Chapter

Nesting Behavior of Indian Giant Squirrel (*Ratufa indica* Erxleben, 1777) in Mudumalai Tiger Reserve, Western Ghats, Southern India

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Abstract

The present study was carried out on the nesting behavior of IGS in the Mudumalai Tiger Reserve during the month of June 2015 to June 2017 (2 years). A total of 192 nesting trees with 279 nests belong to 19 tree species were identified as nesting trees preferences of IGS. Of which *Bambusa arundinacea* grass species was the dominant nesting grass species of the IGS in Mudumalai Tiger Reserve (11%, n = 22). The overall nest height of the IGS was 19.70 m and a maximum height of 34 m and a minimum height of 8 m. The nest direction shows that the North East held the number of the nest (n = 137), and the nest position shows that the Crown (n = 197) contained the number of the nest. The nest position shows that top (n = 220) were contained the number of nests compared to the middle (n = 59). On the other hand, no nest was placed on the down position.

Keywords: Indian giant squirrel, Mudumalai Tiger Reserve, nesting, Western Ghats

1. Introduction

The Indian or Malabar giant squirrel (*Ratufa indica* Erxleben, 1777) is endemic to Peninsular India (South India) [1]. Although it is widely distributed within its range, it occurs in severely fragmented populations [2]. It has faced local extinction and range restriction in several areas due to hunting and habitat loss and suitable habitat is limited in the areas where it occurs [3]. The Indian giant squirrel is currently listed in the "Least Concern" category of IUCN Red List, Appendix II of CITES and Schedule II of the Wildlife (Protection) Act, 1972 of India [4, 3]. The Indian giant squirrel occurs in the elevation range of 180–2300 m and inhabits deciduous, mixed deciduous and moist evergreen forests [5]. It is a large-bodied (90–100 cm), diurnal and arboreal squirrel [6]. A solitary living species, it is seen in pairs only during the breeding season. It usually constructs more than one nest, or drey, within a single breeding season. The nests, which are made of leaves and twigs, are built-in tall, profusely branched trees, in the higher canopy [7, 8]. The species is omnivorous and feeds on fruits, flowers, nuts, bark, bird eggs and insects [9, 8]. The ecology of squirrels from Asian countries has been little studied and published information is scarce [10, 11]. In Mudumalai Tiger Reserve, there is an only one literature was available on IGS population and nesting ecology [12]. Hence the present study was under took major objectives on (1) To find out the nesting tree preference, (2) To find out the nesting trees variables to support the IGS nesting, (3) Nesting behavior of IGS, and (4) To given an scientific recommendation for long term management and sustainable conservation of the species.

2. Study area

Mudumalai Tiger Reserve is one of the few areas in the country with a rich and varied terrain, flora and fauna. Mudumalai plays an important role in biodiversity conservation of especially large mammals, by offering habitat contiguity of about 3300 km^2 with three other protected areas in the region, namely Nagarahole and Bandipur National Park and Wayanad Wildlife Sanctuary through forest corridors between the Western Ghats and the Eastern Ghats. The reserve was created in 1940, the first in southern India, with an area of 60 km^2. In 1956, it was enlarged to 295 km^2 and later to a further 321 km^2 and 688.59km^2 core zone = 321 km^2 and buffer zone = 367.59 km^2 which it is present extent (**Figure 1**). Champion and Seth [13] classified the vegetation type in Mudumalai as Southern Tropical dry thorn forest, Southern Tropical dry deciduous forest, Southern Tropical moist deciduous forest, Southern Tropical semi-evergreen, Moist bamboo brakes, and Riparian fringing forest.

