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Nesting Behaviour of the Baya Weaver Bird, *Ploceus philippinus* (Linnaeus) (Passeriformes: Ploceidae) in Rural Tamil Nadu, India

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ABSTRACT

This paper pertains to the nesting habits of *Ploceus philippinus*with specific reference to nesting-related habitats, populations, nest-supporting plants, nests, stages of development of nests and their orientation in rural Tamil Nadu. A total of 4273 nests (including complete and varying developmental stages of incomplete nests) and 4476 birds were observed on 270 plants belonging to 13 species, 13 genera, and 10 families. The highest number of nests (3550) and birds (3752) occurred on *Borassus flabellifer* Linnaeus (Arecaceae), followed by *Cocos nucifera* Linnaeus (Arecaceae) and *Phoenix sylvestris* (Linnaeus) Roxburgh (Arecaceae). *Ploceus philippinus* appeared to prefer building nests on the male trees of *B. flabellifer* in particular. When analyzing the proportions of potential nest-supporting trees with the total number of similar trees present within 200 m radius from the trees bearing nests in the study area, the preference pattern was *B. flabellifer*, followed by *C. nucifera,* and *P. sylvestris*. Among the various stages of nests observed on these plants, 30.5% nests were at complete nest stage, 30.06% were at the helmet stage, 18.74% at egg-chamber completed stage, 7.32% at wad stage, 5.1% at ring stage, and 2.24% were abnormal nests. The maximum number (88.6%) of nests was oriented towards east, *i.e.*, facing the rising sun. *Ploceus philippinus* preferred to colonize and build nests on plants which were located in proximity to power lines, roads, buildings, and human settlements.

Key Words: Abnormal Nests; *Borassus flabellifer*; *Cocos nucifera; Phoenix sylvestris*; Nest-building; Nest Orientation; Nest Types

INTRODUCTION

India ranks among the top 10 countries of the world in terms of most number of bird species (Lepage 2016). Among the several naturally occurring birds of India, *Ploceus philippinus* Linnaeus (Baya Weaver Bird) are social, gregarious, and polygamous, occurring throughout the Indian subcontinent (Ali and Ambedkar 1956). They are also known in Java and Sumatra (Wood 1926). *Ploceus philippinus* is an architectural genius**,** building intricate, pendant nests. An important behavioural reproductive decision of a bird is where to locate a nest (Cody 1985, Johnson 1994). In India, the breeding season of *P. philippinus* is from June to November (Rasmussen and Anderton 2005). In general, *P. phlippinus s*elect a variety of trees for nesting, but prefer the palms (Arecaceae). Tall, unbranched trunks and long-swaying foliage of palm trees keep away predators and provide convenient leaf strips for building nests (Davis 1974). Males usually build partial nests and complete them only after courting females (Ali et al. 1957). *Ploceus philippinus* prefer *Cocos nucifera* L. (Arecaceae) along the west coast of Indian peninsula, *Borassus flabellifer* L. (Arecaceae) along the east coast, and *Vachellia nilotica* (L.) P.J.H. Hunter and Mabberley (=*Acacia nilotica*, Fabaceae) in the arid north-west (Sharma 1989). These birds utilize well developed leaf tips of *Cycas sphaerica* Roxburgh (Cycadaceae) for nest construction and for raising their offspring (Raju 2009). However, Hosetti and Venkateswaralu (2001) indicate

that *P. philippinus* also builds nests on 30-odd plant species belonging to different families. According to Borges et al. (2012), 87% of nests remain oriented towards the east in Chorao Island, Goa. Wood (1926) indicates that nests in the Northern Province of Ceylon almost invariably hang exposed towards northerly and easterly directions so as to be the least affected by battering winds of the south-west monsoon. Nest-bearing trees usually occur close to a water source and agricultural fields (Wood 1926, Ali 2009, Kumar 2015). But the birds, which start breeding towards the end of monsoon times, tend to build nests in other directions in relation to the nest-bearing tree (Sharma 1990). Dense canopies of nest-bearing trees possibly provide safe sites from predators as well as weather-related problems (Sharma 1992). Nests are usually built as colonies, but isolated nests also have been observed occasionally (Pandey 1991). *Ploceus philippinus* uses fibres of *Dendrocalamus strictus (*Roxburgh) Nees (Poaceae) for construction of nests as those fibres possess excellent tensile strength. Fibres free of silicious deposits are preferred for the construction of egg-chamber to avoid discomfort to their chicks (Borges et al. 2002).

Ploceus philippinus is listed as a protected taxon in Schedule IV, Wildlife (Protection) Act 1972 of India. However, the IUCN Red List of Threatened Species (2016) classifies this species under organisms of least concern (Birdlife International 2016).

