International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133; Print ISSN: 2664-7125; Impact Factor: RJIF 5.28
Received: 15-10-2020; Accepted: 30-10-2020; ; Published: 19-11-2020
Volume 2; Issue 4; 2020; Page No. 494-498

Population structure, regeneration status and ethnobotanical survey of wild edible fruits in sacred groves of Kodagu

Vinayak V Pai[1*], Satish BN[2]
[1, 2] Department of Forest Biology and Tree improvement College of Forestry, Sirsi, Karnataka, India

Abstract
Sacred groves of Kodagu district consist of diversified Wild Edible Fruits (WEF) species which act as an alternate food supply to the rural community. Wild edible fruit species was used for various purposes such as food, medicine, raw material for industries etc. It also provides economic stability to the poor people. Inspite of having multiple benefits many wild edible fruit species were still not yet domesticated or semi domesticated. Wild edible fruits improves the economic status of farmers, by providing additional income to the farming community. Therefore, Population structure of wild edible fruits in sacred groves was assessed by following Simple random sampling technique. Shannon's Diversity Index of wild edible fruits of sacred groves was found to be 2.35 and species richness was 18. The mean density and mean basal area was found to be 202.67ha^{-1} and 42.65 m^{2}ha^{-1} respectively. *Terminalia belerica* (93.83) was the dominant wild edible fruit species found in sacred groves followed by *Grewia tiliaefolia* (45.51) and *Syzygium cumini* (29.19). In sacred groves per cent distribution of stems of wild edible fruit species was higher between 120 and 180cm girth classes. The regeneration status of wild edible fruit species was also studied. In sacred groves the richness of regenerating species of wild edible fruits was found to be 15 and Shannon diversity index was 2.38. *Grewia teliafolia* was found to be the dominant regenerating species. Mean density of regenerating wild edible fruit species of sacred groves was 3666.7 ha^{-1}. Maximum regeneration was found in class I and class II and it followed a reverse J-shaped curve indicating healthy regeneration. A semi structured questionnaire survey was conducted among the people residing in and around the sacred groves to know the utility pattern of wild edible fruits, factors affecting the population status of wild edible fruits and preferred wild edible fruits for domestication based on the local people perception was recorded.

Keywords: regeneration, Ethnobotanical, *Grewia tiliaefolia*, recorded

Introduction

India is one of the 12 mega diversity centers of the world, where in Western Ghats are one of the 34 listed hot spots of the world (Bapat *et al*., 2008) representing a storehouse of several promising economically important plants. Western Ghats or Sahyadri mountain ranges are very rich in wild edible fruit yielding plant species. There are more than 3000 wild edible fruits and nut species (Machamma, 2015) [6]. Sacred groves of Kodagu is a part of Western Ghats and constitutes a rich biodiversity**.** In India there are approximately 4125 sacred groves covering 39,063 ha of forest (Malhotra *et al*. 2007). Sacred groves are seen in many parts of the country. Kodagu District, Karnataka State in South India is a unique landscape known for sustaining the tradition of sacred groves. Kodagu District located at central Western Ghats has 1214 sacred groves covering an area of 2500 ha (Kushalappa and Raghavendra, 2012) [5].

