ECOLOGY OF BABBLERS (*TURDOIDES* SPP.)[1]

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(*With three text-figures*)

INTRODUCTION

The babblers of the genus *Turdoides* have a wide distribution in India. The Whiteheaded Babbler (*Turdoides affinis*) and the Jungle Babbler (*T. striatus*) occur sympatrically in many parts of South India. Both live in flocks and their ecological requirements overlap in many areas. There are a few informative publications on the ecology of babblers of the genus *Turdoides* (Zahavi 1974, Gaston 1976, 1977). From June, 1974 to September, 1977 one of us (VJZ) had an opportunity to carry out a comparative study of the ecology of *T. affinis* and *T. striatus* in Calicut, S. India. DNM worked on the food and moult of the Jungle Babbler from 1975 to 1977 in the same locality.

Study area:

This study was centred at the Calicut University campus 10° 30′-45′ N, 75° 40′-50′ E and in area of 2.27 km^2. A considerable part of the area consists of open secondary scrub jungle and stretches of laterite sparsely covered with grass, intermixed with a few groves of coconut and cashew. The terrain is undulating and the elevation *c.* 80 m. The area of collection, Chelannur, Calicut, was more urbanized but with the same climate and type of layout of crops. The elevation at Chelannur varies from sea level to about 100 m.

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Climate:

The study area is hot and humid. The warm season from March to May is followed by the southwest monsoon from June to September. It may continue to rain in October and November but rains cease after December. During south-west monsoon rainfall is heavy and amounts to more than half of the total rainfall (Table 1).

Vegetation:

The flora is tropical but tree species are few. Plant formations varied from low scrub dominated by *Calycopteris floribunda* to closed canopy woodland comprising *Macaranga peltata* and *Anacardium occidentale*. *Lantana camara* forms thickets in areas where the soil is more moist. The centre of the University campus is more or less open with stretches of grass. In the low lying peripheral areas there is less of laterite and the top soil is deeper. Isolated patches of canopy woodlands are common here.

The southern part of the campus is more densely populated and has a few gardens of crops like banana and cassava. Some of them serve as food for the babblers, and all harboured caterpillars and other small animals preyed upon by the birds. Chelannur area is intensively cultivated with crops like paddy, cassava, coconut, mango, cashew, cowpea, snakegourd, bittergourd, yam etc. The secondary scrub jungles are fewer except for the many sacred groves.

TABLE 1

MONTHLY TOTALS OF RAINFALL RECORDS AT THE CALICUT STATION OF THE METEOROLOGICAL DEPARTMENT

Months	1973	1974	1975	1976	1977
January	000.0	000.0	000.0	000.0	000.0
February	000.0	000.0	005.3	Terace	000.5
March	000.0	08.6	073.4	015.6	002.4
April	62.6	81.6	106.6	134.0	103.4
May	82.8	255.3	149.7	050.1	249.4
June	744.6	305.1	1299.3	209.9	723.0
July	585.1	1700.0	578.8	760.0	998.9
August	501.3	496.8	773.2	254.5	251.1
September	25.2	639.6	648.4	086.2	83.7
October	132.0	61.2	295.2	297.7	439.0
November	73.2	15.8	157.0	335.4	380.6
December	14.8	000.0	012.8	007.5	000.0

METHODS

The babblers were observed using 8 × 30 binoculars. Individual groups were followed for periods from 2-8 hours. For studies of food and moult, specimens of *T. affinis* and *T. striatus* were collected between 1975 and 1977, mostly from Chelannur. Stomachs were preserved in 4% formalin and the contents identified. Insect abundance in the study area was sampled by sweep netting twice a month throughout the year and the number of invertebrates counted.

RESULTS

Turdoides affinis (*c.* 63 g) moves in groups of 3-14 birds in the study area. It forages from dawn to dusk in open fields, grassy hillocks and gardens, progressing slowly by hopping and gliding. It is a poor flier but hops about vigorously on the ground in search of food. *T. striatus* (*c.* 74 g) also occurs sympatrically but in the more sheltered areas full of thickets of lantana. Foraging flocks of both species turn over dead leaves, explore the clumps of grasses, holes on the ground and the crevices on the trunks of trees. The habitat of these babblers in the University campus can be divided into four types.

1) Highly modified areas around human habitation which are systematically watered and cultivated.
2) Open grass-covered hillocks and scrub jungle with a few trees.
3) Closed canopy woodlands 10-12 m. mostly *Macaranga peltata* and *Bambusa arundinacea* with a fairly good undergrowth.
4) Woodland with sparse or no undergrowth, constantly disturbed by removal of vegetation for manuring.

Turdoides affinis occurs in the first, second and fourth types and *T. striatus* in the first, third and fourth types of habitat. The former is usually absent in canopy woodlands and the latter in the open grass-covered hillocks (Fig. 1). Chelannur had very few subhabitats of type 3. Both species of babblers were seen in types 1, 3 and 4 but the Jungle Babbler moved about in shady areas with thickets of lantana or trees like *Macaranga* to seek shelter in.