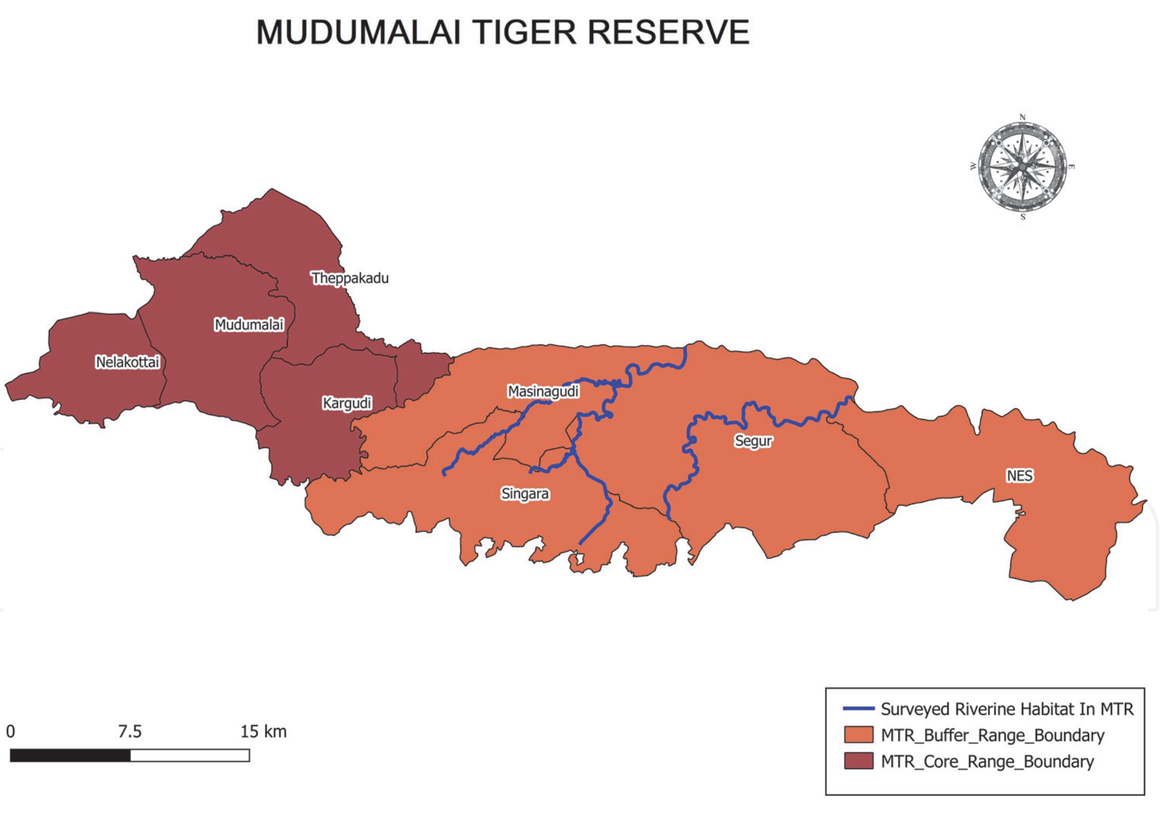

Figure 1.
Map showing the surveyed riverine habitats in Mudumalai Tiger Reserve.

3. Methodology

3.1 Data collection

Data were collected from June 2015 to June 2017 mostly on breeding seasons when the squirrels are more active and easily seen. We searched for animals and their nests along the natural trails in the dry thorn forest. Most of the nesting trees were located through intensive searches in the area by inspecting potential nesting trees and nests. The presence of IGS and their activity provide indirect evidence of use as nest trees. The IGS nesting trees were marked with GPS coordinates and classified with identification. The quantification of nesting habitat followed methods suggested by James and Shugart [14] and subsequently by Kannan [15], Mudappa and Kannan [16], and Girikaran et al. [17]. Vegetation and nest tree parameter was quantified in circular plots of 15 m (0.07 ha) with the nest tree as the center. All the trees (GBH > 25 cm) were enumerated and GBH (Girth at Brest Height) measured. Canopy cover was visually estimated. The elevation of the nesting tree distances to the nearest road, habitation was also noted. The nest tree parameters were measured such as tree height, basal area, diameter at breast height, number of primary branches and secondary, canopy cover, canopy height, canopy width and tree status such as (dead or alive) were noted. Such parameters were also quantified in similar-sized plots located 100 m in a random direction from the nest tree, where the nearest tree of GBH > 250 cm was chosen as the centre tree and the same nest tree parameters were also taken into the account for comparison of random (non-nest) plots with nest tree plots were made to determine parameters likely to affects choice of nesting habitat by Indian Giant Squirrel. The availability and density of potential nest tree species were assessed from 16 0.25 ha (50 m $\times$ 50 m) vegetation plots (2.5 ha).