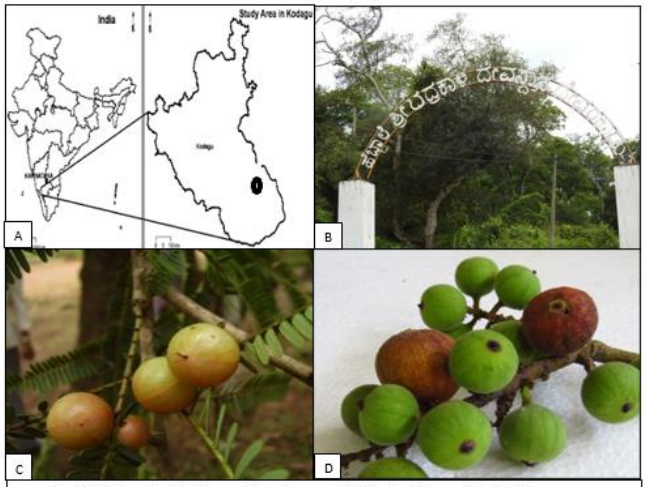
In India, it has been estimated that up to 50 million households supplement their diets with fruits gathered wild from forests and surrounding bush land (Ramachandran, 2000). Among the different forest resources, wild edible plants stand as an important forest resource. They tolerate water stress better than their domesticated relatives, possessing an innate resilience to rapid climate change, which is often lacking in exotic species (Fentahun and Hager, 2009) [3]. In India, about 1,000 species fall into the wild edible plant category (Khaple *et al*., 2012) [4]. Wild edible plants includes different categories such as fruits, tubers, vegetables, leaves, roots, etc. Among the different wild edible plants category, wild edible fruits play a very vital part in supplementing diet of the people. Many people in rural communities and tribal peoples rely on wild edible fruits for food especially during crop failure and famine condition. Wild edible fruits help in improving the livelihood strategies of forest dwellers or tribal people and act as a major income generating source. Wild edible fruits have nutritional value, medicinal value, cultural and social value and contribute to the stability of the ecosystem.

Population structure is expressed in terms of number of individuals present in each of the girth class distribution of tree species. Regeneration performance of tree species in a forest can be revealed from the population structure (Saxena and Singh 1984) [7]. Assessing the diversity of wild edible fruits in different land use systems help in planning the management strategies. The perception of people on wild edible fruits from the point of view of domestication is essential to reduce the harvesting pressure on wild edible fruit species. Documentation of wild edible fruits play a significant role in enhancing the natural food resources which had been used. Wild edible fruits have to be introduced for cultivation as they can serve as food material for ever increasing population (Bhagat *et al*., 2016) [1]. This requires the identification and protection of local indigenous knowledge systems that inform the collection and use of wild edible plants (Tabuti *et al*., 2004) [8]. Documenting wild edible plants of indigenous groups can provide information for planning,

conservation and further research especially in propagation, domestication, and evaluation of nutritional profiles to obtain nutritional composition.

Material and Methods:

Assessment of population structure of Wild edible fruits: Simple random sampling technique was followed for assessing the population structure and diversity of wild edible species. In the selected study area, belt transects of 100 m×5 m dimension was laid in sacred groves. (Bhagwat, 2002) [2]. the latitude, longitude and altitude was recorded for each sampling plot by using Global Positioning System. All the trees ≥30 cm gbh in the main plot were measured by using girth tape and the species were botanically identified by using local flora and field guides. The data collected was used to analyse species richness, diversity, similarity index and structural parameters such as density, basal area, Importance Value Index of wild edible fruit species and the associated species. Within the large sample plots, sub plots of 4m×4m were laid in the starting point, midpoint and end point of the belt transect for assessing regeneration. All the regenerates in the sub plots were enumerated and the species diversity and richness mean density and dominant regenerating species were assessed.



A. Study location B. View of Sacred groves C. *Phyllanthus emblica* D. *Ficus racemosa*

Fig 1

Ethnobotanical survey of wild edible fruits: A semi structured questionnaire was used to conduct ethnobotanical survey of wild edible plants in the study area. Questionnaire survey was done among tribals and households which are adjacent sacred groves. In each study sites, 30 respondents were interviewed. The questionnaire incorporated different aspects like wild edible fruit species consumed, cultivated, medicinal values, factors affecting the status of wild edible fruit species and marketing. Perception of people on wild edible plants with respect to livelihood improvement was also collected. The important wild edible species from the point of view of domestication based on the perception of the people was done by scoring method

Results and Discussion

Species richness and diversity of wild edible fruit species

Results on species composition showed that, the species richness of wild edible fruit species was found to be highest in sacred groves (18). With respect to species diversity, the Shannon's diversity value of wild edible fruit species in sacred groves was (2.35). This implies that sacred groves had more number of wild edible fruit species the favourable conditions prevailing in the sacred groves, restriction in their usage, undisturbed condition and suitable microclimate might be the reason for higher species richness. In sacred groves, 208 stems ha^{-1} were of wild edible fruit species. It was found that, mean density and mean basal area of wild edible fruit species 202.67ha^{-1} and 42.65 m^2ha^{-1} respectively.

