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POPULATION DISTRIBUTION OF INDIAN GIANT SQUIRREL *RATUFA INDICA* IN DRY AND MOIST DECIDUOUS FOREST OF SIRONCHA FOREST DIVISION, CENTRAL INDIA

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ABSTRACT

Distribution of the Indian Giant squirrel (IGS), *Ratufa indica* population was studied in the moist deciduous, dry deciduous forest and moist evergreen forests of Sironcha Forest Division, Maharashtra, India. A total of 2803 nests of IGS were observed including 1533 nests used by the species suggesting 256 individuals. The nests were distributed in clusters and 39% of them occurred in 5 clusters. The nest density ranged between 0.5 and 42.7 km^2. Amongst 98 tree species recorded in the area, IGS used 49 species for nest building. IGF build around 71% of its nests on nine tree species. The most preferred tree species was *Xylia xylocarpa* followed by *Terminalia alata*, *Anogeissus latifolia* and *Madhuca longifolia*. Evergreen trees were preferred for nest building as compared with deciduous trees. The data suggests that even good quality forests with close canopy and high biodiversity are devoid of sizeable IGS population.

Key words: Indian Giant squirrel, *Ratufa indica*, Nesting, Population, Sironcha Forest Division.

Introduction

There is a huge knowledge gap regarding the arboreal giant squirrels (Koprowski and Nandini, 2008) of which three sp viz. Indian Giant squirrel (*Ratufa indica*), Malayan Giant squirrel (*R. bicolor*) and Grizzled giant squirrel (*R. macroura*) are found in India. Indian Giant Squirrel (IGS) is widely distributed in peninsular India (Corbett and Hill, 1992; Nayak and Patr, 2015) from the evergreen to moist and dry deciduous forests of Western Ghats (Rout and Swain, 2005, Mehta *et al*., 2012), and Eastern Ghats (Kumara and Singh, 2006) and Central Indian Hills (Agarwal and Chakraborty, 1979; Gurjar *et al*., 2014). However, their distribution is getting restricted regularly due to their low reproductive potential associated with habitat destruction, cultural attributes and poaching (Koprowski and Nandini, 2008; Srinivas *et al*., 2008; Nayak and Patr, 2015).

Apart from playing significant role in the seed dispersal in tropical forest, IGS are indicator for the forest quality due to their obligate requirement of closed canopy (Dutta and Goyal, 1996). Hence, their ecological studies including their distribution pattern and diversity of their preferred host plant for nesting is very vital (Datta and Goyal, 1996; Baskaran *et al*., 2011; Nayak and Patr, 2015). However, such kind of studies are very few from the Central India (Datta, 1993, 1998, 1999; Mehta, 1997; Datta and Goyal, 1996; Rout and Swain, 2005; Kanoje, 2008). The available information on the nesting of IGS is largely available from protected areas (Prachi *et al*., 2012; Gurjar *et al*., 2014) and such information from outside PAs are lacking. Authors therefore undertook a survey of the nesting IGS with the aim to generate baseline information for the species in the forests outside PAs for their future population monitoring and assess current status.

Study site and Methods

Study was conducted in Sironcha Forest division located in the southern part of Gadchiroli district, Maharashtra (Fig. 1). It lies in between the parallels of latitudes 18^{0}41'15" to 19^{0}20'00" North and between the meridians of longitudes 79^{0}55'19" to 80^{0}22'30" East. Climate is tropical type with average annual rainfall of 1923 mm. Ninety four per cent rains fall during the month of June to October. Approximately 78% of the area is under forest cover. Southern part of the area is covered with South Indian Moist Deciduous Forests and northern part with Southern Tropical Dry Deciduous Forests (Champion and Seth, 1968). Landscape is undulating and intermittently interspersed with hills, nalas (Small stream) and large streams.

Sironcha Forest division falls under two categories; namely Teak Plantation Working Circle (TPWC) where entire forest patch was cleared in the past and replaced by artificial regeneration of the teak (*Tectona grandis*) and

The study suggests that even good quality forest with close canopy and high biodiversity are devoid of sizeable IGS population.

