Agroforest Syst (2020) 94:297–307
https://doi.org/10.1007/s10457-019-00393-5

Structure, diversity and utilization of plant species in tribal homegardens of Kerala, India

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Received: 27 September 2018 / Accepted: 11 April 2019 / Published online: 19 April 2019

Abstract Homegardens in traditional agroforestry systems are considered as sustainable production system with multiple functions. Indigenous knowledge of tribal communities associated with their homegardens always contributes in food security and biodiversity conservation. The present study aims at understanding the structural and floristic diversity of the homegardens, and utilization of plant species by the tribal communities in the Attappady valley of Kerala, India. Overall 104 homegardens were sampled randomly for assessing the diversity and the usage of various plant species. Data on indigenous knowledge was collected from tribal owners. Structurally, two types of homegardens were identified from the study area, which characterized by two and four layered vertical canopy strata. A total of 182 plant species belonging to 160 genera and 67 families were recorded from the sample homegardens. Comparing the diversity and distribution of plant species among the three communities, highest was found in the homegardens of Mudugas who are inhabiting the high and medium rainfall zones (Shannon diversity index 2.18) and observed its lowest value in the low rainfall zone where Irula communities live (Shannon diversity index 1.45). The homegardens of the study area has rich diversity and home for many useful plants. Considering the usage, 39% were edible, 24% were ornamental and 25% were medicinal. Hence the study indicates that the tribal homegardens are contributing considerably to food security and livelihoods of tribal communities in the Attappady valley.

Keywords Agroforestry · Homegardens · Tribal homegardens · Attappady · Western Ghats · Plant diversity

Introduction

Homegardens are a typical type of traditional agroecosystems, being intensively managed lands situated close to human dwellings (Ninez 1987; Hamilton and Hamilton 2006; Peyre et al. 2006a). Homegardens can be defined as an assemblage of plants, which may include trees, shrubs and herbaceous plants, growing in or adjacent to a homestead or home compound, planted and maintained by members of the household, and the products and services are intended primarily for household consumption and ornamental value

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s10457-019-00393-5) contains supplementary material, which is available to authorized users.

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(Soemarwoto 1987; Landon-Lane 2011). The origin of homegardens could be traced back to the stage when human beings transformed from hunters and food gatherers to the status of permanent settlers (Fernandes and Nair 1986). It became an integral part of human civilization when people learnt agriculture and improved it with domestication of useful plant species. Traditional homegardens includes many plant species characterized by different morphology, utility and biological functions. Practice of homegardening is a feature of rural and tribal landscape due to their potential for local subsistence, food security and nutrition. Plants from the homegardens provide much needed nutrition and variety in daily food and in some cases they also contribute to considerable portion of household income (Garrett et al. 1994). Several landraces and cultivars and rare and endangered species have been preserved in homegardens (Watson and Eyzaguirre 2002; Kumar and Nair 2004).

Homegardens in Kerala have chronological and structural similarity to those of tropical homegarden (Jose and Shanmugaratnam 1993). Homegardens in Kerala are typical representations of low to medium input sustainable agroecosystems. Studies regarding the socio-economic and environmental aspects of homegardens in Kerala are done by Krishnankutty (1990), Kumar et al. (1994), Chandrashekara (1995), Sankar and Chandrashekara (2002), Peyre et al. (2006a) and Chandrashekara (2007). Peyre et al. (2006b) studied the structural and functional dynamics of homegarden in Kerala. Four development stages of homegardens were found along a gradient from traditional to modern homegardens. 50% of the homegardens still displayed traditional features, whereas 33% incorporated modern practices. Regeena (2007) surveyed the homestead farms of the south zone of Kerala comprising of the three districts namely Thiruvananthapuram, Kollam and Pathanamthitta and the data revealed that the homegardens are repositories of plant biodiversity. Chandrashekara (2009) conducted a survey on the diversity of fruit trees with respect to abundance, distribution patterns, fruit collection and their management in coffee based homegardens in high altitude agro-climatic zones of Kerala. The study suggested that domestication and sustainable cultivation of tree species in homegardens and other agroforestry system can provide shade, firewood, timber, soil fertility, fencing and edible fruits. Apart from these, studies focusing on tribal homegardens of Kerala were limited.