Though there are differences in colour, size

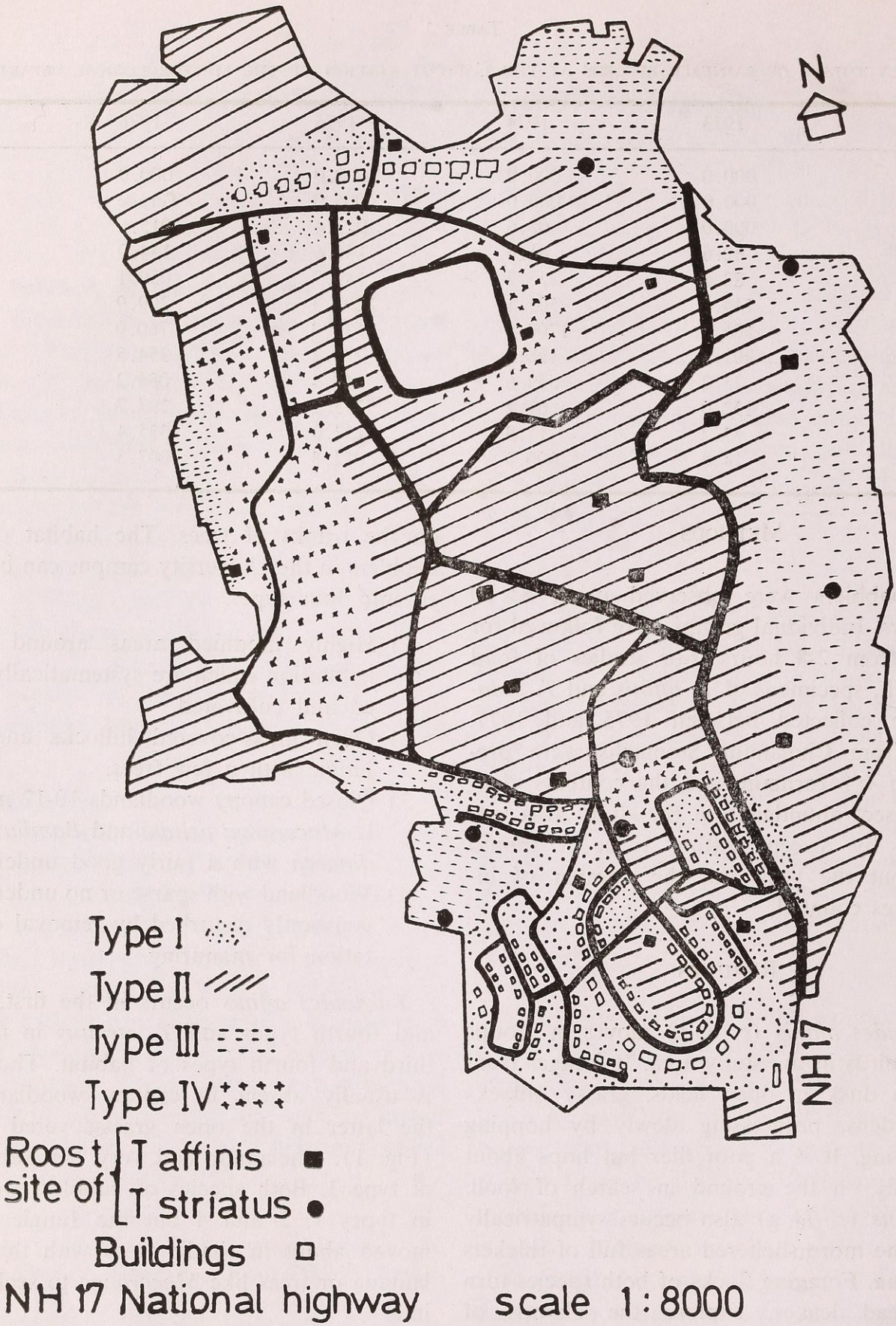

Fig. 1. Distribution of the two species of Babblers in the four types of habitats in the Calicut University Campus.

and calls, some of the behavioural patterns of these babblers are very similar. Interesting differences were noticed in their ecological requirements. The sentinel system occurs in both species. The jungle babbler sentinel perched higher than its congener. The Jungle Babblers perched on much higher branches for roosting (Table 2). Many species of trees are

TABLE 2

HEIGHT OF ROOSTING PERCHES IN BABBLERS

Height (m)	*T. affinis*		*T. striatus*	
	Frequency	Percentage	Frequency	Percentage
2-4	16	55.1	5	29.4
4-6	9	31	8	47.5
6 and above	4	13.8	4	23.5
Total	29		17	

shared by groups of both for roosting. The home range of a group of *T. affinis* varied from 5.7 to 9.3 hectares and that of *T. striatus* from 6.3 to 8.9 hectares. Each group had a strongly defended core area inside the home range in which the group roosted and nested. The border areas of two or more groups and of the two species often overlapped. Throughout the period of study the area of the territory maintained by each group remained more or less the same; though some changes occurred in three groups due to the destruction of vegetation and development of a new park in the University campus.

