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NESTING BIOLOGY, SEASONALITY, AND MATING SYSTEM OF MALAYSIAN FANTAIL WARBLERS

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ABSTRACT.—The breeding biology of Fantail Warblers (*Cisticola juncidis*) in a rice field in northwestern peninsular Malaysia was studied. Data were collected on 38 nests found in rice plants on the 15-ha study area. Clutch size was three or four, incubation lasted 10–14 days, and fledging occurred 14–15 days after hatching. Two breeding seasons occurred annually, January–March and June–September, coinciding with the availability of suitable rice field nesting cover. The presence of several closely spaced, simultaneously active nests on plots occupied by single male birds indicated a polygynous mating system. This was based on the ability of some males to monopolize the limited available nesting habitat early in the rice-growing cycle. These findings differ from those of previous studies, presumably because of differences in the habitat types and mating systems examined.

The Fantail Warbler (*Cisticola juncidis*) is a small sylviid widely distributed in tropical and temperate parts of Europe, Africa, Asia, and Australia. It chiefly inhabits wet grassy areas and rice fields and is rather secretive except during the breeding season when males perform conspicuous aerial displays (Lynes 1930, Givens and Hitchcock 1953). Recent studies in Japan (Motai 1973), France (Robert and Bellard 1975), and Australia (Ey 1977) indicate that the species may be regularly polygynous throughout a substantial part of its range. In this paper, I present results of a study of the nesting biology and mating system of the Fantail Warbler in a Malaysian rice field environment. This research was part of an investigation of the influence of rice cultivation on the breeding seasonality of certain common rice field birds (Avery 1980), and it is the first detailed account of Fantail Warbler breeding biology from the Malayan region since Gibson-Hill's (1950) study, which was conducted on Singapore during the mid-1940's.

STUDY AREA AND METHODS

The study area consisted of 15 ha of experimental rice fields at the Rice Research Center of the Malaysian Agricultural Research and Development Institute at Bumbong Lima, Northern Province Wellesley (5°33′N, 100°28′E). The fields were irrigated, and two crops of rice were harvested annually in March–April and September–October. The study period was June 1975–March 1977.

Most nests were found by observing the movements of adult birds carrying nest material or food. Other nests were pointed out to me by field workers. I visited each nest site every second or third day and recorded the number of eggs or young and the presence or absence of adults. Several nests were observed using a spotting scope in order to monitor the foraging activity of female birds. Boundaries between breeding territories were estimated by observing encounters between males during aerial displays.

I distinguished sexes of adult birds by plumage differences (Chasen 1939) and behavioral traits (during the breeding season, males make extended song flights whereas females make brief, low, usually silent flights). Recently fledged birds were easily distinguished from adults by the yellow wash on the pale feathers of the breast and abdomen. Throughout the study, I mist-netted and banded birds, but did not uniquely mark them for sight identification. Thus, individual recognition in the field was not possible. Field counts of birds on the study area were made an average of three times weekly to obtain an indication of population levels.

RESULTS

NESTING BIOLOGY

I located 38 nests containing either eggs or young. All nests were in rice plants, 0.50–0.75 m above the water or mud, and were of the "soda-bottle" type described by Lynes (1930). The male started nest construction and formed the basic outline by binding together several blades of the rice plant with cobwebs. Beyond this stage, which usually spanned several days, the female assumed all nest-building duties.

Eggs were commonly laid on successive days, with occasional intervals of up to three days. The asynchronous hatching pattern at several nests indicated that incubation began before the completion of the clutch and lasted 10–14 days.

During incubation, females spent much of the daylight hours off their nests; males were never encountered on the nest. Of 88 checks of nests with completed clutches, the female was in attendance only 36 times. The likelihood of finding the female on the nest decreased steadily throughout the day from 70% attendance in the early morning to 26% in late afternoon.