Methodology

Study area

Attappady is one of the two extensive east sloping plateaus on the Western Ghats of Kerala, Southern India, which covers an area of 750 km^2. It is situated in Palakkad District of Kerala State which lies between 10°55′–11°14′ latitude and 76°27′–76°48′E longitude. Attappady forms the drainage basin of river Bhavani, which is a tributary of river Cauvery and one of the three east flowing rivers in Kerala. The mean annual rainfall in the valley is 700–3000 mm, whereas the western region of Attappady receives high rainfall (> 3000 mm) and eastern region receives rainfall of less than 1000 mm. Accordingly, the region has a diverse vegetation pattern ranges from West-coast tropical evergreen forests in the high rainfall western part to Southern tropical dry deciduous and scrub forests in the north as well as eastern areas (GOK 1976). The peculiar rainfall and geographical location, contributes to its different agro-ecological zones and associated vegetation formations. The region is also known for its high concentration of tribal communities. The highest concentration of tribal people is found in Wayanad (17.4%), followed by Idukki (14%) and Palakkad (10.89%) (Chathukulam et al. 2012). Attappady valley holds 56.41% of tribal population in Palakkad district, Kerala. Three different ethnic groups, viz. Kurumbas, Irulas and Mudugas are living in 189 hamlets across different altitudinal and rainfall zones of Attappady (GOI 2011) (Fig. 1). Tamil and Malayalam speaking non-tribal settlers are also living in the valley.

Data collection

The study was conducted among the three tribal communities residing in various rainfall and altitudinal zones of Attappady valley. As the total number of hamlets in Attappady was 189, proportion of Irula hamlets are predominant (77%), followed by Muduga (13%) and Kurumba (10%) (GOI 2011). Of the total hamlets, eight were selected (Irula-4; Muduga-2 and Kurumba-2) considering the following criteria (1)

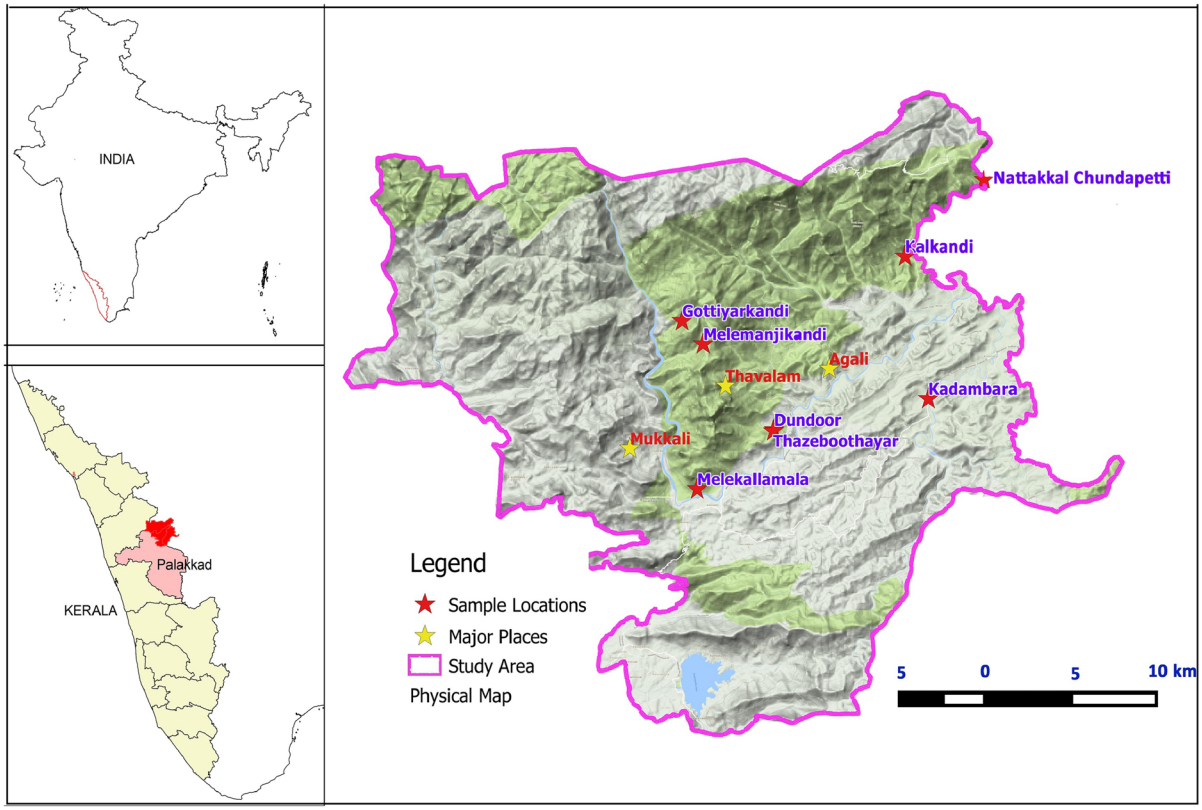

Fig. 1 Map of Attappady showing locations of study tribal hamlets

Hamlets representing three different rainfall zones (2) Hamlets representing proportionately the three tribal communities (3) Hamlets having accessibility, at least with jeepable road (4) Hamlets actively indulged in agricultural practices. Approximately 30% of the total number of households from each hamlet was taken up for the study. Data were collected from 104 randomly selected homegardens and owners from each of the eight sample hamlets (Thazeboothayar, Gottiyarkandi, Melekallamala, Dundoor, Melamanjikandi, Kalkandiooru, Nattakkal chundapetti, Kadambara) during January 2014 and December 2016 (Table 1).