3.2 Statistical treatment

Mean (M) and Standard Error (SE) was calculated to the nesting trees variables in the study area. Pearson's correlation coefficient matrix was performed to understand the variables significances among the nesting trees. Man Whitney U test was used to determine differences in 13 parameters between nest (n = 158) and non-nest (n = 250) plots. Principal Component Analysis was used to understand nest site selection. Statistical analyses were performed using *Graph Pad Prism 5 and SPSS* 17.0 statistical computer software.

4. Result

A total of 192 nesting trees with 279 nests belonging to 19 trees species were identified as nesting trees preferences of IGS in the Mudumalai Tiger Reserve (**Table 1**). Of which *Bambusa arundinacea* was the dominant nesting grass species of the IGS (11%, n = 22) followed by *Terminalia arjuna* (10%, n = 20), *Spondias mangifera* (9%, n = 18), *Syzygium cumini* (7%, n = 14) and *Ficus benghalensis*, *Manilkara hexandra*, *Sapindus emarginata* were each 12 nesting trees (n = 6%), respectively. Among the nest, wise number of nests were recorded in the *Bambusa arundinacea* (20%, n = 56) followed by *Terminalia arjuna* (10%, n = 28), *Spondias mangifera* (9%, n = 26), *Syzygium cumini* (8%, n = 22) and *Ficus benghalensis* (6%, n = 16). There is a significant difference were observed on nesting trees preferences as well as the number of nests in a nesting tree ($t = 2.539$; $P = 0.0184$). The overall nest height of the IGS was 19.70 $\pm$ 3.25 m and a maximum height of 34 m and a minimum height of 8 m and the nest direction shows that North East has held the number of nests (n = 137) followed by South East (n = 83), South West (n = 40) and North West (n = 19) (**Figure 2**). The nest position shows that Crown (n = 197) were contained the number of nest camper to lumb (n = 82). The nest position shows that top (n = 220) were contained the number of nests compare to the middle (n = 59). on the other hand, no nest was placed on the down position. A total of 14 variables

S.No	Scientific name of the nesting trees	Number of nesting trees	Relative abundances of the nesting trees %	Number of nests	Relative Abundances of the nest in nesting trees %
1	*Bambusa arundinacea* (Grass species)	22	11	56	20
2	*Terminalia arjuna*	20	10	28	10
3	*Spondias mangifera*	18	9	26	9
4	*Syzygium cumini*	14	7	22	8
5	*Ficus benghalensis*	12	6	16	6
6	*Manilkara hexandra*	12	6	14	5
7	*Sapindus emarginata*	12	6	12	4
8	*Ailanthus excelsa*	10	5	12	4
9	*Terminalia bellirica*	10	5	10	4
10	*Acasia leucophloea*	8	4	8	3
11	*Schleichera oleosa*	8	4	8	3
12	*Tamarindus indica*	8	4	14	5
13	*Albizia lebbeck*	7	4	7	3
14	*Terminalia crenulata*	7	4	10	4
15	*Cassine glauca*	6	3	12	4
16	*Pongamia pinnata*	6	3	8	3
17	*Ficus mollis*	5	3	7	3
18	*Ficus microcarpa*	4	2	6	2
19	*Filicium decipiens*	3	2	3	1
	Total	192		279	

Table 1.
Nesting tree preference of IGS in the Mudumalai Tiger Reserve.