Proportion of wild edible fruit tree species in sacred groves

In sacred groves, wild edible fruit species viz, *Terminalia belerica, Grewia tiliaefolia, Syzygium cumini, Artocarpus heterophyllus, Phyllanthus emblica* had higher proportion of individuals. There was a decline in the proportion of *Mangifera indica, Ficus mysorensis, Ficus racemosa, Mimusops elengi, Spondias pinnata, Ziziphus rugosa, Canthium dicoccum, Syzygium jambulana, Flacourtia montana, Aporosa lindleyana, Annona reticulata, Cordia dichotoma and Garcinia gummi-gutta*

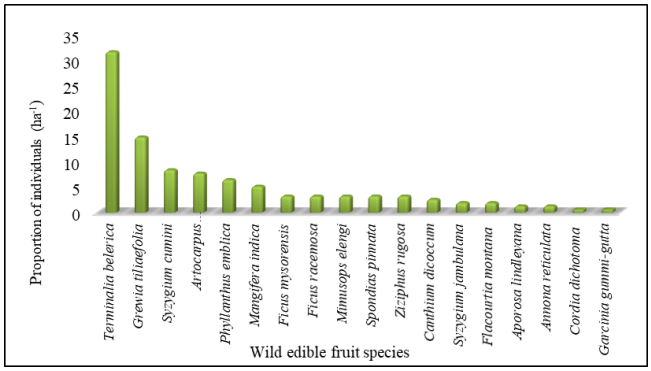


Fig 2: Proportion of WEF tree species in sacred groves

Top ten dominant wild edible fruit species in sacred groves

The dominant wild edible fruit tree species were considered in sacred groves based on IVI values. *Terminalia belerica* (93.83) was the dominant wild edible fruit species followed by *Grewia tiliaefolia* (45.51), *Syzygium cumini* (29.19), *Artocarpus heterophyllus* (21.26), *Mangifera indica* (20.41) followed by *Phyllanthus emblica* (15.71) *Ficus racemosa* (11.28), *Spondias pinnata* (11.20), *Ficus mysorensis* (10.42) and *Ziziphus rugosa* (8.59).

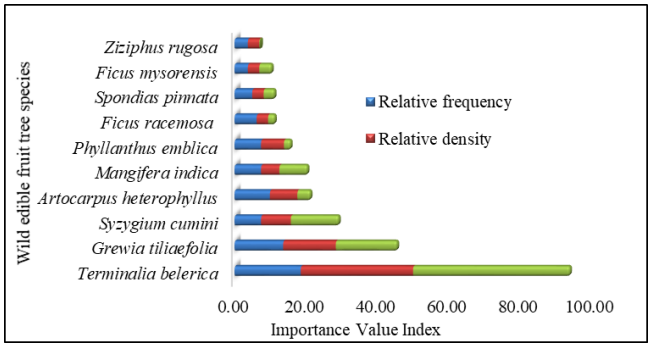


Fig 3: Top ten dominant WEF species in sacred groves

Girth class distribution of wild edible fruit species and associated species

In sacred groves per cent stems of both wild edible fruit species and associated species was higher between 120 and 180cm girth classes. There was an increase in the per cent stems of wild edible fruit species in 180 to 210 cm girth class as compared to that of associated species. The reduction of number of trees in lower girth classes indicates the unsustainable harvesting practices and probability of disturbance which has been started recently