The vertical stratification of homegardens was measured visually. Based on height, trees were categorized into four canopy and height classes (Das and Das 2005): Dominant (10–15 m), under-storey (5–10 m), shrub layer (1–5 m) and herb layer (> 1 m). The enumeration of species in the homegarden was recorded by direct observation method (Martin 1995). Semi-structured interview using an interview guide was administered in the data collection (Cotton 1996) regarding the usage of species. Questions were asked to both the male and female headed households during interview. Respondents were asked about local name of plants, its different usages and management practices. The collected data were verified in focused group discussions (Rabiee 2004).

Data analyses

Profile diagram of two prominent homegarden systems were made according to the structural appearance and height of the species (Pandey et al. 2006). Local and regional flora was used for the identification of plant specimens (Manilal 1988; Vajravelu 1990) and uncertain ones were confirmed with taxonomic experts. The entire data were organized, coded and analyzed, using MS Excel and SPSS. Species diversity was calculated using Shannon–Wiener index (Shannon and Weier 1949), Margalef index (Margalef 1958), Evenness index (Magurran 1988) and Simpson's index (Simpson 1949). Sorensen's Index of Similarity (Sorensen 1948) was used to compare the vegetative composition of homegardens between

Table 1 Profile of study sites

Hamlet	Community	Rainfall zones	No. of households
Nattakkal chundapetti	Irula	LRZ	26
Melemanjikandi	Irula	MRZ	62
Kadambara	Irula	LRZ	45
Kalkandiooru	Irula	LRZ	30
Dundoor	Muduga	MRZ	41
Melekallamala	Muduga	HRZ	38
Gottiyarkandi	Kurumba	MRZ	46
Thazeboothayar	Kurumba	HRZ	35

LRZ low rainfall zone; *MRZ* mid rainfall zone; *HRZ* high rainfall zone

tribal communities. Sorensen's index represents the number of common species between two homegardens. The equation for this measure of similarity is as follows

$$S.I = \frac{2a}{2a + b + c} \times 100$$

where *a* number of common species, b and c are dissimilar species in two homegardens.

For the classification of homegardens, a cluster analysis considering the occurrence of plant species presence/absence was performed, applying squared Euclidean distances as a measure of dissimilarity and the average linkage method (Kehlenbeck and Maass 2004). The matrix contained 8 columns (representing 8 hamlets) and 182 rows (representing 182 plant species).

Results and discussion

Structural characteristics of homegardens

All households selected in the study hamlets possess a homegarden adjacent to the home and few of them were fenced. Structurally, two types of homegardens were identified from the study area. First type of homegardens are characterized by four layered vertical canopy strata mainly found in the high and mid rainfall zone hamlets of Kurumba, Muduga and Irula (Melemanjikandi hamlet) communities (Fig. 2a). Regarding the structure, the trees of the top canopy reaches between 10 and 15 m, having species such as *Albizia amara*, *Areca catechu, Artocarpus heterophyllus, Ceiba petandra, Gmelina arborea,* and so on. The intermediate layer has the height of 5–10 m and was dominated by *Citrus* sp, *Cocos nucifera, Ficus* sp, *Melia azedarach*. Species such as *Artocarpus heterophyllus, Mangifera indica, Cocos nucifera, Areca catechu* were found in more than one layer depends on the growth stage. The layer which has the height of 2–5 m composed of shrubs like *Hibiscus rosa-sinensis*, *Manihot esculenta*, *Carica papaya, Musa paradisiaca.* The ground layer was less than 1 m and was mainly composed of vegetables, ornamentals and medicinal species. Maximum number of species and individuals were found in the first and second layers which is similar to the homegardens of Kerala (Kumar et al. 1994; Nair and Sreedharan 1986) and West Java (Michon et al.1983). The second type consists of only two layers found in the low rainfall hamlets of Irula communities (Nattakkal chundapetti, Kalkandiooru and Kadambara) (Fig. 2b). Those upper two layers were absent in second type of homegardens. The present study showed the structural variation of homegardens influenced by the rainfall zone, irrespective of tribal communities inhabiting the area. The studies reported from traditional homegardens of Meiti community in Assam, North-east India (Devi and Das 2013), Kandyan homegardens of Srilanka (Perera and Rajapakshe 1991) and homegardens of Andaman and Nicobar (Pandey et al. 2006) proved high rainfall regions possess multilayered vegetation structure, which offers advantages in reduction of soil erosion or efficient use of resources.