In this paper, we have sought answers to the questions considering populations of *P. philippinus*, their habitats, types of nest-supporting plants, types of nests, stages of nests, their orientations, and population dynamics of *P. philippinus* with specific reference to Tindivanam Taluk of Viluppuram district, Tamil Nadu (12° 23' N, 79° 65' E). The following objectives were considered: (1) the population status of *P. philippinus* and their preference of plants to build nests and (2) whether *P. philippinus* prefers to build nests on plants occurring in close proximity to areas of human activity and human dwellings.

Natural History

Males of *P. philippinus* construct nests using fibres torn from the green fronds of *B. flabellifer* and *Phoenix sylvestris* (L.) Roxburgh. Usually by mid-June each year, males of *P. philippinus* hover around these trees to select suitable sites for building nests. Using the terminals of foliage of either *B. flabellifera* or *P. sylvestris* or *C. nucifera*, they create a base for nests by knotting the loose fibres first, which constitutes the 'wad' stage (Figures 1a and 2). Normally this activity spreads over two days. Subsequently they build the central ring of the nest in the next five days, when the nest is described 'the ring stage' (Figure 1b). The basal portion of the ring is then built in such a way it separates into two chambers, when the nest is described 'the helmet stage' (Figure 1c), which is achieved in the next 8-10 days. When the female accepts the helmet stage, then the male works to close the egg chamber (Figure 1d), and completes building the entrance tube and renders the nest complete in the following three days (Figure 1e). Nests rejected by females may be torn down by the building male. Once a nest is in use, the building male may build a second, third or even fourth nest, raising many families almost simultaneously. Generally *P. philipinus* males avail 18 days to complete one nest. Besides normal nests, various types of abnormal nests are also built by these birds during breeding season (Figure 1f). The vertical section (Figure 3) provides internal architectural details of a normal nest. During nest construction, some males pick fibres clandestinely from neighbouring nests, when that nest builder is away. Some birds occasionally include wet-clay clumps along the inner sides of the nest chamber and the reasons for these inclusions are not clear presently. Even at the helmet stage of the nests, birds start including the clay along the inner wall of the nest. Males build even three nests at the same time on one tree and may attract females there. The female lays 2-4 white eggs and incubate them for 14 to 17 days (Ali et al. 1957). However Venkataramani (1981) and Sharma (1995) have observed two hard, pure white and stout structured eggs per nest. The matured chicks leave the nest after 17 days (Ali and Ripley 1999).

MATERIALS AND METHODS

Study Area

The present study was carried out in 52 villages in Tindivanam Taluk (11° 38' N to 12° 20' N and 78° 15' E to 79° 42' E), Viluppuram District, spread over 80 km^2, including a human population of *c*. 5,00,000. Agriculture is the primary occupation. The major crops of the area are *Oryza sativa* L., *Sorghum bicolor* (L.) Moench, *Pennisetum glaucum* (L.) R.Br., *Eleusine cora-cana* Gaertn, *Setaria italica* (L.) P.Beauv., *Saccharum officinarum* L. (Poaceae), *Vigna radiata* (L.) R.Wilczek and *Arachis hypogaea* L. (Fabaceae). Small-scale cultivation