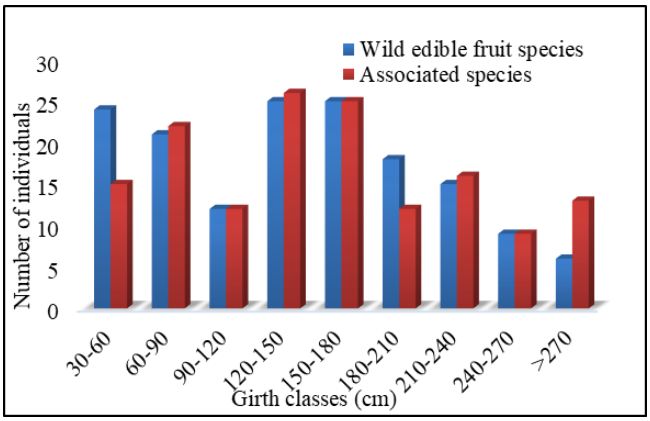


Fig 4: Girth class distribution of WEF species in sacred groves

Regeneration status of wild edible fruit species

Species diversity and richness of wild edible fruit species

In sacred groves, the Shannon's diversity value of wild edible fruit species was (2.38).Whereas, species richness of wild edible fruit species was (15). The mean density of regenerating wild edible fruit species in sacred groves was 3666.7 ha^{-1}.

Regeneration status of wild edible fruit species and associated species under different regeneration classes

The regeneration of wild edible fruit species and associated species of different regeneration classes was assessed to know the survivability of these species. This shows that, the pattern and probability of its establishment and also good indication for future stock. Regenerating individuals of both wild edible fruit species and associated species were represented in all the regenerating classes. In sacred groves, there was reverse 'J' shaped pattern in distribution of regenerating individuals of both wild edible fruit species and associated species indicating healthy regeneration.

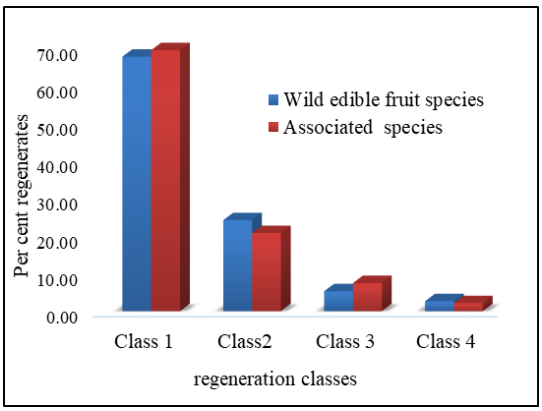


Fig 5: Regeneration status of WEF species

Proportion of regenerating individuals was higher in class I and class II and poor regenerating individuals was found in class III and class IV. The poor regeneration in class III and class IV could be due to dominance of invasive species mainly *Lantana camera* and *Chromolaena odorata.*

Proportion of regeneration of wild edible fruit species in sacred groves

In sacred groves, higher proportion of regenerating wild edible fruit species was found in *Grewia tiliaefolia.* Whereas, few other wild edible fruit species viz., *Terminalia belerica, Artocarpus heterophyllus, Aegle marmelos, Phyllanthus emblica, Syzygium cumini, Annona reticulata, Aporosa lindleyana and Garcinia gummi-gutta* showed relatively lower proportion of regenerating individuals.

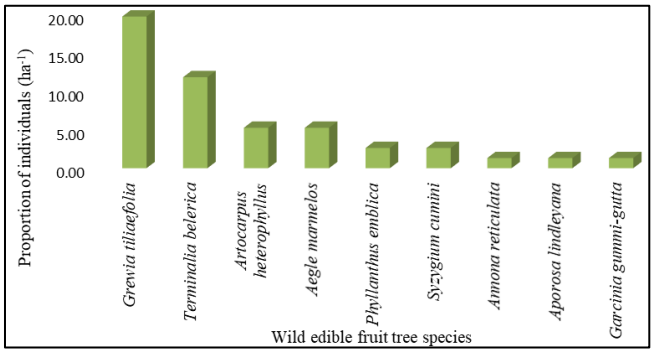


Fig 6: Proportion of regeneration of wild edible fruit species in sacred groves

Dominant regenerating wild edible fruit species in sacred groves

The dominant regenerating wild edible fruit species based on IVI values in sacred groves were *Grewia tiliaefolia* (36.94) followed by *Terminalia belerica* (25.13), *Artocarpus heterophyllus* (10.96), *Phyllanthus emblica* (6.41), *Syzygium cumini* (6.41), *Annona reticulata* (3.20) *Aporosa lindleyana* (3.20) and *Garcinia gummi-gutta*(3.20).