Species composition

Among the 104 homegardens sampled, size ranged between 7.03 and 17.07 m^2 with an average of 12.81 m^2 and mean number of species ranges from 6.8 to 12.53 with an average of 10.46 (Table 2). Mean number of species and size of the present homegarden was low, when comparing with homegardens of

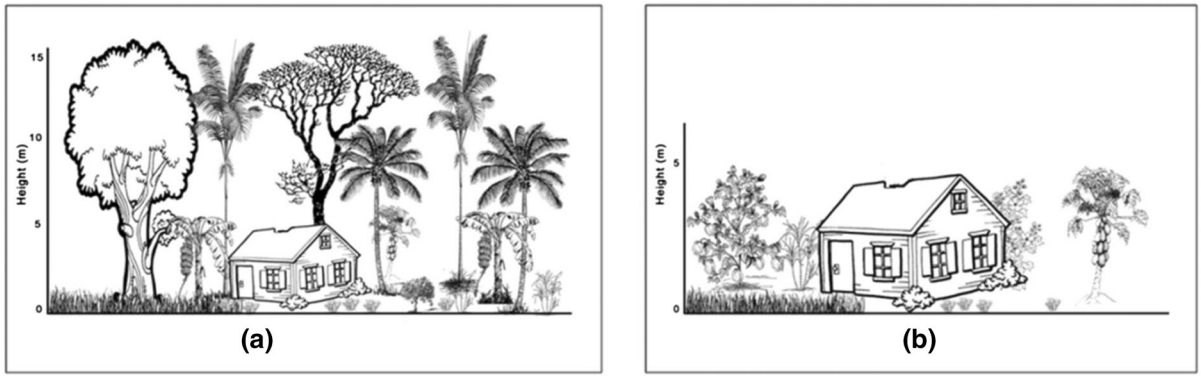

Fig. 2 Pictorial representation of tribal homegardens in Attappady **a** Homegarden type in high and mid rainfall zone **b** Homegarden type in low rainfall zone

Table 2 Characteristics of homegardens in the sample hamlets of Attappady

Hamlet	Number of homegardens	Total number of species	Mean number of species per garden	Average size of homegarden (m^2)
Nattakkal chundapetti	8	69	10.66 (7–16)	12.22
Melemanjikandi	21	70	8.2 (5–24)	12.73
Kadambara	14	50	10.92 (3–22)	7.15
Kalkandiooru	10	38	6.8 (3–10)	7.03
Dundoor	13	95	11.21 (5–26)	14.14
Melekallamala	12	77	12.31 (5–24)	15.37
Gottiyarkandi	15	75	11.07 (4–28)	17.07
Thaze boothayar	11	85	12.53 (6–19)	16.84

Palakkad district in Kerala, where the average number of species in the various homegarden types ranges from 17 to 51 and size ranging from 0.14 to 1.01 ha (Peyre et al. 2006a).This may due to the factors such as socio-economic status and land holding size of the tribal people in the region. The study observed size of the tribal homegardens doesn't influence species richness of homegardens which is contrary to the studies conducted in Kerala (Kumar et al. 1994) and Africa (Drescher 1996) reported that floristic diversity was greater in smaller homegardens. Mean number of species per garden found to be highest in hamlet belong to high rainfall zone, Thazeboothayar (12.53) which comes in the ranges (11–39) reported from the Kerala homegarden (Kumar et al. 1994). And the lowest found to be in Kalkandiooru (6.8) belongs to low rainfall zone. This implies the influence of rainfall pattern in the species composition of homegardens. Furthermore, poor natural regeneration of plants and intense rearing of the cattle was prominent in those hamlets could be the reason for having lower diversity mainly in Kadambara and Kalkandiooru.