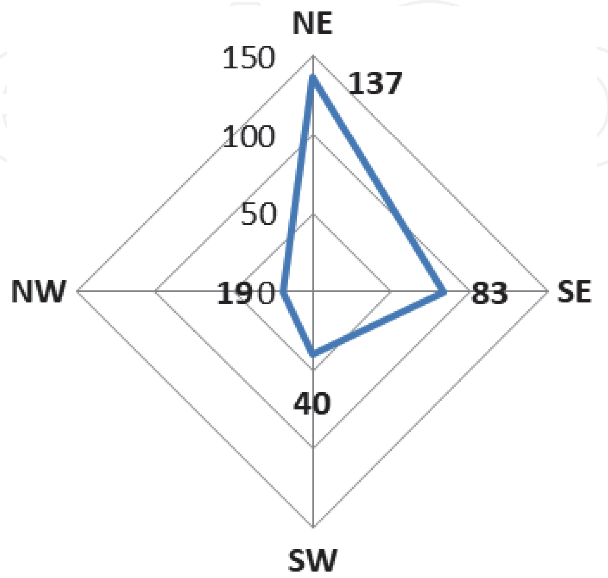

Figure 2.
Nest direction in nesting trees in Mudumalai Tiger Reserve.

were collected from the nesting trees and non-nesting trees for analyzing the preferences of IGS nesting in the study area (**Table 2**).

Fourteen variables of nest tree and centre tree of non-nest sites were measured and are given above (**Table 2**). Nest trees differed significantly from centre trees of non-nest plots, in terms of size. The height of the tree, basal area, GBH, Branch end, secondary branches, canopy length, canopy cover, and elevation were all significantly greater in nest trees than non-nest centre trees (**Table 2**). But there was no significant difference in, Branch start, branch start, and branch end distance, Primary branches, canopy width, Distance to human habitation and distances to the road between nest plot and centre trees of non-nest plots. However, there was a significant difference in large tree density (GBH ≥ 25 cm, GBH ≥ 26–75 cm, GBH ≥ 126–175 cm and GBH ≥ 326–375 cm) between the nest and non-nest plots (**Table 2**).

Variables	**Nest plot (n = 192)**	**Non-nest plot (n = 250)**	***U***	***P < 0.05***
Nest/centre tree height (m)	25.63 ± 0.68	21.48 ± 0.47	2750	0.40*
Nest/centre tree basal Area (cm)	423.56 ± 19.28	389.35 ± 14.78	2125	0.03*
Nest/centre tree girth at breast height (cm)	397.32 ± 17.25	358.46 ± 16.25	2091	0.00*
Nest/centre tree branch start (m)	7.35 ± 0.29	5.46 ± 0.37	2093	0.12
Nest/centre tree branch end (m)	23.35 ± 0.46	19.27 ± 0.49	2782	0.05*
Nest/centre tree branch start and branch end distance (m)	9.18 ± 0.37	10.23 ± 0.29	3272	0.77
Nest/centre tree primary branches	3.68 ± 0.19	5.16 ± 0.13	2951	0.17
Nest/centre tree Secondary branches	42.37 ± 1.27	44.19 ± 0.78	2901	0.03*
Nest/Centre tree Canopy length (m)	27.53 ± 0.68	28.32 ± 0.83	2466	0.00*
Nest/Centre tree canopy width (m)	28.34.88 ± 0.75	29.56 ± 0.43	2992	0.22
Nest/Centre tree canopy cover (%)	78.32 ± 2.35	82.34 ± 1.36	3078	0.05*
Nest/centre tree Distance to human habitation (km)	10.36 ± 1.26	11.12 ± 0.18	3298	0.54
Nest/centre tree Distance to road (km)	9.09 ± 0.35	8.63 ± 0.52	3259	0.37
Nest/centre tree elevation (m)	893.68 ± 19.84	887.37 ± 17.39	4235	0.02*
Tree density/ha				
i. Trees of GBH ≥ 25 cm	28.35 ± 0.54	26.53 ± 0.69	2833	0.05*
ii. Trees of GBH ≥ 26–75 cm	5.17 ± 0.16	4.52 ± 0.32	2496	0.00*
iii. Trees of GBH ≥ 76–125 cm	3.36 ± 0.17	3.85 ± 0.19	3612	0.35
iv. Trees of GBH ≥ 126- 175 cm	3.13 ± 0.29	2.98 ± 0.93	2843	0.04*
v. Trees of GBH ≥ 176–225 cm	2.38 ± 0.59	1.87 ± 0.53	3036	0.16
vi. Trees of GBH ≥ 226–275 cm	1.25 ± 0.17	1.89 ± 0.23	3314	0.65
vii. Trees of GBH ≥ 276- 325 cm	1.35 ± 0.29	1.59 ± 0.12	3194	0.37
viii. Trees of GBH ≥ 325 cm	1.13 ± 0.75	1.38 ± 0.74	2841	0.03*
ix. Trees of GBH ≥ 376–425+ cm	0.52 ± 0.46	0.75 ± 0.49	3217	0.04*