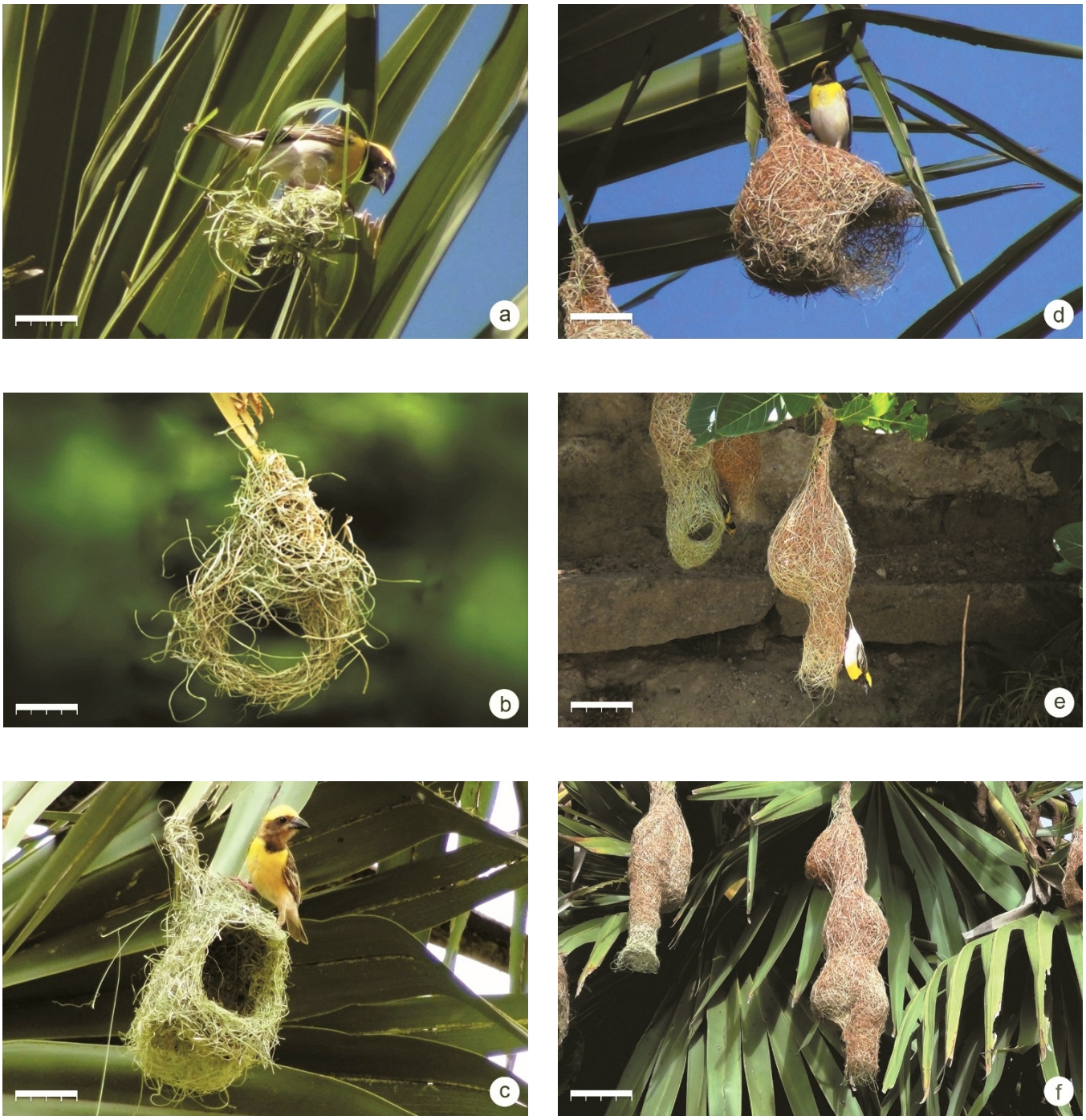

Figure 1. Images of various stages of nests of *Ploceus philippinus*. (a) wad stage (scale bar - 3.5 cm), (b) ring stage (scale bar - 2.8 cm), (c) helmet stage (scale bar - 7 cm), (d) egg-chamber closed stage (scale bar - 7.5 cm), (e) complete nest with entrance tube (scale bar - 10 cm), and (f) abnormal nest (Scale bar - 16.5 cm).

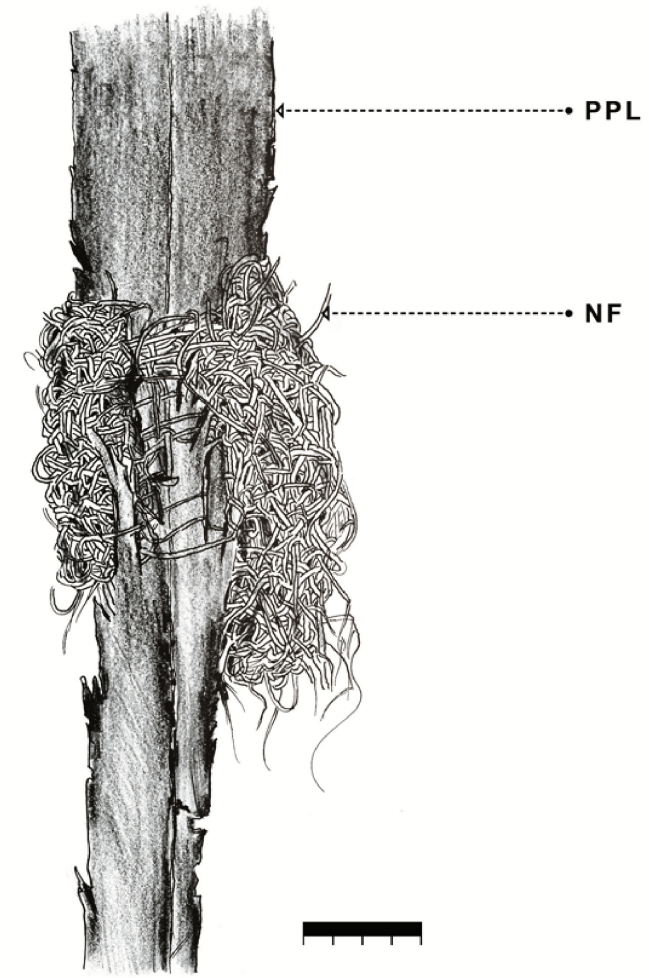

Figure 2. Early stage nest of *Ploceus philippinus* showing details of the intricate knotting pattern. PPL: palmyrah leaf, NF: nest fibre (scale bar - 0.5 cm)