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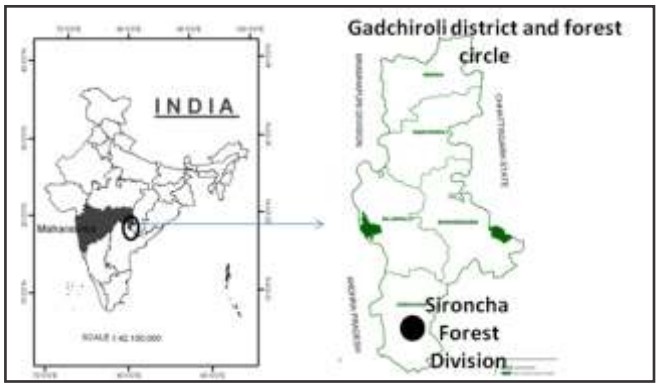

Fig. 1: Location of the study site (Sironcha Forest Division).

miscellaneous crop where selective removal of the high girth tree is being taken up and known as Selection cum Improvement Working Circle (SCI) and Improvement working circle (IWC).

For undertaking census in present study, total count method was used (WWF, 2000). It requires less technical training to be imparted to frontline staff in case of total count method rather than transect line method which is otherwise is a widely used technique for population estimation of giant squirrel (Jathana *et al*., 2008; Baskaran *et al*., 2011; Prachi *et al*., 2012). Besides, when survey is being undertaken on large scale, high investments required to establish transects before sampling could commence becomes a limiting factor (Roberts, 2011).

High resource requirement of total count method was obliterated by the large establishment of Forest Department with a patch of forest area under control of one Forest Guard assisted by permanent Forest laborers (Van Mazoor) and temporarily Protection laborers. Frontline staff were trained regarding different aspects of the giant squirrel and survey techniques. It enabled the census to be undertaken simultaneously in entire division within short time period.

All the nests were counted with the GPS reading of the nest, host tree, and type of the nest. Observations were made during daylight hours i.e. 6000-1200 hr or 1200-1800 hr as the animal is diurnal in nature. The nest trees were surveyed taking different parameters like nest tree species, tree height, and girth at breast height (GBH).

Using method prevalent in Bhimashankar wild life sanctuary (WLS), where on an average one IGS is counted against six nests (Borgis and Rao, 2014), population count of IGS was done indirectly. In each compartment total IGS population was enumerated indirectly through counting active nests and total area of the compartment were used to calculate the density at compartment level, similarly total area of range was used to calculated density at range level. Location of the nests were depicted on the Map

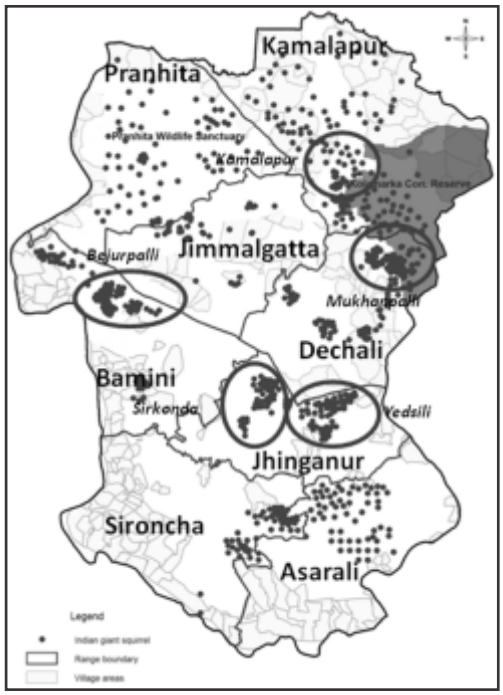

Fig. 2: Distribution of the IGS nests and clusters in Sironcha Forest Division.

using Geomedia version 6 software. The area having large congregations of the nests were marked on the map to ascertain the cluster of the IGS population. Compartment falling in the cluster were clubbed to ascertain the area of the cluster and population of the cluster. Figures were used to calculate density of nest (per km^2).

Interviews with tribal hailing from local villages were also accounted. They were commonly asked about the importance of giant squirrel in their food habit, culture, and their hunting style. Besides, they gave information about the distribution and change in population size since past.

Results

A total of 2803 nests of IGS were recorded from the entire forest division. Of these, 1207 nests were abandoned by the animals and rest were still used by them (Table 1). It suggested 256 individuals in the entire division as per Field guide written by Borgis and Rao (2014). We also sighted 80 IGS individuals Maximum individuals were recorded from Asarali Forest Range followed by Kamlapur Forest Range and minimum in Pranhita Forest Range. Similar trend was observed in nest densities. Overall density was 1 IGS individual per 10 km^2. Nests were recorded in clusters from moist deciduous, dry deciduous and moist evergreen forests along big nalas and streams. Thirty nine per cent nests were found in 5 clusters (Table 2, Fig. 2). Usually, clusters were located away from the village areas but one was also recorded near the National Highway (NH16).