**Parameters that was significantly different between nest and non-nest plot P < 0.05 significant.*

Table 2.
Characteristics of nest-site and non-nest site plots of IGS in the Mudumalai Tiger Reserve.

The principal component analysis (PCA) was carried out using the nest site characteristics data from all the nests of IGS observed (n = 158). **Table 3** shows Pearson's correlation matrix between the 14 variables.

PCA extracted three principal components that elucidated 87.12% variability (**Table 4**). The first component explained 39.02% variability that gives details of seven nest tree variables such as tree height, Branch Start, Branch End, Branch Start and Branch End Distance, Canopy Width, Distance to human habitation and Distance to Road in the plot and that were positively correlated with the first component. High values on the first component corresponding to the tallness of nest trees, Branch Start, Branch End, Branch Start and Branch End Distance, Canopy Width. Thus, the first component represents, with increasing values, the size of the nest tree and tallness will also increase. The first component was also positively correlated to Distance to human habitation and Distance to Road variable, which indicates, with increasing values, greater distance to human habitation and roads. The second component explained 29.07% variability that explained five nest tree variables such as basal area, GBH, Primary Branch, Secondary Branch and Canopy Length (**Table 4**). High values on the second component correspond to a basal area GBH, Primary Branch, Secondary Branch and Canopy Length. Thus, the second component also represents, with increasing values, the size of the nest tree and basal area and branch structure of the tree will also increase. The third component explained 11.68% of the total variance and was related to Canopy cover and human habitation. The fourth component explains 7.35% of the total variance and was related to Canopy cover and Elevation (**Table 4**).

A total of 24 potential nest tree species of IGS that occurred at the study area was identified based tree genera or species those that generally attain a large tree size (**Table 5**). Of these only 19 species were used for nesting by IGS in the Mudumalai Tiger Reserve. All of these trees were emergent, large girth trees and are relatively more common than other species; in fact, *Terminalia arjuna* was the most common tree species among these. The overall occurrence of *Terminalia arjuna* was 29.3 trees per ha and 10.4 per ha for trees of GBH ≥ 250 cm which were recorded in the 146 0.25 ha plots during the study period (**Table 5**). Density of large trees (GBH ≥ 250 cm) species *Alianthus excelsa* 8.91 per ha recorded in the 146 0.25 ha plots and *Pongamia pinnata* 5.89 per ha, *Manilkara hexandra* 4.40 per ha, *Schleichera oleosa* 3.46 per ha and *Spondias mangifera* 2.46 per ha recorded in the 146 0.25 ha plots. According to the tree size, the overall availability of the species was an important factor in the nest tree selection by Indian Giant Squirrel. In the study plots covering 36.5 ha, the overall availability of trees GBH ≥ 250 cm was 14.75 per ha (56.56 trees) (**Table 5**).