Complete clutches contained either three (16 nests) or four eggs (21 nests). The most common brood size was three (15 of 30 broods). Of 103 eggs for which I have complete data, 80% produced nestlings and 41% produced fledglings. At two nests which were followed closely from hatching, the chicks fledged at 14–15 days of age.

Females with four nestlings averaged 11 feeding trips/h (range 5.3–13.4). Males were not seen feeding nestlings. One female with four nestlings foraged up to 80 m away, but 50 of 77 measured foraging trips were within 30 m of the nest, mainly in standing rice. Stubble and weedy areas were also used, and the bird often returned to the same spot on successive trips. Food items brought to the nest included spiders, caterpillars, and grasshoppers.

BREEDING SEASONALITY

At Bumbong Lima, there were two distinct breeding seasons annually, January–March and June–September. The 1977 data are incomplete due to the termination of the study. During the January–March 1976 breeding season, I found only one nest and it was never completed. Although male courtship flights and interactions between males were frequent, I saw no birds carrying nest material or food during that season. Nevertheless, the capture of recently fledged young in mist-nets from March through May indicated that nesting had occurred.

On the study area, the timing and duration of Fantail Warbler breeding seasons were determined by the rice-growing regime. In January and July, most rice plants were approximately six weeks old and just beginning to become suitable as nesting cover. Harvesting began in March and September and nesting was impossible thereafter. Because the rice-growing cycle was somewhat asynchronous among the plots on the study area, the warblers had two to three months when nesting habitat was available.

Field counts showed that Fantail Warblers were present year-round, but their numbers fluctuated seasonally according to the abundance of rice field vegetation and the presence of newly fledged birds. Counts were lowest during May–June and October–December, following harvest when vegetation on the study area was minimal. Juvenile birds were common in mist-nets during March–April and August–November but were rarely caught at other times (Fig. 1).

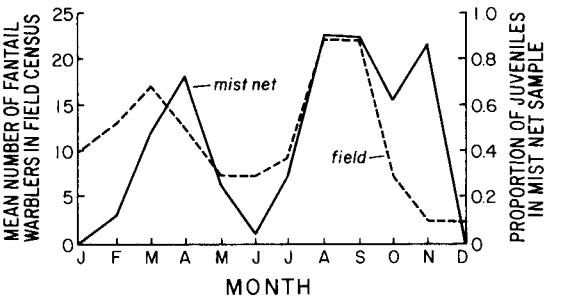

FIGURE 1. Monthly field counts of Fantail Warblers on the study area and proportions of juveniles in monthly mist-net samples.

POLYGYNY

I first suspected the existence of polygyny in this population of warblers in July 1976 when I found seven active nests in a relatively small area (about 1,650 m^2) where only one male had been evident. Eventually, two more nests were found in this same plot yielding an overall density of 1 nest/183 m^2. Only 8 of the 38 nests found during the study appeared to belong to monogamous males. Two males had 4 nests each, and four other males patrolled 2, 3, 8, and 9 nests, respectively. These data are subject to some qualifications. I rarely witnessed copulations and the birds were not individually marked, so I cannot state unequivocally that just one male occupied each territory throughout the breeding season and mated with all of the females within the territory. Furthermore, the number of nests found undoubtedly underestimates the actual number present because I could not thoroughly search the entire study area. The males presumed to be monogamous may have had additional nests that were not detected. Thus, the frequency of polygyny reported here should be regarded as a minimum estimate.

Only 1 of the 8 presumably monogamous nests produced fledglings compared to 15 of the 29 nests of polygynous males. The fate of one nest is unknown. These results suggest that there was some advantage to mating polygynously, although the difference in success rates is not statistically significant ($\chi^2 = 2.49$, $0.25 > P > 0.10$, 1 df). Similarly, I found no significant relationship between month of nest initiation and frequency of polygyny ($\chi^2 = 1.64$, $0.25 > P > 0.10$, 1 df) even though 13

TABLE 1. Differences in Fantail Warbler breeding biology between the present study and Gibson-Hill (1950).