The tribal homegardens traditionally represent a complex system with cultivated and wild plants, mainly perennials and annuals. In this study, a total of 182 plant species belonging to 160 genera and 67 families were recorded from the selected 104 homegardens of eight tribal hamlets. Out of the 182 plants species, 160 (87%) were dicotyledonous and 24 (13%) were monocotyledons plants. Of the 67 families, 66 belonged to angiosperms and one family represents pteridophytes (Marattiaceae). Habit wise analysis of the plant species revealed that 43% were herbs, 26% shrubs, 19% trees and 12% were climbers. Majority of the plant species recorded from the tribal homegardens have specific local names and exotic ornamental plants

cultivated in homegardens were commonly called 'Poochedi', which means ornamental plant. The common species identified in the tribal homegardens of Attappady are having similarity with the homegardens throughout the tropics e.g., banana, coconut, jack fruit, guava, mango, papaya, citrus, etc. (Mendez et al. 2001; Nautiyal et al. 2008). The diversity and richness of tribal homegardens in Attappady is relatively high (182 species from 104 homegardens) when compared with the various studies conducted in the Kerala State (Jose 1991; Chandrashekara et al. 1997; Sankar and Chandrashekara 2002; Chandrashekara and Baiju 2010).

Species diversity

Hamlet wise, diversity index ranges from 1.05 to 2.19 with significantly higher value ($P < 0.05$) in Dundoor than Kalkandiooru (Table 3). Comparing the community wise diversity, home gardens of Muduga community has the highest plant diversity with Shannon diversity index (2.18). Diversity was observed its lowest in the low rainfall zone where Irula communities live, with Shannon diversity index (1.45) (Fig. 3). Highest diversity of species found in Muduga hamlets may be due to the introduction of exotic ornamental plants from the homegardens of malayali settlers and other outside areas, since the Muduga settlements are situated adjoining to non-tribal malayali settlers. Whereas, the Irula hamlets showing lowest

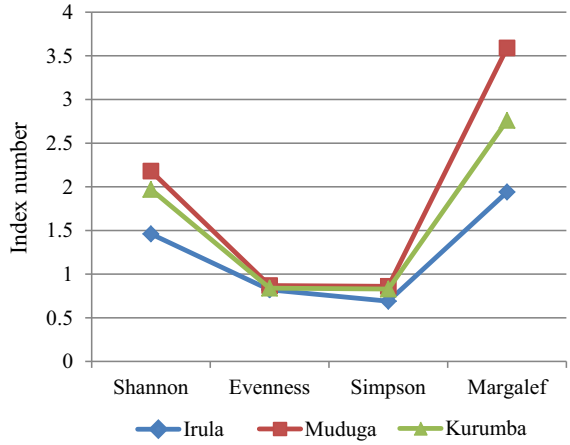

Fig. 3 Species diversity of homegardens between tribal communities

diversity were situated in the area having scarce rainfall. Thus it may be generalized that factors such as rainfall and proximity to non-tribal hamlets influence the floristic composition in the area. Mean Shannon indices in study area were 1.05–2.19 which falls in the range from 0.93 to 3.00 reported in tropical homegardens (Karyono 1990; Drescher et al. 1999). However, studies from some of the old-mixed species homegardens of Kerala found higher Shannon index of 2.99 than the new mixed-species homegardens (Chandrashekara and Baiju 2010). The evenness values (0.58–0.89) obtained here are also comparable to values (0.24–0.71) reported by Kumar et al. (1994) for

Table 3 Species diversity of tribal homegardens in the study hamlets

Tribal Hamlets	Shannon Index	Evenness	Simpson	Margalef
Kottiyarkandi	1.82 ± 0.05ab	0.84 ± 0.03a	0.81 ± 0.01ab	2.64 ± 0.16bcd
Thazeboothayar	2.14 ± 0.28a	0.85 ± 0.08a	0.86 ± 0.05ab	2.89 ± 0.30abc
Melekallamala	2.17 ± 0.05a	0.89 ± 0.03a	0.83 ± 0.07ab	3.62 ± 0.84a
Dundoor	2.19 ± 0.35a	0.87 ± 0.05a	0.89 ± 0.02a	3.57 ± 0.47ab
Melemanjikandi	1.61 ± 0.07bc	0.83 ± 0.03a	0.80 ± 0.00b	2.23 ± 0.13cde
Nattakkalchundapetti	1.90 ± 0.12ab	0.83 ± 0.01a	0.83 ± 0.03ab	2.55 ± 0.07 cd
Kalkandi	1.05 ± 0.26c	0.58 ± 0.01c	0.53 ± 0.01d	1.31 ± 0.41e
Kadambara	1.27 ± 0.06bc	0.74 ± 0.01b	0.63 ± 0.02c	1.70 ± 0.01de
F value	9.950**	14.14***	25.72***	8.540**

ANOVA with Duncan's multiple range test was performed

Values with same alphabets in the superscript are not significantly different at the level of P value > 0.05

***Difference is significant at 0.001 level

**Difference is significant at 0.01 level

the homegardens of Kerala. On the whole evenness value showed the preference of farmers to particular species.