Table 1: Distribution of the IGS nests in different ranges of the Sironcha Forest Division, Maharashtra, India.

S. No.	Range	Total area (km^2)	Forest area (km^2)	% of the forest area	Direct sighting of the IGS	Nest being used	Nests under repair	Left over nests	Total nests	Probable no. of IGS individuals	Average area occupied per nest (km^2)	Number of nests 100/ km^2
1	Pranhita	401.42	353.96	88.2	4	39	17	26	94	9	2.6	38
2	Jimalgatta	303.68	275.94	90.9	3	60	2	29	91	10	3.7	27
3	Bamini	328.89	219.41	66.7	5	92	10	85	198	17	7.7	13
4	Kamalapur	532.91	490.17	92	26	367	150	391	934	86	17.6	6
5	Dechali	299.49	272.47	91	10	76	0	112	188	13	4.6	22
6	Sironcha	392.7	229.39	58.4	6	89	0	38	127	15	6.5	15
7	Asarali	351.64	241.77	68.8	24	324	226	472	1034	92	37.9	3
8	Jhinganur	242.24	202.28	83.5	2	23	58	54	137	14	6.7	15
		2610.73	2083.11	79.8	32	1070	463	1207	2803	256	12.3	8

[P] protected site and H hunted site. While TRL denotes Territorial Forest Division, WL means Wildlife Division.

Table 2: IGS distribution in clusters in Sironcha Forest Division, Maharashtra, India.

S.No.	Cluster name	Area (km^2)	Probable number of IGS	Density of nest (km^2)
1	Kamlapur	1.18	50	42.7
2	Mukhanpalli	7.75	13	1.7
4	Bejurpalli	10.09	16	1.5
5	Sirkonda	15.21	10	0.6
6	Yedsili	23.68	12	0.5
	Total	57.91	100	5.7

Among 98 tree species recorded in the area, IGS utilized 49 plants for nest building (Table 3). Host trees for nesting belonged to 22 families including 5 families (Combretaceae: 24.1%; Sapotaceae: 14.3%; Annonaceae: 12.4%; Fabaceae: 11.1%; and Rubiaceae: 9.2%) accounting for 71.14% of the counted nests.

Nine species were used for constituting 71.4% of all the nests led by *Xylia xylocarpa* (11.6%), *Terminalia alata* (10.4%), *Anogeissus latifolia* (9.4%) and *Madhuca longifolia* (8%) (Table 4). Of the total trees recorded for nesting by IGS, seven were evergreen (11.9%) and rest were deciduous (Table 4). The share of evergreen trees for nesting purpose was 25.2% implying preference for evergreen trees over other types nesting was recorded more from forest patches with dominance of evergreen trees. Many tree species (e.g. *Terminalia alata*, *Xylia xylocarpa*, *Madhuca longifolia*, *Dillenia pentagyna, Dalbergia paniculata*) were used by multiple animals for nesting. Out of 49 sp being used for nest building, 38 sp are preferred for selection felling (Table 4).

Discussion

Present study reveals that still many forest areas have to be explored to access the real threat status of the IGS. They were found in both moist deciduous, dry deciduous forest and moist evergreen as reported earlier also. Total IGS count in present study may be underestimation due to inaccessibility of some areas due to geographical factors as well as influence of the left wing extremism. Reason for the patchy distribution is probably inability of surveying in many inaccessible areas. Besides, quality of habitat may also be one of the reasons for uneven distribution. Furthermore, absence of IGS population (called 'Varse' in Madia dialect) in many good quality forest patches may be result of cultural attributes of Madia tribe, one of the Primitive tribal groups (PTGs) dwelling in the area (Tiwari, 2002). Madhusudan and Karanth (2000) also reported that intensive hunting may result into decline in population size of the IGB. However, locals claim that the use of IGS for their sacred ceremonies has declined, though they still hunt it for food.

All nesting clusters were present in miscellaneous crop only, though Baskaran *et al*. (2011) has reported teak contributing significantly (around 49%) in the diet of IGS In teak plantations, IGS habitat may get deteriorated through monoculture plantation (Baskaran *et al*., 2011) accentuated by felling work which in turn creates hindrance in their arboreal movement (Ramachandran, 1988,1992) and pushing them to predation (Datta and Goyal, 1996). Illicit teak smuggling practiced in the study area is another point of concern.