5. Discussion

Preference for nesting trees could depend on factors such as access to nesting material and food, nest safety and the branching pattern of the tree species. A total of 18 tree species and one grass species were recognized as nesting trees of IGS in the Mudumalai Tiger Reserve. Of which *Bambusa arundinacea* (grass species) was dominant for nesting of the IGS (11%, n = 22) followed by *Terminalia arjuna* (10%, n = 20), *Spondias mangifera* (9%, n = 18), *Syzygium cumini* (7%, n = 14). The previous study reported that in this region a total of 15 tree species were utilized for nesting purposes by IGS of which *Spondias mangifera* and *Schleichera oleosa* tree species were most preferable tree species for nesting [12]. The high preference for *Bambusa arundinacea and Terminalia arjuna*, *Spondias mangifera* and *Syzygium cumini* which are found mostly along rivers and streams could be due to their dense

	H	BA	DBH	BS	BE	BSBED	PB	SB	CL	CW	CC	DHH	DR	ELEV
H	1.000													
BA	−0.241	1.000												
DBH	0.014	0.901*	1.000											
BS	0.866*	−0.269	0.019	1.000										
BE	0.992*	−0.272	0.000	0.884*	1.000									
BSBED	0.876*	−0.177	0.019	0.546*	0.862*	1.000								
PB	0.012	0.692*	0.635*	−0.239	−0.047	0.207	1.000							
SB	−0.029	0.700*	0.593*	−0.044	−0.087	−0.050	0.570*	1.000						
CL	−0.053	0.785*	0.738*	−0.318	−0.126	0.151	0.886*	0.612*	1.000					
CW	0.862*	−0.123	0.025	0.501	0.825*	0.971*	0.292	0.056	0.256	1.000				
CC	−0.551**	0.292	0.117	−0.341	−0.518	−0.484**	−0.141	0.256	−0.119	−0.575**	1.000			
DHH	0.488*	0.245	0.376	0.441	0.469*	0.511*	0.136	0.405	0.187	0.476	0.691*	1.000		
DR	0.602*	0.369	0.436	0.481*	0.564*	0.596*	0.269	0.539*	0.360	0.623*	0.056	0.842*	1.000	
ELEV	0.224	−0.052	−0.054	0.154	0.176	0.200	−0.153	0.177	0.114	0.224	−0.114	0.216	0.254	1

Significant at $p < 0.05$.
**Positive correlation.*
***Negative correlation.*

Table 3.
Pearson's correlation coefficient matrix between nesting tree variables, by IGS in the Mudumalai Tiger Reserve.

Variables	Communality	PC1		PC2		PC3		PC4	
		r	**c**	**r**	**c**	**r**	**c**	**r**	**c**
Height	0.978	0.895*	0.153	−0.408	−0.094	−0.074	−0.042	0.076	0.069
BA	0.923	0.134	0.023	0.947*	0.217	−0.006	−0.004	0.087	0.079
GBH	0.794	0.323	0.055	0.798*	0.183	−0.060	−0.034	0.224	0.203
Branch Start	0.792	0.700*	0.120	−0.452	−0.104	0.235	0.134	0.208	0.188
Branch End	0.968	0.860*	0.147	−0.454	−0.104	−0.053	−0.030	0.142	0.129
Branch Start and Branch End Distance	0.884	0.852*	0.146	−0.285	−0.065	−0.270	−0.154	0.063	0.057
Primary Branch	0.916	0.292	0.050	0.722*	0.166	−0.553	−0.316	0.056	0.050
Secondary Branch	0.784	0.328	0.056	0.776*	0.178	0.242	0.138	−0.129	−0.117
Canopy Length	0.965	0.303	0.052	0.813*	0.187	−0.424	−0.242	−0.178	−0.162
Canopy Width	0.918	0.876*	0.150	−0.211	−0.048	−0.323	−0.184	−0.053	−0.048
Canopy Cover	0.815	−0.409	−0.070	0.373	0.085	0.639*	0.365	0.618*	0.288
Distance to Human habitation	0.801	0.714*	0.122	0.205	0.047	0.459*	0.256	0.219	0.198
Distance to Road	0.918	0.845*	0.144	0.287	0.066	0.331	0.189	0.106	0.096
Elevation	0.855	0.316	0.054	−0.039	−0.009	0.309	0.176	0.812*	0.736
Eigen value		5.85		4.36		1.75		1.10	
% Variance explained		39.02		29.07		11.68		7.35	
% Cumulative explained		39.02		68.10		79.77		87.12	