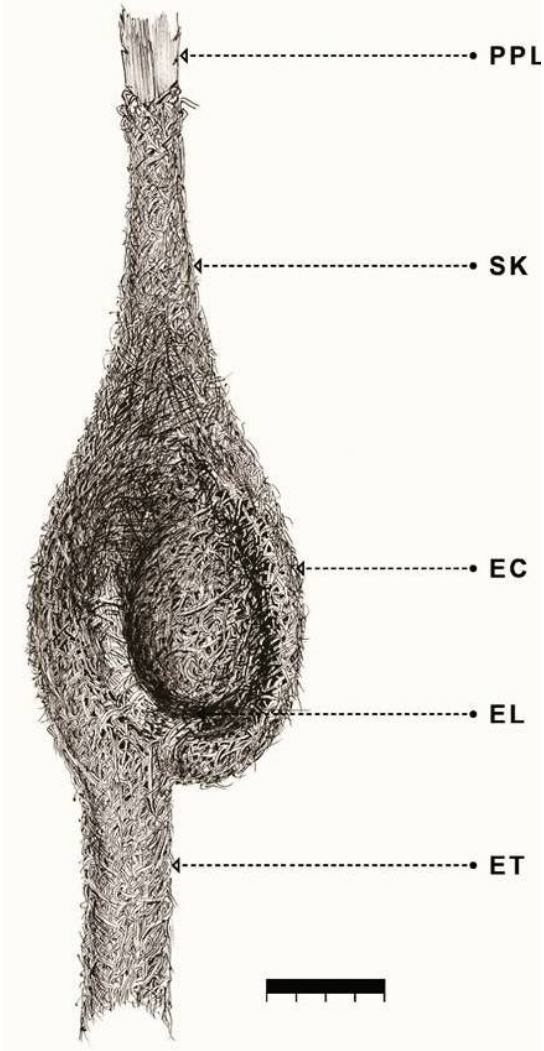

Figure 3. Longitudinal sectional view of the nest of *Ploceus philippinus*. PPL: Palmyrah palm leaf, SK: Nest stalk, EC: Egg-chamber, EL: Egg-chamber egg lining, ET: Entrance tube. (scale bar - 2.2 cm).

of ornamental flowers, vegetables, and fruits also occurs. The maximum and minimum temperatures of the district are 36 ºC and 20 ºC, respectively. The average annual rainfall in the district is 1060 mm (www.viluppuram.nic.in).

Populations of *P. Philippinus* and Their Preference of Plants to Build Nests

To inventorize the number of birds on each nest-supporting plant, the study areas were visited between 0600 and 1100 h and 1500 and 1800 h from 01 May to 31 July 2017 for 50 days with two-three days interval and every nest-supporting plant was observed uninterruptedly for 60 min, causing least disturbance to the inhabiting birds. The maximum number of birds perched at one time on nest-supporting plants during the inventorization was determined as the number of birds per plant. Locations of the inventorized 270 plants were determined using a standard GPS model Garmin Etrox 20x (2017) manufactured by Garmin Corporation, Taiwan. The orientations of the nests were determined using a 'Compass App' in a smart phone iPhone China Model A1530. Using a Super Zenith 20x50 field binoculars made in Japan, the nests, their developmental stages, the total number of birds visiting nest-supporting plants with nests were observed without disturbing nests and residents. Photographs and videographs were made

using Sony HDR-CX13 during the entire period. Nest-supporting plants were identified using Gamble (1918) and Nair and Henry (1989). One-way Analysis of Variance (ANOVA) was used to test for differences in means of variance between nests and birds with nest-supporting plants by using SPSS (Statistical Package for Social Sciences). Test of significance was assessed at p=0.05. Collected data were tabulated, analyzed and shown as graphical representations.

Measurement of Preference of *P. philippinus* in Building Nests on Plants

To study the preference of *P. philippinus* in selecting specific plants for nest building, the distance between nest-supporting plants and power lines, roads, buildings and human dwellings were measured using a 100 m measuring tape. The distance between nest-supporting plants, and nests and the above-listed factors were grouped under 01-50 m, 51-100 m, 101-150 m, 151-200 m, and >200 m distances. Incidence of nest-supporting plants, nests, and birds within 100 m distances from power lines, roads, buildings, human dwellings were considered especially.