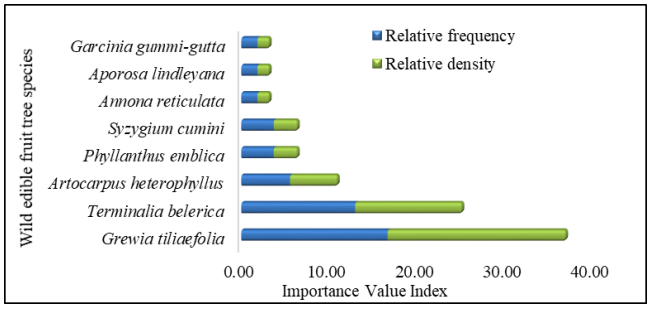


Fig 7: Dominant regenerating wild edible fruit species in sacred groves

Utility pattern of wild edible fruits

The wild edible fruits documented in the present study have been grouped into six distinct categories based on their utility pattern viz., direct consumption, medicinal, preparation of pickle, wine, juice and vinegar. Wild edible fruits were mainly used for direct consumption. The respondents adjacent to sacred groves utilize wild edible fruits for direct consumption purpose (54 per cent)

followed by medicinal usage (19 per cent) and preparation of juice (11 per cent).

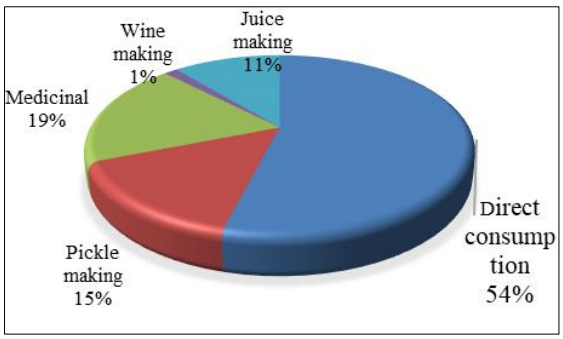


Fig 8: Utility pattern of WEF

The variations in the utility pattern of the wild edible fruits by local people might be due to the variation in the species, and culture of the communities with respect to food preference and preparation.

Farmer's preference for cultivation of wild edible fruit trees in farming lands

Preferences given by the farmers in the different land use types for the cultivation of wild edible fruit species in their farm lands are grouped into six categories *viz*., direct consumption, medicinal, income generation, shade and conservation. The peoples residing adjacent to sacred groves were used to cultivate wild edible fruit tree species in their farmlands mainly for own consumption or direct edible purpose and also with the intension of marketing to improve the livelihood.

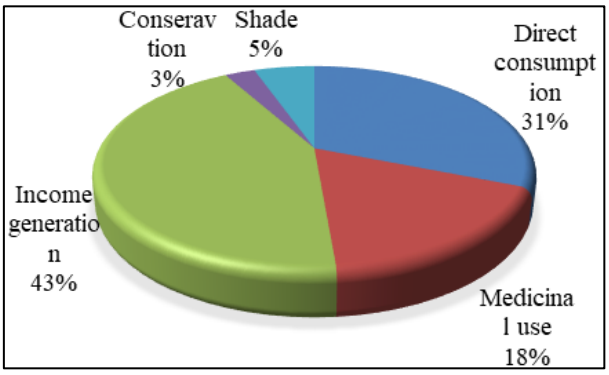


Fig 9: Farmers preference for cultivation of WEF

Preferred wild edible fruits for domestication based on farmers perception

Farmers in the vicinity of the sacred groves were interviewed and their perception on domestication of species were documented. The farmers residing adjacent to the natural forest, preferred *Mangifera indica (*21.98 per cent) and *Phyllanthus emblica* (19.78 per cent) followed by *Artocarpus heterophyllus* (18.68 per cent). The main reason of preferring these species was multiple use.The local people prefer the species which is economically important. These species were having high demand in local markets and it can be also used in value addition and medicinal purposes. The people residing adjacent to the sacred groves prefer to domesticate the species which were having high market demand. Further they prefer to domesticate wild edible fruit tree species with the intention of income generation through marketing.