Similarity between homegardens of tribal communities

The diversity of species identified from the tribal homegardens showed some similarities between the tribal communities (Fig. 4). There was high similarity of plant species composition in homegardens between Muduga and Kurumba (Sorenson coefficient 66%) than between Irula-Kurumba (59%) and Irula-Muduga (57%). High similarity between Muduga and Kurumba may be due to the cultural mingling among the two and also due to the similar rainfall pattern. Hamlets of both communities were distributed in mid and high rainfall zones. The hamlets were classified based on presence/absence of species and four clusters were distinguished from the study area (Fig. 5). Kalkandiooru, Kadambara and Nattakkal chundapetti belongs to cluster I, Melekallamala, Melemanjikandi and Thazeboothayar belongs to cluster II, Gottiyarkandi in cluster III and Dundoor in cluster IV. Distance within cluster I was low, showed high similarity between the three hamlets in which Nattakkal chundappeti and Kadambara showed highest similarity. This may due to the location of three hamlets in low rainfall zones and therefore typical type of species adapted to dry condition could be found in their homegardens. For instance, climber like *Leptadenia reticulata*, which is an edible and medicinal plant can seen only in eastern Attappady where rainfall is less. In the second cluster, Melemanjikandi and Thazeboothayar showed similar species composition

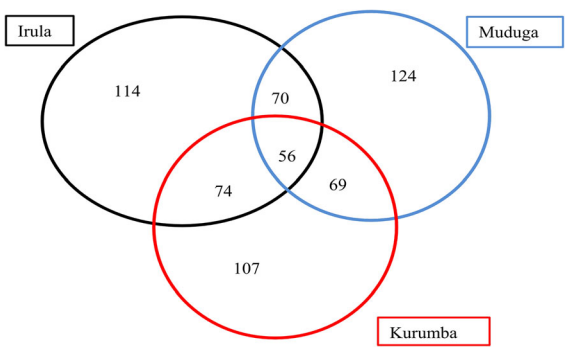

Fig. 4 Occurrence of species in homegarden of three tribal communities and between the communities

than in Melekallamala. In which former two were located in the mid rainfall zone and the later in high rainfall zone. The cluster II seems to be defined by homegardens with ornamental flowers like *Bougainvillea glabra, Catharanthus roseus, Crossandra infundibuliformis, Jasminum sambac, Portulaca grandiflora, Rosa multiflora,* which are found uncommon in homegardens of other clusters. Gottiyarkandi and Dundoor form separate clusters due to the difference in floristic composition from other hamlets mainly the presence of several herbaceous and creeper plants like *Alternanthera sessilis, Asystasia gangetica, Basella alba, Biophytum sensitivum*. Though both hamlets belong to different communities, they both fall in mid rainfall zone in which Gottiyarkandi has maximum diversity of traditional crops whereas Dundoor has the highest diversity of ornamental plants. All the homegardens of cluster I, II, III and IV have common fruit trees such as lemon, papaya, coconut, jackfruit and mango. Besides ecological factors, the plant species combination found in the homegardens of a region is strongly influenced by the specific needs and preferences of the household and nutritional complementarity with other major food sources (Asfaw and Woldu 1997; Christanty et al. 1986; Vogl et al. 2002). A similar finding was observed in a study of floristic composition of homegardens conducted in Mexico and the authors had classified homegardens into four due to the presence or absence of species (Blanckaert et al. 2004).

Usage pattern of plant species in homegardens

Most of the plants recorded from the sample homegardens of Attappady have reported multipurpose usages. Of which, the edible plants ranked first with 82 species (39%), 53 species were used for medicinal purpose (25%), 52 species having ornamental value (24%), 10 species (5%) were used in ritual events and 7% contributes for uses such as construction timber, firewood, shade tree, fence and saleable products (Fig. 6). The main parts used in the food plants comprise of fruits (47%), leaves and tender shoots (26%), pods (12%) and seeds and tubers (7%). Presence of 25% of medicinal plants in the homegardens clearly showed that medicinal plants still play an important role in the treatment of ailments among Attappady tribals (Table S2). *Aerva lanata* and *Aloe*

