1.25	1.81	0.1	3.17
15	*Diospyros sylvatica*	2.39	3.64	0.53	6.56					
16	*Garcinia gummi-gutta*	1.99	2.42	1.76	6.18					
17	*Artocarpus heterophyllus*	2.39	2.42	1.02	5.84					
18	*Carallia brachiata*	0.8	1.21	2.86	4.87					
19	*Elaeocarpus tuberculatus*	1.59	2.42	0.83	4.86					
20	*Chrysophyllum roxburghii*	1.99	1.82	0.82	4.64					
21	*Spondias pinnata*	0.8	0.61	0.91	2.32					
22	*Madhuca neriifolia*	0.8	1.21	0.15	2.17					
23	*Meyna laxiflora*	0.8	0.61	0.16	1.56					
24	*Randia dumentorum*	0.8	0.61	0.08	1.49					

Table 3: Top ten dominant associated tree species in evergreen and moist deciduous vegetation

Sl. No.	Evergreen					Moist Deciduous				
	Species	Rd	Rf	RD	IVI	Species	Rd	Rf	RD	IVI
1	*Apodytes beddomei*	9.33	8.37	25.71	43.42	*Terminalia tomentosa*	34.51	19.31	26.09	79.92
2	*Holigarna nigra*	6.67	5.44	9.87	21.98	*Lagerstroemia microcarpa*	7.75	7.95	11.74	27.44
3	*Schefflera racemosa*	6.4	5.44	9.29	21.14	*Stereospermum chelanoides*	5.63	7.95	9.14	22.74
4	*Chionanthus malabaricus*	9.33	6.69	3.00	19.03	*Annogeisus latifolia*	9.15	7.95	3.7	20.82
5	*Memecylon umbellatum*	6.13	5.86	6.62	18.61	*Pterocarpus marsupium*	4.23	5.68	8.63	18.54
6	*Euonymus indicus*	8	5.86	3.01	16.87	*Mytragyna parviflora*	4.93	5.68	6.868	17.48
7	*Xanthophyllum flavescens*	7.73	4.18	2.8	14.73	*Vitex altisima*	4.93	5.68	2.992	13.6
8	*Turpinia malabarica*	4.53	4.18	4.66	13.38	*Tectona grandis*	2.82	4.54	6.163	13.53
9	*Symplocos cochinchinensis*	2.4	2.93	4.56	9.89	*Terminalia paniculata*	3.52	4.54	4.473	12.54
10	*Canarium strictum*	1.87	2.93	4.97	9.77	*Butea monosperma*	4.23	3.4	2.324	9.96

Table 4: Mean density and mean basal are of wild edible fruit tree species and other associated tree species in evergreen and moist deciduous vegetation

Parameters	Evergreen			Moist Deciduous		
	Wild edible fruit trees	Associated tree species	Total	Wild edible fruit trees	Associated tree speceis	Total
Density/ha	251	375	626	80	142	222
Basal area (m^2/ha)	14.75	20.81	35.6	6.98	10.44	17.42

Table 5: Student't' test for mean density and basal area between Wild edible and other associated tree species in evergreen vegetation

Parameters	Evergreen				Moist Deciduous			
	Wild edible fruit trees (Mean±SD)	Associated tree species (Mean±SD)	t-value	p-value (p≤ 0.05)	Wild edible fruit trees (Mean±SD)	Associated tree species (Mean±SD)	t-value	p-value (p≤ 0.05)
Mean density	10±2.93	15±3.48	2.01	1.58	4.44±5.07	3.84±3.89	2.04	0.71
Mean basal area (m^2/ha)	0.67±0.54	0.80±0.36	2.01	0.53	0.43±0.58	0.38±0.60	2.02	0.80

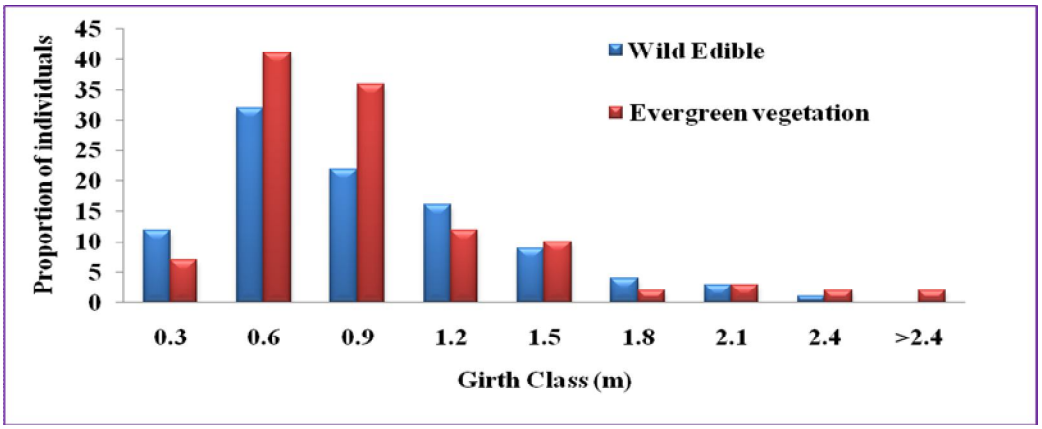

Fig. 5: Girth class distribution of wild edible and other tree species in evergreen vegetation