Factor	Gibson-Hill	Present study
Habitat type	Tall grass	Rice field
Breeding season	March–August	January–March; June–September
Male role in nest building	Male participates throughout, but less than female	Male constructs only the outer framework of nest
Clutch size	2–3	3–4
Incubation	Both parents	Only the female
Feeding nestlings	Both parents	Only the female
Mating system	Monogamy	Polygyny

of 14 nests started in June were polygynous compared to 10 of 15 started in July and August.

Thirteen of 21 nests initiated in June and July produced fledglings compared to 1 of 9 nests started in August. A variety of factors contributed to the significantly ($\chi^2 = 4.65$, $0.05 > P > 0.01$, 1 df) lower success rate among later nesting attempts. As the rice grains filled, the plants became top-heavy and were less able to support the combined weight of the nest and grains. Frequent rain and strong wind either knocked the plants down and killed the nestlings outright or exposed them to drowning and predation. Fields were drained before harvest so that nest sites became accessible to mammalian predators, especially house cats. Furthermore, late nesters were endangered directly by the harvesting operations.

DISCUSSION

Prior to this study, Malaysian Fantail Warbler nests with eggs or young had been recorded from February through September with no indication of seasonal breeding patterns (Medway and Wells 1976). My observations do not indicate the frequency of breeding by individuals, but they do show that this species has two discrete periods of breeding activity. Voous (1950) noted a relationship between the breeding activity of Fantail Warblers and the rice-growing schedule in Indonesian rice fields, but he obtained no clear evidence of double breeding in any species. In India, breeding by this species correlates with the occurrence of rain and the resultant availability of nesting vegetation (Ali and Ripley 1973). At Bumbong Lima, the presence of nesting cover is determined by the irrigation schedule rather than directly by the onset of rainy weather. Rice seasons are not synchronous throughout Malaysia, and Fantail Warblers might breed year-round with peak periods of activity varying geographically according to local rice-growing practices.

The Fantail Warbler resembles other polygynous avian species in that it is sexually dimorphic and the males possess elaborate flight song displays (Pleszczynska 1978). Also, the rice field habitat where the warblers nest is essentially two-dimensional, as in habitats of many other polygynous species. Verner and Willson (1966) postulated that in habitats such as grasslands and marshes, food resources are distributed in a very narrow vertical range where unaided females can obtain sufficient food to raise a brood. Rice fields are structurally similar to marshes and the primary productivity on the study area was approximately 10,000 kg/ha each season, within the range of other two-dimensional habitats (Verner and Willson 1966). The breeding system of the warblers at Bumbong Lima may be a type of resource defense polygyny (Emlen and Oring 1977) in which a few males can monopolize the first patches of rice field that become available for nesting each season and thereby control access to females who attempt to nest early.

The polygynous mating system and several aspects of the Fantail Warbler's nesting biology reported here differ from much of the previously published information on this species in the Malayan region (Table 1). I believe these differences are attributable mainly to the types of habitat examined. Gibson-Hill (1950) studied these birds on Singapore where little rice was grown. The nests he found were in open grassy areas in an internment camp and adjacent golf course. The dominant grass species there, *Imperata cylindrica,* or lalang, readily invades disturbed sites and is common throughout lowland areas. The lalang habitat used by Gibson-Hill's birds may have been less than optimal and required the participation of both adults throughout the nesting cycle.

In contrast, polygyny prevailed in the rice fields on my study area, and females were able to raise broods unaided. I do not have sufficient data to accurately compare the relative suitability of the rice field and lalang habitats, but habitat quality does influence the type of mating system in some species (Orians 1969, Dyrcz 1977). Apparently the warblers studied by Gibson-Hill (1950) nested in habitat below the "polygyny threshold" (Verner and Willson 1966) whereas the rice fields exceeded this threshold. This explanation accounts for the differences listed in Table 1 although additional study is necessary to determine which

resources are crucial in setting the threshold for polygyny.

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