FOOD AND FEEDING HABITS

The Whiteheaded Babblers are omnivorous. Their food includes many insects. They spend considerable time searching for food in the open grasslands, scrub jungles, paddy fields, in the compounds of houses, orchards, and gardens. They consume a good quantity of plant food like seeds of *Lantana, Zizyphus,* and *Macaranga,* tubers of cassava and kitchen scraps. Their animal food included insects such as beetles, grasshoppers, caterpillars, termites, bugs, spiders and lizards. Large caterpillars were pinned by the feet and torn to bits before eating, and smaller ones were wedged between the tips of the bill and pulled into the mouth gradually.

The Whiteheaded Babblers probe the holes on the trunks of trees and among the leaf bases of banana and coconut palms in search of food. The leaves of twiners attached to trees like cashew are explored for caterpillars. Time and again they flick dead leaves in search of prey. They dig around the roots of grasses and probe holes on the ground. They forage on trees up to a height of 10 m. flitting from branch to branch. The caterpillars clinging to leaves are sometimes taken by tearing a bit of the leaf along with the prey. The Whiteheaded Babblers usually do not go to the top of taller trees for foraging. The foraging methods of the two species of babblers can be classified into the following categories: (Andrle & Andrle 1976).

1) *Stationary plucking*: The birds hover over bunches of fruits and pluck them.
2) *Inverted feeding*: The birds hang upside down from the leaves to catch caterpillars.
3) *Peering*: The birds twist their heads to one side and peer under leaves from perches in search of caterpillars.
4) *Springing up vertically*: This method is used on trees as well as on the ground. On the trees the birds spring vertically to pluck the overhanging fruits like those of *Macaranga.* On the ground they spring up to catch winged termites and other insects.

5) *Aerial feeding*: Very rarely *T. affinis* jumps into the air from its perch to catch flying insects.
6) *Probing*: The birds insert their bills into curled-up leaves, gaps in the bark and holes on the trunks of trees.
7) *Hopping and gliding*: This is the most common method used close to the ground to catch grasshoppers and crickets.
8) *Lifting of dead leaves*: Birds lift dead leaves on the ground with their bills. The dead leaves are flicked to one side or the other.

Aerial feeding is not used by *T. striatus*. It does not spring up vertically. The methods of foraging are compared in Table 3.

TABLE 3

FORAGING METHODS OF BABBLERS

Methods	*T. affinis*	*T. striatus*
Stationary plucking	22	14
Inverted feeding	30	3
Peering	18	6
Springing vertically	24	2
Aerial feeding	8	—
Probing into curled-up leaves on trees	18	4
Hopping and gliding	40	31
Digging and probing into holes on ground	32	22
Flicking of dead leaves on ground	42	44
Total observations	234	126

Sampling of insect abundance in the field showed that all invertebrates were numerous during and after the rains (Fig. 2). The steep increase in June is related to the number of caterpillars which feed on the leaves. Crops such as cassava, paddy and peas are cultivated at the onset of rains and harvested towards the end of the year. Observations in the field and study of the stomach contents showed a

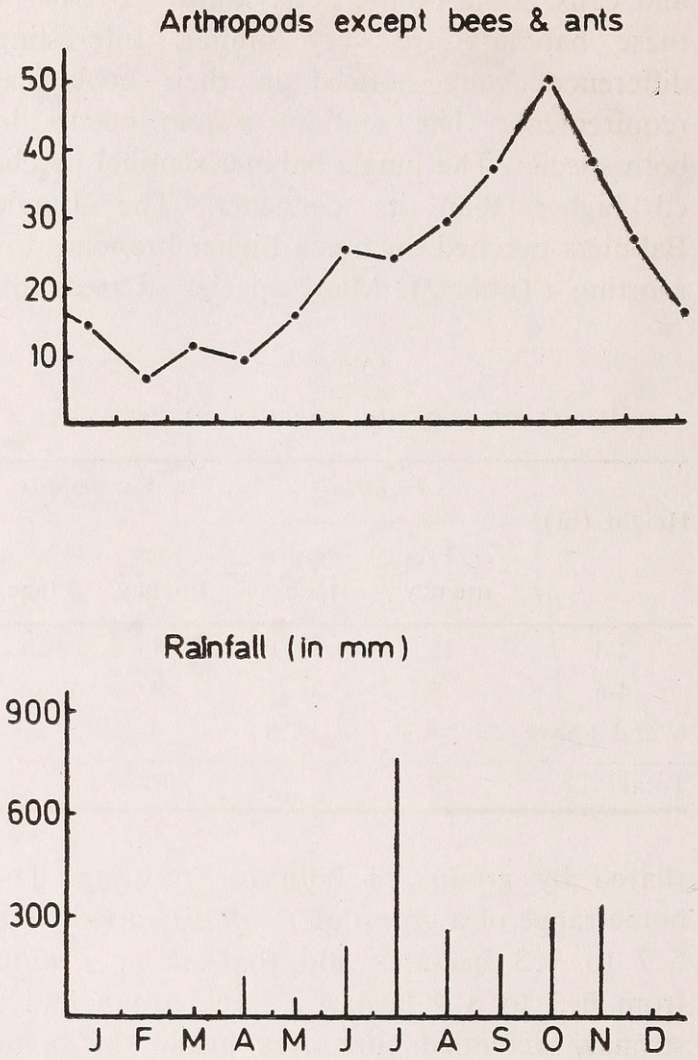

Fig. 2. Monthly abundance of some arthropods and rainfall in the study area.

direct relationship between the feeding behaviour observed in the field and the quality of food taken. Monthwise studies of the stomach contents of *T. affinis* and *T. striatus* are shown in Tables 4 & 5. Grasshoppers were the most frequent items of food from September to November along with caterpillars. Termites were consumed in large quantities from March to June. Fruits of *Macaranga* were eaten from March to May. Since a large portion of the study area is irrigated, grasshoppers are available in varying quantities throughout the year.