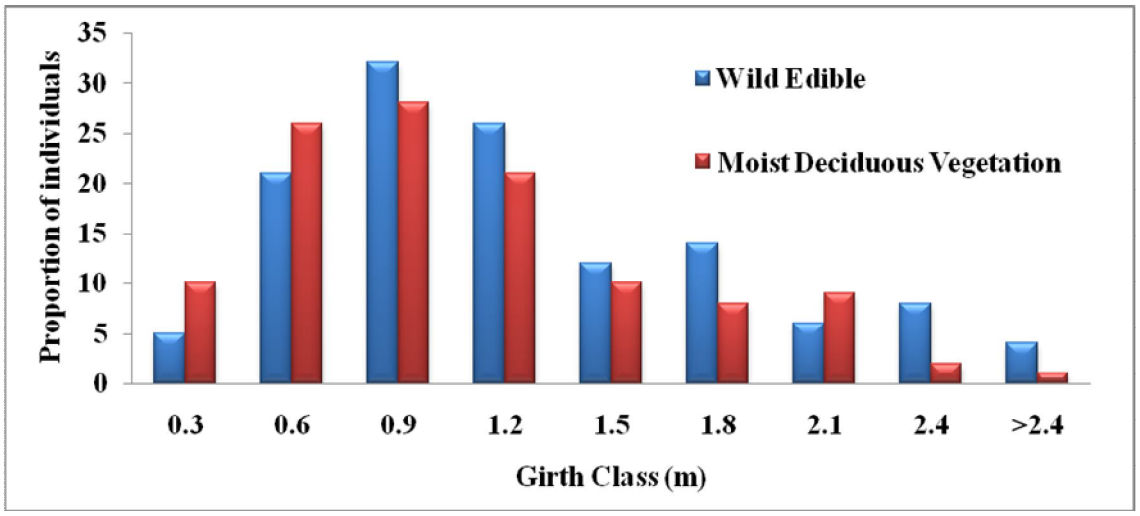

Fig. 6: Girth class distribution of wild edible and other tree species in moist deciduous vegetation

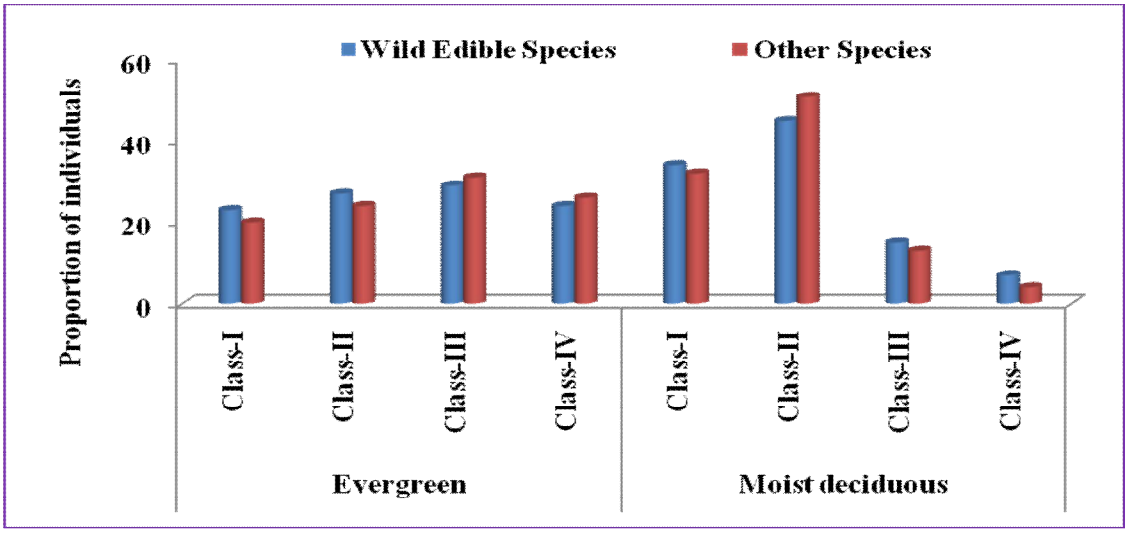

Fig. 7: Regeneration of Wild edible and other tree species under different regeneration classes in evergreen and moist deciduous vegetation.

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