Many small clusters were located in riparian forests with closed canopy, greater floral diversity and easy availability of food throughout the year.

Overall lower IGS individual density (0.12/km^2) as compared with many other studies (Baskaran *et al*., 2011, 2014; Nayak and Patr, 2015) is probably due to undertaking surveys in barren areas, open forest, semi open forest, degraded forest near villages. High density (42.7 IGS/km^2) in Kamlapur cluster compared with other clusters may be due to no felling work undertaken since last many years resulting into more closed canopy and better habitat.

A large number of the host plants species being used for nest building by the IGS provide them flexibility to

Table. 3: Host plants used by IGS for nest building.

S.No.	Family	Botanical name	Local name
1	Anacardiaceae	*Lannea coromandelica*	Moyen
		Buchanania lanzan	Achar
		Mangifera indica	Aam
2	Annonaceae	*Xylia xylocarpa*	Suriya
		Miliusa velutina	Karai
3	Bignoniaceae	*Stereospermum suaveolen*	Padar
4	Burseraceae	*Garuga pinnata*	Kakad
		Boswellia serrata	Salai
5	Caesalpiniaceae	*Cassia fistula*	Amaltas
		Hardwickia binata	anjan
		Bauhinia racemosa	Apta
		Tamarind indica	Chinch
6	Combretaceae	*Terminalia alata*	Saja/ain
		Anogeissus latifolia	Dhaoda
		Terminalia arjuna	Arjun
		Terminalia bellirica	Beheda
		Terminalia chebula	Hirda
7	Ebenaceae	*Diospyros melanoxylon*	Tendu
8	Euphorbiaceae	*Cleistanathus collinus*	Garari
		Bridelia retusa	Kateyen
		Emblica officinalis	Aonla
9	Fabaceae	*Pterocarpus marsupium*	Bija
		Albizia odoratissima	Chichwa
		Dalbergia latifolia	Shisham
		Dalbergia paniculata	Dhoban
		Pongamia pinnata	Karanj
		Ougenia oojeinensis	Tiwas
		Erythrina indica	pharad
		Butea superba	palas wel
10	Lecythidaceae	*Careya arborea*	Kumbhi
11	Lythraceae	*Lagerstroemia parviflora*	Lendia
12	Magnoliaceae	*Dillenia pentagyna*	Rankela
13	Bombacaceae	*Bombax ceiba*	Semal
14	Meliaceae	*Soymida febrifuga*	Rohan
15	Mimosaceae	*Acacia leucophloea*	Hiwar
16	Myrtaceae	*Syzigium cumini*	Jambhul
17	Rubiaceae	*Mitragyna parviflora*	Kalamb
		Mitragyna parviflora	Karam
		Adina cordifolia	Haldu
		Gardenia resinifera	Dikamali
18	Rutaceae	*Limonia acidissima*	Kavath
		Aegle marmelos	Bel
18	Sapotaceae	*Madhuca longifolia*	Moha
		Schleichera oleosa	Kusum
19	Sapotaceae	*Manilcora hexandra*	Khirni
20	strychnaceae	*Strychnos potatorum*	Nirmal
21	Tiliaceae	*Grewia tilifolia*	Dhaman
22	Verbenaceae	*Gmelina arborea*	Shivan
		Tectona grandis	Sagwan

switch over to different species during period of distress. Number of tree species used as host plant was higher compared to those reported in the Bhimashankar WLS (~31sp.) (Borgis and Rao, 2014), Kuldhia WLS (15 out of 27 sps.), Mudumalai WLS (15 sps.) and Sitanadi WLS (30 sps.) (Nayak and Patr, 2015, Kanoje, 2008, Baskaran *et al*., 2011); though comparable to those reported by Prakash *et al*. (2011) in Dalma WLS (59 sps.). Trees being used as host plants are entirely different from those used in the Bhimashankar WLS which reveals that IGS population is adapted to the specific niche in which they are found.

Table 4: Host plant preferred by IGS along with nature of host plant and their selection during felling carried out by department.