Factors which affects the population status of wild edible fruits

There are many factors which affects the population status of wild edible fruits. These factors were categorised into different groups based on perception of farmers. Based on the opinions of the farmers near to sacred groves, the reduction of wild edible fruits population was mainly due to Elephant damage (21.18 per cent) followed by low rainfall (20 per cent) and deforestation (15.29 per cent).

Table 1: preferred WEF for domestication

Sl. No	Species	Percent respondents in Sacred groves
1	*Mangifera indica*	21.98 (1)
2	*Phyllanthus emblica*	19.78 (2)
3	*Artocarpus heterophyllus*	18.68 (3)
4	*Spondias pinnata*	15.38 (4)
5	*Syzygium cumini*	14.29 (5)
6	*Garcinia gummi-gutta*	9.89 (6)

Table 2: Factors affecting WEF

Sl. No	Factors	Percent respondents in Sacred groves
1	Elephant problem	21.18 (1)
2	Low rainfall	20.00 (2)
3	Deforestation	15.29 (3)
4	Encroachment	14.12 (4)
5	Forest fire	11.76 (5)
6	Overgrazing	10.59 (6)
7	Water scarcity	4.71 (7)
8	Climate change	2.35 (8)

N=30 * N is people respondents (Values in parenthesis are in ranks)

Conclusion

The species richness and diversity of wild edible fruit species was more in case of sacred groves. Ideal condition and better management were the reasons for higher species richness and diversity of sacred groves. The regeneration was present in scared groves of moist deciduous vegetation. Per cent regenerates was high in class-I and class-II followed by Class-III and class-IV. The regeneration of seedlings shows a reverse J-shaped curve indicates healthy regeneration. Ethnobotanical survey of wild edible fruits indicates that, rural and tribal people depends on wild edible fruits for various purposes like food, medicinal and value addition etc. and these fruits were mainly used for direct consumption. *Mangifera indica, Syzygium cumini, Phyllanthus emblica* and *Garcinia gummi-gutta* species were the most preferred species for domestication based on the perception of the local people.

References

1. Bhagat BR, Chambhaga M, Mate S, Dudhale A, Zaware NB. Prospective wild edible fruit plants from part of Northern Western Ghats (NWG), Mulshi (MS), India. Journal of Medicinal Plants Studies. 2016; 4(1):15-19

2. Bhagwat S. Biodiversity and conservation of a cultural landscape in the Western Ghats of India. Ph.D. thesis, Univ. Oxford, (UK), 2002, 233.
3. Fentahun, MT, Hager H. Exploiting locally available resources for food and nutritional security enhancement: wild fruits diversity, potential and state of exploitation in the Amhara region of Ethiopia. Food Security. 2009; 1(2):207-219.
4. Khaple AK, Gurav M, hubballi S. Population studies of wild edible fruit tree species in Kodagu, India. International journal of Life Sciences. 2012; 1(3):48-55.
5. Kushalappa CG, Raghavendra S. Community-linked conservation using Devakad (sacred groves) in the Kodagu Model Forest, India, The Forestry Chronicle. 2012; 88(3):266-272.
6. Machamma Y. Quality evaluation and value addition of fruits of *Elaeocarpus serratus* L. (*Ceylon* Olive tree). M.Sc. thesis, University of Agricultural Sciences, Kerala (India), 2015.
7. Saxena AK, Singh JS. Tree population structure of certain Himalayan forest associations and implications concerning their future composition. Vegetatio. 1984; 58:61–69.
8. Tabuti JRS, Dhillion SS, Lye KA. The status of wild food plants in Bulamogi County, Uganda. International Journal of Food Sciences and Nutrition. 2004; 55(6**)**:485-498.