Generally the insects which were available in good numbers in the area of collection

TABLE 4

ANALYSIS OF STOMACH CONTENTS OF *T. affinis* IN VARIOUS MONTHS, 1975-1977

Item	Frequency of each item in a month's sample											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Orthoptera	5	3	2	2	6	5	8	13	12	9	9	8
Dermaptera	–	–	–	–	–	–	–	1	–	–	–	–
Isoptera	11	11	14	13	13	14	9	12	12	15	10	7
Heteroptera	1	–	1	–	2	8	5	7	2	2	3	5
Coleoptera	9	6	9	7	10	10	14	17	18	16	15	11
Hymenoptera	14	9	9	7	9	10	7	11	11	11	13	11
Lepidoptera	2	1	2	–	–	1	2	1	1	4	7	3
Diptera	–	1	–	–	–	–	–	–	–	1	–	–
Myriapoda	–	–	–	–	–	–	–	1	–	1	–	1
Arachnida	1	2	–	–	–	1	2	1	4	4	2	5
Mollusca	–	2	–	1	1	–	–	1	–	–	–	–
Vertebrates (bones)	–	–	–	–	–	–	–	–	1	1	–	1
Seeds & fruits												
Zizyphus jujuba	1	–	–	–	–	–	–	–	–	–	–	–
Leguminosae	–	–	–	–	–	–	–	1	1	–	–	–
Passiflora foetida	–	–	–	–	–	1	–	3	4	4	2	–
Ixora coccinea	1	–	–	–	–	–	–	–	–	–	–	2
Physalis minima	2	–	–	–	–	–	1	3	–	1	–	–
Lantana camara	–	1	1	–	1	1	1	1	3	4	3	6
Macaranga indica	–	–	9	12	–	–	–	–	–	–	–	–
Cassava starch	3	7	6	5	6	6	4	5	8	7	4	3
Oryza sp. (grains)	6	7	3	–	–	–	–	–	1	–	–	–
Graminae	–	1	–	–	–	1	1	2	–	–	–	–
Other seeds & Plant fibres	1	2	1	–	5	3	–	1	1	1	–	1
Total number of specimens examined	14	12	15	13	13	15	15	18	19	17	16	16

during a particular month were the most numerous item of food in the stomach contents for that month. Whiteheaded Babblers tore their prey to small pieces before swallowing it and it was therefore difficult to separate many of the items of food found in their stomach. The Jungle Babbler is slightly larger than its congener and with a larger bill (Table 6) and took slightly larger prey also. Observations in the field and study of the stomach contents both support this view. Although only a few insects were identified up to family level in our sample, the variety of insects consumed appeared to be greater in *T. striatus* (Table 8). The samples also suggested that more individuals of *T. affinis* had consumed termites, bugs and hymenopterans (Table 7) whereas more *T. striatus* had consumed coleopterans. The members of more families of beetles in the stomach contents of *T. affinis* from Cuddapah district, Andhra Pradesh and Palghat District, Kerala. The fruits of *Lantana, Passiflora* and *Macaranga* are eaten by both *T. affinis* and *T. striatus.*

Though there is a clear overlap in the items of food of the two species of babblers, they

TABLE 5

ANALYSIS OF STOMACH CONTENTS OF *T. striatus* IN VARIOUS MONTHS, 1975-1977

Item	Frequency of each item in a month's sample											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Orthoptera	3	7	2	6	1	10	12	6	18	13	10	8
Isoptera	14	17	16	19	11	17	13	11	7	9	10	8
Heteroptera	4	–	–	4	1	4	2	2	3	1	–	2
Coleoptera	16	14	13	18	11	20	16	19	21	17	16	15
Lepidoptera	–	–	1	1	–	4	–	–	5	3	1	2
Diptera	–	–	–	1	–	–	–	–	1	–	1	–
Hymenoptera	11	7	8	7	8	13	10	14	13	16	11	8
Myriapoda	1	–	–	–	–	–	–	–	–	–	1	1
Arachnida	–	–	–	–	1	–	5	1	–	1	3	3
Mollusca	1	1	–	–	–	–	–	–	–	–	–	–
Vertebrates (Bones)	–	–	–	–	–	–	–	–	1	–	–	–
Seeds & fruits												
Zizyphus jujuba	3	–	–	–	–	–	–	–	–	–	–	–
Laguminosae	2	1	–	–	–	–	–	–	1	1	1	–
Passiflora foetida	–	–	–	–	–	1	–	–	–	–	–	–
Ixora coccinea	–	1	2	1	1	–	–	–	–	–	–	–
Physalis minima	–	–	–	–	–	–	1	2	1	1	–	–
Lantana camara	–	–	–	3	1	1	2	6	5	2	2	–
Macaranga indica	–	–	11	15	–	–	–	–	–	–	–	–
Cassava starch	10	12	3	2	4	9	11	11	10	9	11	5
Oryza sp.	8	9	5	–	2	–	–	–	2	–	2	2
Plant parts	–	1	–	2	–	2	1	2	1	4	1	–
Total number of species examined	16	17	16	22	13	21	17	19	24	17	17	15