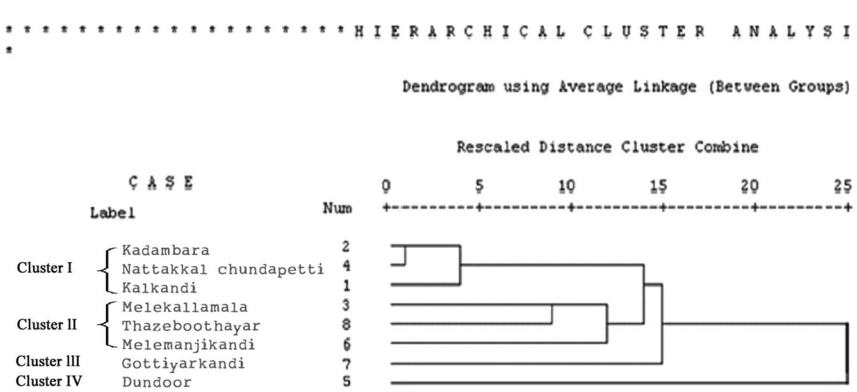

Fig. 5 Dendrogram classifying eight hamlets of the Attappady valley based on species composition

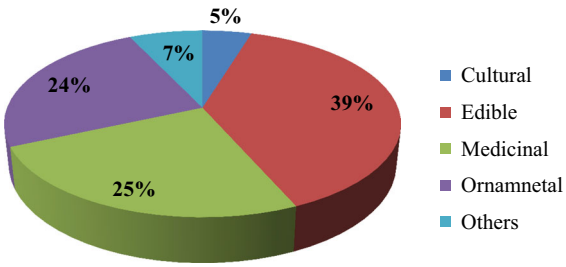

Fig. 6 Usage pattern of plant species in tribal homegardens

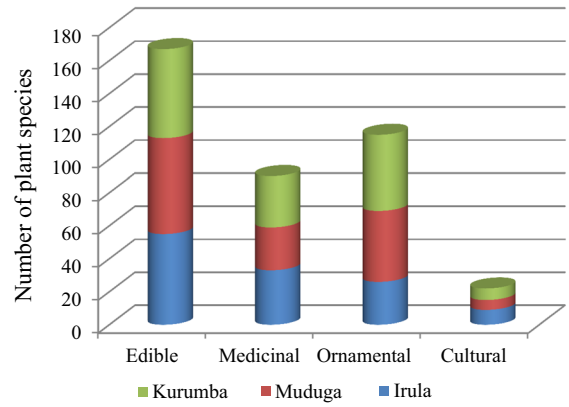

Fig. 7 Plant usage pattern between tribal communities

vera are mainly used in puberty ceremonies. Other plants such as *Areca catechu, Calotropis gigantea, Cynodon dactylon, Euphorbia hirta, Ocimum basilicum, Ocimum gratissimum, Ocimum tenuiflorum* are used in worship. Leaves of *Mangifera indica* are used for decoration during marriage ceremonies and auspicious events. Plant species such as *Albizia chinensis, Grewia tiliifolia, Tectona grandis* and *Mitragyna parvifolia* were used as construction timber. *Grewia tiliifolia, Melia dubia* and *Tectona grandis* were *also* used as firewood. *Young t*wigs of *Sida acuta* collected and used as broom to clean the courtyard. *Coffea arabica* was cultivated by most of the households in the Muduga and Kurumba hamlets and the beans were for sale. To mark the boundary of the homegarden, *Jatropa curcas* and *Gliricidia sepium* were used as live fence. *Mangifera indica, Grevillea robusta, Tamarindus indica, Ceiba pentandra* and *Psidium guajava* were some of the shade providing plants grown in homegardens. In all selected tribal homegardens, food plants were found to be highest in number (Fig. 7). Similar studies on multipurpose use values of homegardens could be found worldwide. A study from Hawassa of Ethiopia (Regassa 2016), documented a total of 258 useful plant species. Out of the 258 plants, 47.29% were ornamental plants, 29.75% food plants, and 15.89% medicinal plants. In the Eastern Ghats of Orissa, vegetables and spices were obtained from traditional homegardens (Dash and Misra 2001).

Conservation status of species in homegardens

Looking into the conservation status of homegarden species, about 90% was under "not evaluated" category in the IUCN database. Among the species recorded from the homegardens of the study area, only 18 species were found in the IUCN evaluated categories. Of the 18 species, 11 are under least concern, 4 species are under data deficient category. *Brugmansia arborea*, an exotic garden plant, is considered as extinct in wild according to the IUCN category. However, the plant is common in the high altitude zones along the Western Ghats. Hence it

doesn't require any conservation measures. *Platycladus orientalis* found to be near threatened, where as *Santalum album* is in vulnerable category. When considering the origin and geographical distribution of plant species, 51% are exotic, 47% are native and only 2% are endemic to the Western Ghats.