r- Pearson correlation coefficient, c- Factor Score coefficient
** Correlation significant at* $P < 0.05$

Table 4.
Summary statistics of principal component analysis.

S.No	Scientific name	Height (m)	DBH	Overall tree density/ha	Tree density/ha (GBH ≥ 250 cm)
1	*Acasia leucophloea*	8–26	96.57	1.2	0
2	*Alianthus excelsa*	5–28	93.44	8.91	0.26
3	*Albizia lebbeck*	6–	75.1	2.06	0
4	*Cassine glauca*	7–28	191.8	2.33	0.73
5	*Schleichera oleosa*	8–18	114.52	3.46	0
6	*Spondias mangifera*	8–25	228.61	2.46	0.93
7	*Syzygium cumini*	4–28	175.75	1.40	0.47
8	*Terminalia arjuna*	2–34	188.64	29.3	10.4
9	*Terminalia crenulata*	6–26	107.36	0.80	0.17
10	*Ficus benghalensis*	9–24	296.15	1.86	0.53
11	*Ficus microcarpa*	4–21	94.66	2.86	0.06
12	*Ficus mollis*	11–26	120.71	0.53	0.06
13	*Filicium decipiens*	8–20	134.17	1.13	0.13
14	*Manilkara hexandra*	7–28	150.73	4.40	0.6
15	*Sapindus emarginata*	8–16	96.5	0.86	0
16	*Tamarindus indica*	8–18	92.56	1.13	0.13
17	*Terminalia bellirica*	8–23	215.23	0.45	0.12
18	*Pongamia pinnata*	5–18	136.21	5.89	0.03
19	*Butea monosperma*	4–15	142.27	0.26	0
20	*Chloroxylon swietenia*	6–16	112.65	0.58	0
21	*Ficus racemosa*	10–23	286.12	0.34	0.05
22	*Ficus religiosa*	8–22	254.85	0.19	0.06
23	*Givotia rottleriformis*	5–13	116.57	0.68	0
24	*Holoptelea integrifolia*	6–12	154.36	0.75	0.02

Table 5.
Potential nest tree species, tree characteristics, and availability of IGS in MTR.

canopy cover, and higher canopy height and contiguity that could offer better protection and escape from predators.

A total of 192 nesting trees harboring 279 nests in an average of 2.66 nesting trees per km and 3.87 nests/km in a 72 km transect. In the previous study stated that a total of 83 nests were located along 54.2 km transects, giving an encounter rate of 1.5 nests/km of transects [12]. Previously the number of nests was reported in the moist deciduous forest [18] but in this study, I recorded the high number of nests in dry thorn forest riverine patches, it's evident that riverine patches afford good habitat for IGS in the environment. The assortment of nesting sites in most of the arboreal animal communities was seen in the riparian ecosystem, since of the diversity of plant species and tallness of the trees establish in these kinds of habitats and also accessibility of water for thermoregulation and humidity the stage of the enormous role for assortment of this habitat [19].