TABLE 6

*WEIGHTS AND MEASUREMENTS OF THE TWO SPECIES OF BABBLERS

	T. affinis		*T. striatus*	
Weight (in g)	63.3	(52–70)	74.3	(60–87)
Length (in cm)	22.9	(21–23.5)	24.5	(23.8–25.2)
Wing (in mm)	104	(96–108)	106	(104–108)
Tail (in mm)	98	(95–105)	103	(98–108)
Tarsus (in mm)	35	(32–37)	38	(36–39)
Bill (in mm)	24	(19–24)	28	(22–28)
Total number of specimens	30		15	

* Mean

TABLE 7

INSECTS IDENTIFIED IN STOMACH CONTENTS OF *T. affinis*

Item	Frequency	Percentage*	Remarks
Orthoptera	82	44.8	Acrididae 6, Tettigonidae 5, Mantis 1, Blattidae 1, Cockroaches 10.
Dermaptera	1	0.47	Forficulid.
Isoptera	148	80.8	Termites.
Heteroptera	36	19.7	Fulgoridae 1.
Coleoptera	142	77.6	Carabidae 1, Buprestidae 1, Coccinellidae 3, Tenebrionidae 1, Scarabidae 2, Chrysomelidae 4, Cürculionidae 11.
Hymenoptera	122	66.6	Ichneumonidae 6, Chalcididae 5, Chrysididae (cuckoo wasp) 3. Specoidae 1, Formicidae; *Oecophylla* sp. 37, *Camponotus* 80, *Solenopsis* 2.
Lepidoptera	24	13.1	Geometridae 1, Sphingidae 2.
Diptera	2	1.1	
Total number of specimen examined	183		

* Percentage of the number of specimens which had consumed the item of food.

TABLE 8

INSECTS IDENTIFIED IN THE STOMACH CONTENTS OF *T. striatus*

Item	Frequency	Percentage*	Remarks
Orthoptera	96	44.9	Acrididae 3, Tettigonidae 3, Gryllidae 2, Mantidae: Mantis sp. 4, Phasmidae: Stick insect 2, Blattidae: Cockroaches 18.
Isoptera	152	71	Termites
Heteroptera	23	10.8	Reduviidae 2, Pentatomidae 3, Fulgoridae 1.
Coleoptera	196	91.6	Carabidae 3, Histeridae 1, Buprestidae 3, Cucujidae 2, Coccinellidae 3, Molandridae 1, Tenobrionidae 1, Bostrichidae 1, Scarabidae 14, Melolonthidae 1, Chrysomelidae 4, Curculionidae 19.
Hymenoptera	126	58.8	Ichneumonidae 2, Chalcididae 3, Chrysididae (Cuckoo wasp) 13, Formicidae 18, *Oecophylla* sp. 33. *Camponotus* sp. 84.
Lepidoptera	17	7.9	Geometridae 2.
Diptera	3	1.4	—
Total number of specimens examined	214		

* Percentage of the number of specimens which had consumed the item of food.

appear to adjust with each other and to co-exist due to the differences in their feeding behaviour and microhabitat.

Breeding biology

In the study area both *T. affinis* and *T. striatus* breed throughout the year. Ali (1969) reported *T. affinis* to be irregular in breeding. In our study area active nests of *T. affinis* were found during all the months of the year with two peak periods, April and September (Fig. 3). In *T. striatus* which is also an irregular breeder (Ali 1969), there are records of egg laying in all months except June and November. In both species no egg laying was observed in July, the month of heaviest rainfall. Eighty two nests of *T. affinis* and 23 of *T. striatus* were studied.

Nest construction:

The breeding pair is assisted by helpers in *T. affinis* and *T. striatus* for building the nest. First year birds, second year and nonbreeding adults acted as helpers in building the nest.