To interact with farmers, shepherds, agricultural labourers, and other residents of villages**,** a questionnaire in Tamil language was used for acquiring details of each nest-supporting plant and for collecting details such as the number of nest-supporting trees, their types, locations, diameter at breast height (dbh), volumes of green and dry foliage on trees, numbers of nests, their developmental stages, the numbers of birds, and relative distance of nest-supporting plants from electric lines, road, building and human dwellings.

RESULTS

Populations of *P. philippinus* and Their Plant Preference to Build Nests

A total of 270 plants belonging to 13 species, 13 genera, and 10 families were observed bearing nests of *P. philippinus* of which the maximal nest-supporting plants were *B. flabellifer* (*n*= 205; 77.93%), *P. sylvestris* (*n*=30*;* 11.11%*),* and *C. nucifera* (*n*=12; 4.4%*).* A total of 4273 nests, both complete and incomplete and 4464 individuals of *P. philippinus* were observed on the 270 nest-supporting plants in 52 villages. The three primary nest-supporting tree species selected by these birds as nesting substratum were palms (Arecaceae), whereas a few trees belonging to the Dicotyledons were also found to be occasionally used. The nests on these plants were under various developmental stages, *viz*., wad stage - 7.32% (*n*=313), ring stage - 5.1% (*n*=218), helmet stage - 36.06% (n=1541), egg-chamber closed stage - 18.74% (*n*=801), complete nests - 30.5% (*n*=1304), and a small percentage of 2.24% were found to be abnormal nests (*n*=96). Most of the abnormal nests (89%, *n*=86) occurred on the male trees of *B. flabellifer* (Table 1). Of the total 4273 nests, 88.6% nests (*n*=3787) were oriented towards east facing the rising sun, while 9% (*n*=386) and 1.52% (*n*=65) of nests were oriented towards north and west, respectively. Only 0.74% nests (*n*=35) were found facing south on the nest- supporting plants.

Of the total *B. flabellifer* trees (8684) occurring within of 200 m radius from such nest-bearing trees, *P. philippinus* populations preferred 137 out of 3444 *B. flabellifer* male trees (3.97%), 68 out of 5240 *B. flabellifer* female trees (1.29%), 12 out of 1003 *C. nucifera* (1.19%), and 30 out of 7106 *P.* sylvestris (0.42%) for building nests (Table 2). Out of 205 *B. flabellifer* trees bearing nests, 66.8% (*n*=137) were male and 33.2% (*n*=68) were female trees. We found that 73.4% nests (*n*=2607) and 72.5% birds (*n*=2721) were living on male trees and 26.6% nests (*n*=943) and 27.5% birds (*n*=1031) were on female trees.

Analysis of variance (ANOVA) was applied to test differences among the three principal nest-supporting palms, *B. flabellifer, C. nucifera*, and *P. sylvestris* and various stages of nests on these trees. Since the other nest-supporting plants were numerically few, they were ignored. A significant difference among the three principal nest-supporting trees with respect to the number of nests of egg-chamber closed stage ($p<0.006$) and complete nests ($p<0.011$) existed (Table 3), but the remaining stages of nests, such as the wad stage, ring stage, helmet stage and abnormal nests showed no significant differences. No significant differences occurred among the height, dbh, numbers of green and dried foliage of nest-supporting trees on one hand and the number of nests and birds on the other. When ANOVA test was used to determine the differences between the total number of nests (including all stages of nests) and birds observed on the three principal nest-supporting trees, significant differences existed among the number of nests ($p<0.045$), birds ($p<0.037$) at 5% ($p<0.05$) level of significance (Table 4).

Table 1. *Ploceus philippinus* nest-supporting plants, developmental stages of nests, and orientation of populations observed in Viluppuram, Tamil Nadu