The nesting tree characters shows that the average height of the nesting tree and DBH and Trunk size and canopy had a very good percentage. Among the 19 nesting trees *Bambusa arundinacea* (Grass species), *Terminalia arjuna*, *Spondias mangifera* and *Syzygium cumini* trees contained the tallest height as well as DBH and Trunk size and canopy cover. The high preference for *Bambusa arundinacea*,*Terminalia arjuna*, *Spondias mangifera* and *Syzygium cumini* which are found mostly along rivers and streams, could be owing to their dense canopy cover, and higher canopy height and contiguity that could proffer better guard and escape from predators. Such prejudiced assortment towards matured trees with greater canopy contiguity could make easy group to and from the nest in all instructions, the main benefit to escape from predators and to move to other parts of the home range for foraging and other activities as reported by Ramachandran [8] Datta and Goyal [20] and Parathan [11].

The canopy length and width, as well as branch start and branch end, was very good in *Terminalia arjuna*, *Spondias mangifera* and *Syzygium cumini*, as well as these trees, hold most numbers of nest compare the other nesting trees. These results coupled with the results of nest tree characters show that the squirrels prefer the largest trees available and highest locations on the trees within their home range to build their nests. The selection is however strongly influenced by tree species and their physical characteristics including canopy contiguity as reported elsewhere [20] for the species. Prakash et al. [21] stated that the canopy length width is an important factor for choosing a nesting tree it provides shelter as well as protection.

This study found that a single tree holds a maximum five numbers of nest and minimum one nest and the average height of the nesting trees was 24.4 m. There were more than one or two nests in a single tree [18]. The tree species with multiple numbers of nests were *Terminalia arjuna*, *Spondias mangifera* and *Sizizyum cumini*. Kumara and Singh [22] sighted the Indian giant squirrel mostly at a height of 16 to 20 m in moist forests and 11 to 15 m in dry forests. We observed the Indian giant squirrel nesting on a large variety of the tree species (n = 37) in Karlapat wildlife sanctuary. Kanoje [23] also reported the use of a large variety of tree species (n = 30) for nesting in Sitanadi wildlife sanctuary, India. The nests were not built on the highest possible branch, as the squirrels sought cover above the nest. Such cover might help avoid direct heat from the sun and serve as hiding—place from birds of prey [10]. Among the 279 nests most of the nests were facing the northeast direction this is the influence of the sunlight effects plays a huge role in the nest position [24]. The maximum nests' width and length 70 and 35 cm, respectively. The nest condition, as well as length and width, play an important role in utilization as well as the care of young ones [7]. A nest was mostly located in the top (79%) and Middle (21%) of the canopy these results coupled with the results of nest tree characters show that the squirrels prefer the largest trees available and the highest locations on the trees within their home range to build their nests. The variety is however strongly predisposed by tree species and their physical characteristics as well as canopy contiguity as recorded in a different place [20] for the species.

6. Conclusion

Mudumalai Tiger Reserve faces severe pressure from the collection of non–timber forest products (NTFP) collection. Fruits of *Spondias mangifera* and *Tamarindus indica* are among the top NTFP collections and *Bambusa arundinacea* is highly utilized by local people for fences and home construction activities etc. which are also the preferred nesting trees of the Indian giant squirrel. The threats to this squirrel population in Mudumalai Tiger Reserve are immediate and visible. The results of this study support the need to implement the following conservation measures for the Indian giant squirrel: prevention of cutting *Bambusa arundinacea* of the preferred nesting species and regular monitoring of NTFPs; prevention of forest fires and mitigation of heavy grazing to allow regeneration of trees.

Mudumalai Tiger Reserve holds a good population of this endemic mammalian species in India. The sanctuary is a natural mosaic of different forest types and effective conservation management could have a positive, long-lasting impact on the population of the Indian giant squirrel.

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