Nests were built on isolated plants and trees in the scrub jungles, and gardens. Trees like *Anacardium occidentale, Mangifera indica, Strychnos nux-vomica, Artocarpus integrifolia and Cocos nucifera* and bushes such as *Calycopteris floribunda, Memecylon edule* and *Eupatorium odoratum* were used by *T. affinis* for nesting. Garden plants such as *Casuarina* and *Tecoma* were frequently used. In two cases the roofing of a shed constructed of dry folded coconut fronds served as a base for nests. All the plants mentioned above were used by *T. striatus* also for nesting. The nests of the latter were also recorded from *Strychnos nux-vomica,* and *Macaranga indica.* Thirty six per cent of the nests of *T. affinis* were found on *Calycopteris,* 17% on *Anacardium occidentale,* and six per cent on

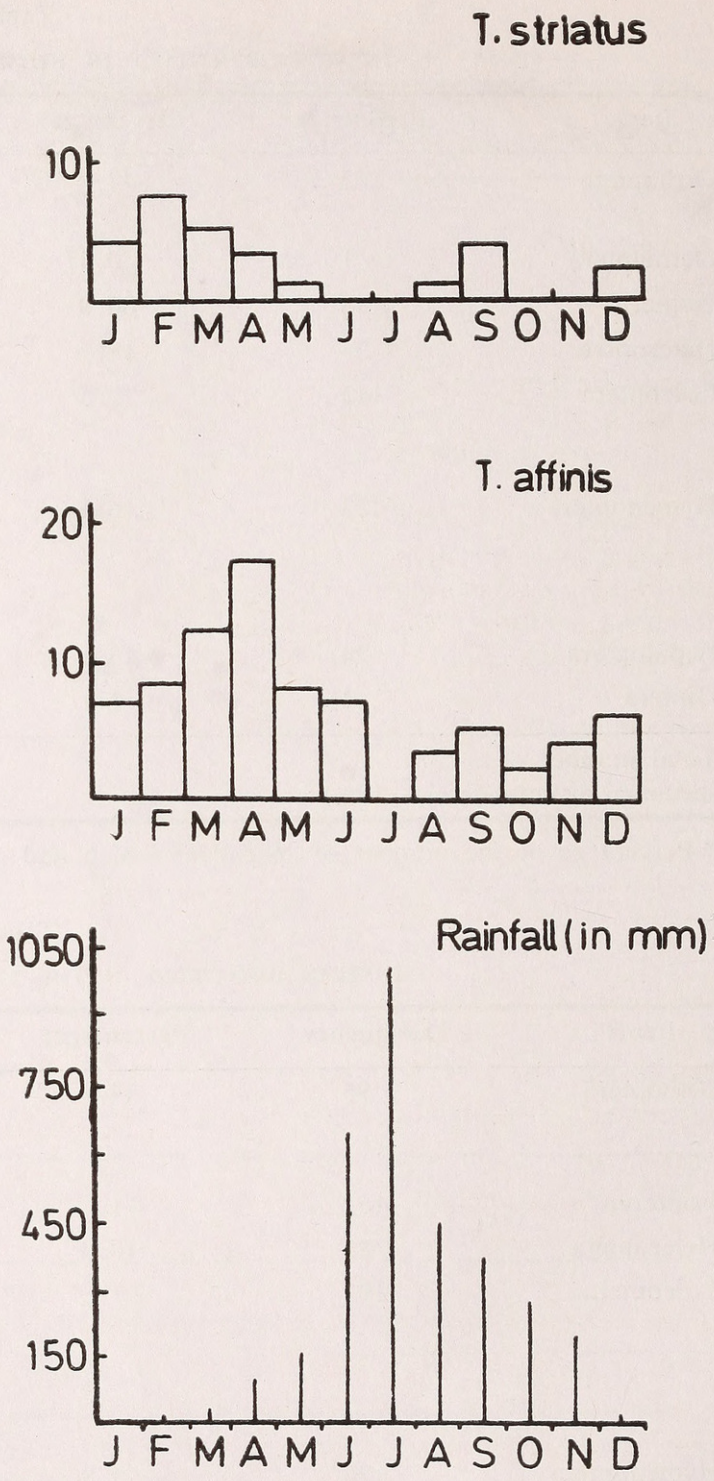

Fig. 3. Rainfall and number of new clutches started.

Strychnos nux-vomica (Table 9). Twenty eight per cent of the nest of *T. striatus* were found on *Calycopteris floribunda,* 16% each on *Anacardium occidentale, Mangifera indica* and *Macaranga peltata.*

TABLE 9

PLANTS USED FOR NESTING BY BABBLERS

Species	*T. affinis*		*T. striatus*	
	Frequency	Percentage	Frequency	Percentage
Anacardium occidentale	14	17.2	4	16
Mangifera indica	10	12.3	4	16
Strychnos nux-vomica	5	6.2	–	–
Macaranga indica	–	–	4	16
Artocarpus integrifolia	1	1.2	–	–
Santalum album	1	1.2	1	4
Terminalia paniculata	1	1.2	–	–
Cocos nucifera	4	4.9	1	4
Calycopteris floribunda	29	35.8	7	28
Syzygium caryophyllatum	1	1.2	1	4
Eupatorium odoratum	4	4.9	–	–
Memocylon edule	3	3.7	3	12
Casuarina equisetifolia	3	3.7	–	–
Agava sp.	1	1.2	–	–
Eugenia sp.	1	1.2	–	–
Tecoma stans	1	1.2	–	–
Coconut frond roofing of shed	2	2.5	–	–
Total	81		25	

Nests of *T. affinis* were built at heights of 0.2-6 m from the ground (Table 10). Nests built in the smaller bushes were invariably placed in the centre where they were best concealed. Seventy two per cent of the nests were built below 2 m height from the ground. In *T. striatus* height of the nest varied from 0.5 to 8 m. above the ground.