Nest-supporting plants	Total no. of plants	Total no. of nests observed	Total no. of birds observed	Stages of nests						Orientation of nests			
				Wad	Ring	Helmet	Egg chamber Closed	Complete	Abnormal	East	West	North	South
Borassus flabellifer	205	3550	3752	255	147	1242	709	1111	86	3097	61	361	31
Phoenix sylvestris	30	292	267	37	34	154	22	44	1	280	1	9	2
Cocos nucifera	12	229	236	9	10	86	38	86	0	219	0	10	0
Ficus benghalensis	1	11	4	0	1	2	1	5	2	11	0	0	0
Securinega leucopyrus	3	10	9	1	6	3	0	0	0	7	3	0	0
Phyllanthus reticulatus	4	38	38	2	3	9	8	15	1	33	0	4	1
Cissampelos pareira	3	53	59	3	6	15	10	17	2	53	0	0	0
Morinda tinctoria	6	30	33	3	2	13	4	5	3	27	0	2	1
Pithecolobium dulce	2	15	16	1	1	9	3	1	0	15	0	0	0
Ruellia prostrata	1	1	1	0	0	0	1	0	0	1	0	0	0
Azadirachta indica	1	2	2	0	0	2	0	0	0	2	0	0	0
Prosopis juliflora	1	35	44	2	1	6	5	20	1	35	0	0	0
Casuarina equisetifolia	1	7	15	0	7	0	0	0	0	7	0	0	0
Total	**270**	**4273**	**4476**	**313**	**218**	**1541**	**801**	**1304**	**96**	**3787**	**65**	**386**	**35**

Table 2. Proportions of potential nest-supporting trees used by *Ploceus philippinus* for building nests

Potential nest-supporting trees	Total number of trees used by birds to built nests	Total number of similar trees existing within 200 m radius	Percentage of trees used by *P. philippinus* for building nests
Borassus flabellifer (Male)	137	3444	3.97
Borassus flabellifer (Female)	68	5240	1.29
Phoenix sylvestris	30	7106	0.42
Cocos nucifera	12	1003	1.19

Preference of *P. philippinus* in Building Nests on Plants Occurring Close to Human Dwellings

The study also tested the relationship between proximity of power lines, roads, buildings, human settlements, type of crops and selection of nest-supporting plants by *P. philippinus* populations. Ninety-three percent of nest-supporting plants (*n*=252), 95% of nests (*n*=4055), and 96% of birds (*n*=4305) occurred within 100 m radius from power lines (Figure 4). Eighty-six percent of nest-supporting plants (*n*=232), 87% nests (*n*=3736), and 88% birds (*n*=3916) occurred within 100 m radius from constructed areas such as human dwellings, cattle sheds, and motor-pump sheds in crop fields (Figure 5). Sixty-four percent of nest-supporting plants (*n*=174), 66% nests (*n*=2817) and 66% birds (*n*=2959) occurred within 100 m distance from roads (Figure 6). The birds select apparently those trees adjacent to roads with busy vehicular traffic and railway tracks to build nests. Thirty-seven percent of nest-supporting plants (*n*=100), 43% nests (*n*=1845) and 44% birds (*n*=1947) occurred within 100 m distance from human settlements and the birds even built nests on trees occurring in the human settlements (Figure 7). Forty percent of nest-supporting plants (*n*=107), 40% nests (*n*=1697) and 39% birds (*n*=1757) were in *Casuarina equisetifolia* Linnaeus plantations. Thirty-two percent nest-supporting plants (*n*=87), 32% nests (*n*=1378), and 34% birds (*n*=1503) occurred adjacent to rice fields, followed by sugarcane and pulses crop fields in providing habitat to *P. philippinus* populations (Figure 8).

Table 3. Parametric ANOVA for the variations exist among the various stages of nests borne by *B. flabellifer, P. sylvestris* and *C. nucifera*

Stages of nests	Nest-supporting trees	N	Mean ± SE	F value	P value
Wad stage	*Borassus flabellifer*	205	1.24 ± 0.14	0.353	0.703
	Cocos nucifera	12	0.75 ± 0.494		
	Phoenix sylvestris	30	1.23 ± 0.355		
	Total	247	1.22 ± 0.126		
Ring stage	*Borassus flabellifer*	205	0.72 ± 0.078	1.775	0.172
	Cocos nucifera	12	0.83 ± 0.297		
	Phoenix sylvestris	30	1.13 ± 0.243		
	Total	247	0.77 ± 0.072		
Helmet stage	*Borassus flabellifer*	205	6.06 ± 0.363	0.725	0.485
	Cocos nucifera	12	7.17 ± 2.029		
	Phoenix sylvestris	30	5.13 ± 0.837		
	Total	247	6.0 ± 0.332		
Egg-chamber closed stage	*Borassus flabellifer*	205	3.46 ± 0.322	5.244	0.006*
	Cocos nucifera	12	3.17 ± 1.014		
	Phoenix sylvestris	30	0.73 ± 0.239		
	Total	247	3.11 ± 0.279		
Complete nests	*Borassus flabellifer*	205	5.42 ± 0.511	4.639	0.011*
	Cocos nucifera	12	7.17 ± 2.785		
	Phoenix sylvestris	30	1.47 ± 0.626		
	Total	247	5.02 ± 0.458		
Abnormal nests	*Borassus flabellifer*	205	0.42 ± 0.089	2.016	0.135
	Cocos nucifera	12	0 ± 0		
	Phoenix sylvestris	30	0.03 ± 0.033		
	Total	247	0.35 ± 0.074		