Botanical name	Total number of nest	Share in total number of nest (%)	Evergreen/ deciduous	Selection during felling
Lannea coromandelica	340	11.6	D	Y
Buchanania lanzan	304	10.4	D	N
Mangifera indica	274	9.4	E	N
Xylia xylocarpa	233	8.0	E	Y
Miliusa velutina	186	6.4	D	Y
Stereospermum suaveolen	177	6.0	D	Y
Garuga pinnata	136	4.6	D	Y
Boswellia serrata	129	4.4	D	Y
Cassia fistula	116	4.0	D	Y
Hardwickia binata	114	3.9	E	Y
Bauhinia racemosa	82	2.8	D	Y
Tamarind indica	71	2.4	E	N
Terminalia alata	69	2.4	D	Y
Anogeissus latifolia	58	2.0	D	Y
Terminalia arjuna	53	1.8	D	Y
Terminalia bellirica	47	1.6	D	Y
Terminalia chebula	44	1.5	D	N
Diospyros melanoxylon	43	1.5	D	Y
Cleistanathus collinus	41	1.4	D	Y
Bridelia retusa	39	1.3	D	Y
Emblica officinalis	34	1.2	D	N
Pterocarpus marsupium	32	1.1	E	N
Albizia odoratissima	30	1.0	D	Y
Dalbergia latifolia	26	0.9	D	Y
Dalbergia paniculata	23	0.8	D	Y
Pongamia pinnata	22	0.8	D	Y
Ougenia oojeinensis	22	0.8	D	Y
Erythrina indica	20	0.7	D	Y
Butea superba	17	0.6	D	Y
Careya arborea	16	0.5	D	Y
Lagerstroemia parviflora	14	0.5	D	Y
Dillenia pentagyna	13	0.4	D	Y
Bombax ceiba	12	0.4	D	Y
Soymida febrifuga	12	0.4	D	Y
Acacia leucophloea	11	0.4	D	Y
Syzigium cumini	11	0.4	E	N
Mitragyna parviflora	9	0.3	D	Y
Mitragyna parviflora	8	0.3	D	Y
Adina cordifolia	7	0.2	D	Y
Gardenia resinifera	6	0.2	D	Y
Limonia acidissima	5	0.2	D	N
Aegle marmelos	4	0.1	D	N
Madhuca longifolia	4	0.1	D	N
Schleichera oleosa	4	0.1	E	Y
Manilcora hexandra	2	0.1	D	N
Strychnos potatorum	2	0.1	D	Y
Grewia tilifolia	2	0.1	D	Y
Gmelina arborea	1	0.0	D	Y
Tectona grandis	1	0.0	D	Y

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सिरोंचा वन प्रभाग, मध्य भारत के शुष्क और आर्द्र पर्णपाती वन में इंडियन जाइन्ट *स्कवीरील रेटूफा इंडिका* के आबादी वितरण

प्रभु नाथ शुक्ला एवं विरेन्द्र कुमार मिश्रा

सारांश

सिरोंचा वन प्रभाग, महाराष्ट्र, भारत के आर्द्र पर्णपाती शुष्क पर्णपाती वन और आर्द्र सदाहरित वनों में इंडियन जाइन्ट *स्कवीरील* (आई जी एस), *रेटूफा इंडिका* आबादी के वितरण का अध्ययन किया गया। 256 एकलों के साथ प्रजाति द्वारा प्रयुक्त 1533 घोंसलों को मिलाकर आई जी एस के कुल 2803 घोंसले देखे गए। घोंसले समूहों में वितरित थे और इनमें से 39 प्रतिशत 5 समूहों में पाए गए। घोंसला घनत्व 0.5 और 42.7 वर्ग कि.मी. के बीच था। क्षेत्र में अभिलिखित 98 वृक्ष प्रजातियों में से इंडियन जाइन्ट स्क्वीरील ने घोंसला बनाने के लिए 49 प्रजातियों का उपयोग किया। आई जी एस ने करीब 71% अपने घोंसले नौ वृक्ष प्रजातियों पर बनाए। सबसे पंसदीदा वृक्ष प्रजाति थी *जाइलिया जाइलोकार्पा,* इसके बाद *टर्मिनेलिया अलाटा, एनोजिसस लेटिफोलिया* और *मधुका लांगिफोलिया* । पर्णपाती वृक्षों की तुलना में घोंसला निर्माण हेतु सदाहरित वृक्षों को पंसद किया गया। आँकड़े सुझाव देते हैं कि सघन छत्र और उच्च जैवविविधता वाले अच्छी गुणवत्ता के वन भी पर्याप्त मात्रा में इंडियन जाइन्ट स्क्वीरील आबादी से विहीन थे।

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