Management of homegardens

The management of homegardens in general, includes tree planting, watering, weeding and fencing. In particular, food crop species are subjected to a range of management practices. In Kerala management of homegardens include pruning, weeding, application of fertilizers and chemicals and crop spacing (Nair and Sreedharan 1986). It was also noticed that a given plant species that was managed in one homegarden may not be managed in another homegarden due to the necessity and attitude of the owner. According to the tribal homegardeners, several factors are considered in managing a plant species in their homegardens. For instance, wild species which has limited spreading are least concerned about. On the other hand, farmers control the spread of those species which adversely affect the growth and yield of major crops in their garden. Majority of the plant species in the homegardens are cultivated (58%), followed by wild (42%). It was interesting to note that majority of the cultivated plants in homegardens are ornamentals (39%), followed by medicinal (32%) and edible ones (29%) (Fig. 8). Introduction and invasion of exotic and ornamental species may replace the traditional native species in the area. Similar kind of invasion of exotic and ornamental species was reported in the traditional homegardens of the Nuba mountains, Sudan which increasingly subjected to the introduction of exotic species and indicated a trend towards the loss of traditional plant species and farming practices (Wiehle et al. 2014). Among the wild plants in the tribal homegardens, about 54% are edible ones and it indicates the importance of traditional homegardens for biodiversity conservation and food security of tribal people. In a study conducted in Pachmarhi Biosphere Reserve in India by Kala (2010) emphasized the importance of traditional ecological knowledge of homegarden farmers in conserving the threatened wild species in homegardens. Fruit trees and timber trees received less attention in the homegardens. Farmers also pointed out that they do not spare time and energy for managing the seasonal and herbaceous species growing in and around their homegardens. Inputs such as chemical fertilizer and pesticides, are rarely used in the tribal homegardens since the manure from the homestead animals and the leaf litter in the vicinity was sufficient to maintain the fertility of the homegardens. Men usually go for daily wages work, so mostly women are involved in the management of homegardens than men. Younger women are more concerned about ornamental plants, whereas in the interior hamlets the knowledge on wild plants was relatively high. The management of homegarden was influenced by factors such as type and fertility of the soil, slope of the garden, size of the household, resource endowment and individual farmer's preference (Rugalema et al. 1994; Vogl and Vogl-Lukasser 2003).

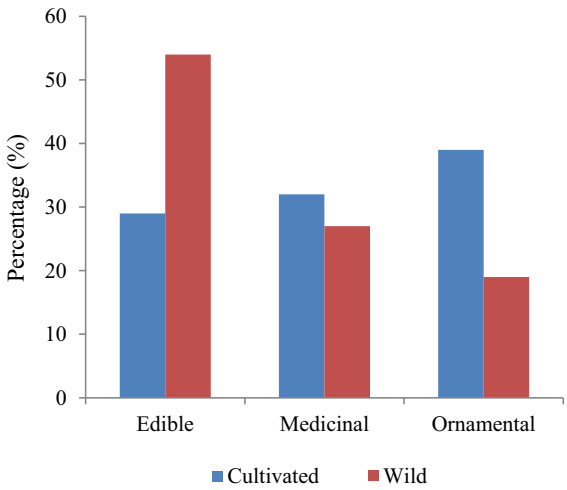

Fig. 8 Plant management in tribal homegardens

Conclusion

The study reveals that the floristic composition, diversity, structure and use value of plant species in tribal homegardens of Attappady valley is relatively high and rich. The homegardens of the study area is found harbouring many useful plant species of both cultivated as well as wild nature. And it contributes to the food and nutrition security and livelihood of the tribal people significantly. Majority of the homegardens could be seen with multilayer structures and maximum number of plants seen in the first and second

layers of canopy from the ground. A total of 182 plant species belonging to 160 genera and 67 families were recorded from the selected homegardens of eight tribal hamlets in Attappady valley. Maximum number of plant species was found in the Dundoor hamlet and in the homegardens of Muduga community. Plant species found in homegardens has multipurpose values in which edible plants ranked highest followed by species of ornamental and medicinal value. Considering the similarity of species in the homegardens, a total of 56 plant species were common distribution across the gardens of all the three communities. Four clusters were distinguished during the classification of homegardens between the hamlets according to the presence and absence of species in homegardens. Besides, traditional tribal homegardens are found as a potential habitat for the conservation of genetic diversity of several species.

Acknowledgement The research project was funded by Department of Science and Technology, New Delhi through DST-INSPIRE fellowship. We are thankful to Irula tribal field assistants, Pappal and Nanji, for accompanying in our field visits and express our gratitude to various tribal elders for providing necessary information. We thank the external reviewers for their valuable comments that helped to great extend in modifying the manuscript. We are also grateful to Dr. A P Thomas, Director, Advanced Centre of Environmental Studies and Sustainable Development for giving necessary support and encouragement.

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