*significant at 5% (P<0.05)

DISCUSSION

Populations of *P. philippinus*, Their Preference of Plants to Build Nests and Their Orientation

Of the total nests (*n*=4273), the 'egg-chamber closed' and 'complete' nest stages constitute nearly 50% (*n*=2105) and the remaining stages of nests *viz*., wad, ring, helmet and abnormal, constitute the remainder (*n*=2168) explaining that breeding activities of *P. philippinus* populations had commenced in the 'egg-chamber closed' and 'complete' nests. *Ploceus philippinus* uses *B. flabellifer* extensively in the eastern parts of the peninsular India (Sharma 1989), whereas Davis (1974) indicates that more than 60% of *P. philippinus* nests occur on both *B. flabellier* and *C. nucifera.* In the present study, we found that *P. philippinus* prefer *B. flabellifer* (75.9%; *n*=205) in the study area, since 83% of nests (*n*=3350) occurred on them. *Ploceus philippinus* also prefers the male trees of *B. flabellifer* for building nests. Out of 205 *P. phillippinus*'s nest-bearing *B. flabellifer* trees, 66.8% were male trees (*n*=137) and 33.2% were female trees (*n*=68). Why such a preference occurs will be verified in future investigations.

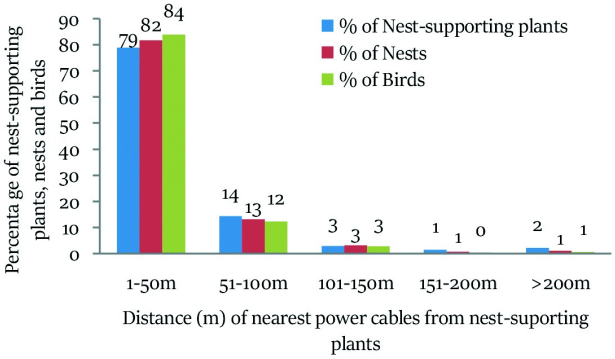

Figure 4. Relationship between the distance of nearest power cables and nest-supporting plants, nests and birds.

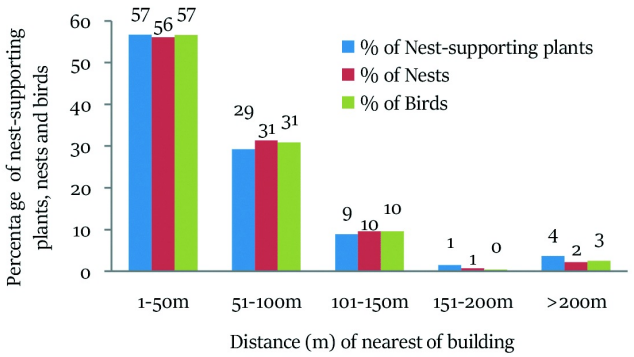

Figure 5. Relationship between the distance of nearest building and the number of nest-supporting plans, nests and birds.

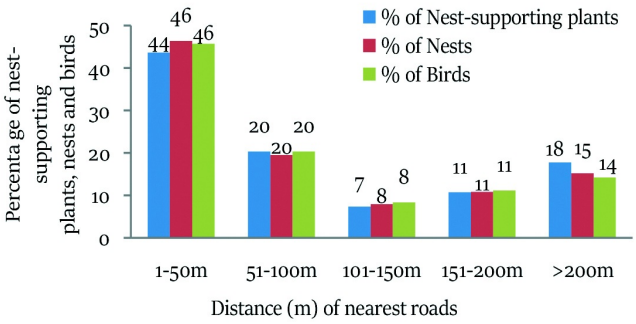

Figure 7. Relationship between the nearest human settlements and the nest-supporting plants, nests and birds.

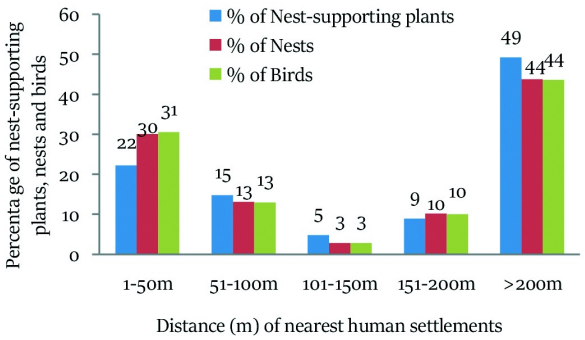

Figure 6. Relationship between the nearest roads and the nest-supporting plants, nests and birds.