Herbs such as *Oldenlandia heynii, Borreria stricta, Desmodium triflorum, Canscora pauciflora, Evolvulus alcinoides,* and *Centrosoma verginiana* and coconut husks were used by both species for nest construction. In the ten nests of *T. affinis* examined carefully there was a uniform proportion of coconut husks, *Evolvulus alcinoides* and grasses for the inner lining. Sixty per cent of the nests of *T. striatus* had coconut husks for inner lining.

The duration of nest building in *T. affinis* varied from 3.5 to 6 days and that of *T. striatus* from 4-6 days. In both cases the number of helpers had no relation to the duration of nest building. The completed nest in both species was a loosely put together cup of twigs, roots and grass.

TABLE 10

NESTING HEIGHTS OF BABBLERS

Height (m)	*T. affinis*		*T. striatus*	
	Frequency	Percentage	Frequency	Percentage
1–2 m	14	39.0	5	25
1–2 m	14	28.3	5	25
2–2 m	6	16.6	3	15
3–4 m	2	5.5	3	15
4 & above	2	5.5	5	25
Total	36		20	

Egg laying:

T. affinis and *T. striatus* laid eggs on the day following the completion of the nest. But in *T. affinis*, the first egg was laid only three days after the completion of the nest in three cases, after 16 days in one case and after 18 days in a third. American Goldfinches and some Redstarts of the genus *Mycoborus* may wait a week or more before egg laying begins (Vantyne & Berger 1976).

Eggs of both species were turquoise blue in colour. Twelve eggs from five clutches of *T. affinis* had an average size of 24.0 × 18.6 mm. Ten eggs from three clutches of *T. striatus* had an average size of 26 × 18.5 mm. Freshly laid eggs of *T. affinis* had an average weight of 4.27 g. (16 eggs) and *T. striatus* 4.5 g. (6 eggs).

Clutch size:

The size of the clutch in *T. affinis* varied from 2-6 with an average of 3.1 (N = 80). In three nests were five eggs each. Clutch sizes of 3 and 4 eggs were more common in April and of 2 in March.

The clutch size in *T. striatus* varied from 2-6 with an average of 3.4. Seventy per cent of the nests had 3 eggs, 18 per cent had 4 eggs, 12 per cent 2, and 8 per cent 6 eggs. In the last case the eggs were evidently laid by two females since they were of two sizes (Table 11).

Incubation:

Incubation began with the laying of the first egg in *T. affinis* and *T. striatus*. Some of the second year and adult birds other than the breeding pair also took part in incubation in both species. The interval between the laying of the first egg and the hatching of the last egg varied from 14-16 days. Nestlings were attended to by more than two birds. The number of helpers varied from nest to nest in *T. affinis* and *T. striatus*.

Normally the chicks of *T. affinis* left their nests on the 13th day (N=10) and that of *T. striatus* on the 14th day (N=6) after hatching. Juvenile birds usually stay in their natal groups in both species. But five out of 104 fledglings of *T. affinis* joined neighbouring groups within 40 days after fledging.

Rainfall and Breeding activity:

Even though *T. affinis* and *T. striatus* bred almost throughout the year, the clutch size, intensity of laying and the number of nestlings fledged were better in the period between January and June. No new clutch was started after 8th June and there appears a depression in the breeding activity in July, the month of heaviest rainfall (Gaston, Mathew & Zacharias 1979).

Brood Parasitism:

In September, 1974 and October, 1975 two nests of *T. striatus* were parasitized by *Cuculus varius*. In these two nests the young cuckoos were the only survivors. In September, 1975 a group of *T. affinis* with four birds was observed raising a young *Clamator jacobinus* along with a nestling of their own. In the Palghat area where there are no *T. striatus*, Neelakantan (Pers. comm.) observed several instances of *T. affinis* groups feeding the chicks of *Cuculus varius* without any babbler chicks.

Hatching failure:

Out of 150 eggs studied in 82 nests of *T. affinis*, eight failed to hatch. In 23 nests of *T. striatus* studied, of 77 eggs, only three failed to hatch.

Nesting success:

During the years 1974-1977, 41.6% of the total eggs of *T. affinis* laid, produced fledglings. For *T. striatus*, the percentage of eggs producing fledglings was 43.

Nest's proximity to residences:

Nine nests of *T. affinis* (out of 82) were situated within 1-3 m. from residential buildings and seven of these were successful. None of the *T. striatus* nests were seen close to residential buildings (Table 11).

TABLE 11

CLUTCH SIZE OF THE TWO SPECIES OF BABBLERS

Clutch size	Number of cases observed	
	T. affinis	*T striatus*
2	21	1
3	33	16
4	22	4
5	3	–
6	1	2
Total	80	23

Predation and loss of eggs and chicks:

Many nests of *T. affinis* and *T. striatus* lost eggs and chicks. Predators of eggs included the Ratsnake *Ptyas mucosus* and Crow-Pheasant *Centropus sinensis.* Birds such as *Corvus splendens, C. macrorhynchos. Accipiter badius* and the mongoose *Herpestes edwardsi,* took the chicks of both the species. Two cases of the Ratsnake eating eggs and two cases of devouring of chicks of *T. affinis* were observed. The local people who collect firewood and green leaves for manuring, cut the nesting trees and destroyed several nests.