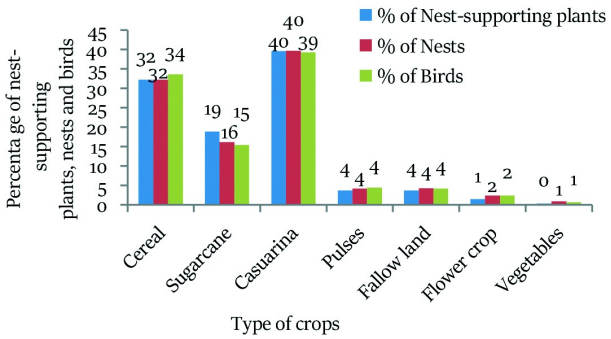

Figure 8. Relationship between type of crops and nest-supporting plants, nests and birds.

Table 4. ANOVA for variations in the total number of nests and birds borne by potential nest-supporting trees *Borassus flabellifer, Phoenix sylvestris* and *Cocos nucifera*

Variables	Potential nest-supporting trees	N	S	SE	F value	P value
Total number of nests	*Borassus flabellifer*	205	17.12	1.208	2.868	0.045*
	Cocos nucifera	12	19.08	5.728		
	Phoenix sylvestris	30	9.73	8.839		
	Total	247	16.48	1.068		
Total number of birds	*Borassus flabellifer*	205	18.30	1.376	3.345	0.037*
	Cocos nucifera	12	19.67	6.332		
	Phoenix sylvestris	30	8.90	1.214		
	Total	247	17.23	1.214		

*significant at 5% (P<0.05)

Orientation of Nests

Of a total 4273 nests, 88.6% (n=3787) were oriented towards the east, while only 9% (*n*=386), 1.52% (*n*=65), 0.74% (n=35) of nests were oriented towards the northerly, westerly, and southerly directions, respectively. Orientation of *P. philippinus* nests towards east has also been reported by Borges et al. (2012) in Chorao Island, Goa. One correlation found in the present study was between the orientation of nests and types of crops

cultivated: 60.5% nests occur within the areas where vegetables and fruits are cultivated, 13% nests in *Casuarina equisetifolia* plantations, 11.6% nests in pulse fields, and 9.9% nests in cereal fields, 7.6% nests in flower beds, and 3.3% nests in sugarcane farms were facing towards other directions than east. Similarly**,** the type of crops cultivated around the nest-supporting plants have some impact on the determination on the orientation of nests by birds. Particularly the impact of *Casuarina equisetifolia* plantations, pulse and cereal crops on the orientation of nests on plants needs further study.

As a social bird, *P. philippinus* generally prefers to live near human dwellings and agricultural areas with significant human activity. For example, Ali (2009) found that *P. philippinus* populations used electricity lines as fetching site for collection of food and nesting materials. The present study matches with his findings that 93% of nest-supporting plants occur at <100 m distance from the power lines located within crop fields. These birds appear to select plants in close proximity to power lines that passed through crop fields and used the same as fetching and roosting sites while foraging, collection of materials for building nests and feeding broods. Electricity lines are also used as nest-support sites.

Forty pe cent of nest-supporting plants, 40% nests, and 39% birds were found in *Casuarina* plantations. Cereal, sugarcane, and pulses crops occupy next place in providing habitats to these birds. The crop patterns seem to bear an effect on the population of *P. philippinus*. *Ploceus philippinius* depend primarily on cereal crops for food, close to 40% (*n*=1757) built nests on plants occurring within *Casuarina* plantations, although they neither use *Casuarina* as nesting substratum nor use any parts of it as nesting materials. Since the occurrence is significant (40%), it could form material for another study.

CONCLUSION

Nest-supporting plants, nests and populations of *P. philippinus* in 52 villages in rural Tindivanam Taluk in Viluppuram District were studied, and a total of 270 nest-supporting plants belonging to 13 species, 13 genera and 10 families were identified, of which three species belonged to Monocotyledons and the remaining 10 species belonged to Dicotyledons. 4273 nests of various developmental stages and 4476 birds were observed on these 270 nest supporting plants. *Ploceus philippinus* populations preferred *B. flabellifer* male trees for building nests and breeding activities than female trees. Of a total 4273 nests, 88.6% (n=3787) were oriented towards the east, while only 9% (*n*=386), 1.52% (*n*=65), 0.74% (n=35) of nests were oriented towards the north, west and south directions, respectively. The rural areas of Tindivanam Taluk remains a potential breeding ground for *P. philippinus* populations and their habitats need protection.

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