Changes of iris colour:

In the Whiteheaded Babbler the iris appears to be greenish grey in the newly fledged young. Within the next 3-4 months the iris changes into pale cream colour which is retained in the adult. The dark grey iris of the juvenile Jungle Babbler becomes creamy. These changes are gradual and seemed to be related to post-juvenal moult as observed by Gaston in the Common Babbler *T. caudatus.*

Changes in Weight:

No difference was observed in the weight of the body between sexes. There is little seasonal variation in body weight of both *T. affinis* and *T. striatus.* But the birds are heavier in January and October, and heaviest in October. This may be correlated with (1) the abundance of food supply, (2) preparation for the intensive breeding activity and (3) the termination of flight feather moult.

Moult:

The juvenile Whiteheaded Babblers underwent a partial moult beginning at three months after fledging. This moult was complete only in birds fledged in the early part of the year. In the later fledglings the late developing feathers were retained. They underwent a complete moult in the next year. Pattern of moulting in the Jungle Babbler is similar to that of the Whiteheaded Babbler. The Whiteheaded Babblers and Jungle Babblers nested and renewed their feathers simultaneously, with the body feathers moulting from March to November and the flight feathers from May to November. The duration of primary moult of *T. affinis* and *T. striatus* at the individual level could be crudely calculated as 16-20 weeks (Table 12). Gaston (1981) observed a shorter duration of primary moult in babblers add some other birds in Delhi. In Sarawak, Fogden (1972) recorded the duration of primary moult of individual birds of 18 species ranging from 17-20 weeks. The duration of moult in *T. affinis* and *T. striatus* in the study area is slow compared to temperate birds of seasonal tropics (Delhi) but similar to duration for species of moist tropics.

Group size:

In the study area the group size of *T. affinis*

TABLE 12

COMMENCEMENT AND COMPLETION OF PRIMARY MOULT IN *T. affinis* AND *T. striatus*

Stages of Primary Moult	Earliest recorded date		Last recorded date	
	T. affinis	*T. striatus*	*T. affinis*	*T. striatus*
Commencement of Primary Moult	April 26	April 20-26	June 1st week	June 6
	(1)	(6)	(4)	(1)
Completion of Primary Moult	Sept. 28	Aug. 27	November 1st week	November 1st week
	(1)	(2)	(4)	(4)

Figures in brackets show the number of specimens examined.

varied from 3-14 and that of *T. striatus* from 4-23. The number of birds in the groups of the two species fluctuated frequently, mainly due to (1) recruitment by breeding, and (2) emigration and immigration. Intergroup movements of birds of all age classes were noticed frequently in *T. affinis*. This phenomenon has been described in *T. striatus* (Gaston 1976) and in *T. squamiceps* (Zahavi 1972). There appears to be a direct relationship between the quality of the habitat and group size in both species.

DISCUSSION

The Whiteheaded Babbler and the Jungle Babbler occur sympatrically in different parts of Malabar. *T. affinis* is smaller than *T. striatus* and is more frequently seen in the open grasslands and scrub jungles than *T. striatus*, which lives in the closed canopy woodlands and other areas with plenty of plant cover. The behavioural patterns of these two species are very similar in spite of the differences in colour, size and call. The two species share many items of food, but differ in their microhabitats, feeding methods and in the proportion in which the different items of food are consumed. A good number of harmful insects such as termites, grasshoppers, beetles and bugs are eaten by both, and their usefulness to man cannot be disputed.

T. affinis and *T. striatus* breed throughout the year with two peak periods. In nest building, incubation and caring of chicks the breeding pair was assisted by helpers in the two species. But some differences were noted in the nesting material collected, the nesting trees, and the height of the nest above the ground. The eggs of both species had the same colour, but the size and weight of the eggs and clutch size were different. Both species had several common predators. The group size of *T. affinis* appeared to be smaller than that of *T. striatus*.

The most significant difference is in the shelter seeking and feeding behaviour. The Jungle Babbler moves in the close vicinity of bushes and trees into which they withdraw immediately on disturbance, their darker coloration merges with the dimly lit background. The lighter coloured Whiteheaded Babbler feeds in the open grassy hillocks and cultivated gardens. Their lighter colour merges beautifully with grassy hillocks.

The moult of the Whiteheaded Babbler and the Jungle Babbler is characterized by (1) its long duration and (2) lack of separation between breeding and moulting activities.

The most prominent difference between groups of Whiteheaded and Jungle Babblers

in the study area was the smaller group size of the former. In the Whiteheaded Babbler the groups with fewer members appeared to be more stable than the larger groups.

Though the two species of Babblers have many characters in common, the differences in their ecological requirements allow them to co-exist in the study area. The habitats of both species of babblers are undergoing rapid destruction. The plant cover including low scrub, which is one of the most essential requirements for their survival, is constantly removed. If the destruction of habitat is continued at the present rate, the population of both of these economically useful species will be adversely affected.

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