NAT. HIST. BULL. SIAM SOC. 30 (1) : 33–44, 1982.

OBSERVATIONS OF ANIMALS FEEDING IN A STRANGLER FIG, *FICUS DRUPACEA*, IN SOUTHEAST THAILAND

*Warren Y. Brockelman**

ABSTRACT

Observations were made from the crown of a strangler fig tree, *Ficus drupacea* Thunb., on diurnal animals eating figs during two fruiting periods, in Khao Soi Dao Wildlife Sanctuary, Southeast Thailand. Gibbons *(Hylobates pileatus)* and a giant squirrel *(Ratufa bicolor)* were the only mammals observed feeding. Seventeen species of birds, including four of flowerpeckers, ate figs. Quantitative observations of feeding were made on two days. The most abundant feeders were Thick-billed Flowerpeckers *Dicaeum agile*, Blue-eared Barbets *Megalaima australis* and Thick-billed Pigeons *Treron curvirostra*, all flocking species. All birds except hornbills fed by pecking at the soft ripe figs while they were attached to the branch rather than picking and swallowing them. Because of this method of feeding, *F. drupacea* figs, although fairly large in size, attract medium to very small birds.

INTRODUCTION

Large strangler fig trees are numerous in Thai forests and offer bonanzas of high quality fruit to mammals and birds at regular intervals, but at somewhat unpredictable times. In Asia, figs are a major source of food for all species of gibbons (CHIVERS, 1974, *in press*; RAEMAEKERS, 1979; GITTINS & RAEMAEKERS, 1980; SRIKOSAMATARA, *in press*) and monkeys (MACKINNON & MACKINNON, 1978, 1980). Fruiting fig trees also attractive numbers of birds of many species (RIDLEY, 1930; MCCLURE, 1966; LECK, 1971; WELLS, 1975). It is thought that figs and other fruiting plants that periodically offer food in superabundance are, in a sense, specialists in attracting large numbers of opportunistic feeders to promote seed dispersal (MCKEY, 1975; HOWE & ESTABROOK, 1977; JANZEN, 1979). SNOW (1981), however, states that figs are important foods of specialized frugivores in Africa, Southeast Asia and Australasia, and that some species depend exclusively on them.

* Department of Biology, Faculty of Science, Mahidol University, Rama 6 Road, Bangkok 10400 Thailand.

Many species of fig trees typically coexist in the same forest, and their fruit varies greatly in size, shape, texture and position of attachment (cf. JANZEN, 1979). Some species of fig trees have fruit the size of small peas and others larger than golf balls. Aside from a few observations by MCCLURE (1966), no information seems to exist on the differential attractiveness of fig species or on differences in dispersing organisms used by them.

One difficulty in studying fig eaters is the great height of the canopies of most strangler figs. Small birds such as flowerpeckers can hardly been seen with ordinary binoculars from the ground, let alone identified. In this study I was able to see all species easily by observing from a platform built near the top of the canopy. I report on the relative abundance of bird species seen feeding throughout the day, on their behaviour and feeding methods, and on a few species of mammals seen.

STUDY SITE AND METHODS

The tree (Fig. 1) a large *Ficus drupacea* Thunb., is located on a hillside at 320 m in elevation in Khao Soi Dao Wildlife Sanctuary, Chanthaburi Province, Southeast Thailand. The forest surrounding the tree is relatively undisturbed wet semievergreen, receiving more than 2000 mm of rainfall per year mostly during May to September. According to the Holdridge scheme it would be considered Subtropical Wet near the warm moist transition, with monsoonal influence (HOLDRIDGE *et al.*, 1971). The site is just to the west of the high mountains in the headwaters of the Khlong Ta Riu (river).

The tree is 27 m tall and has a large hemispherical crown about 25 m in diameter, which grew up out of a trunk of column roots extending to a height of 17 m. The tree could be climbed unaided to 18 m; rungs were nailed to a large bough to ascend further to 24 m. The figs grew on thick twigs and were 26 to 35 mm long and 18 to 25 mm wide. They were bright orange when ripe but turned purplish red when overripe and softer.

The fruiting interval is about 9 months. The tree was observed fruiting in October 1978, late July 1979 and early 1980. During July 20–29, 1979, I sat at the base of the crown of the tree for about 38 h on 5 days, watching and photographing animals, particularly pileated gibbons. These gibbons were the habituated study group of SRIKOSAMATARA (1980), GI, in whose territory the tree was located. During the next fruiting I constructed a platform of bamboo (Fig. 2), hung with heavy wire and nails, at 24 m and watched animals during May 13 to 16, 1980, My main purpose was to

Fig. 1. View from the canopy of *Ficus drupacea* tree, Khao Soi Dao Wildlife Sanctuary, Southeast Thailand.

Fig. 2. Looking up into canopy of *Ficus drupacea*.

Fig. 3. Juvenile Pileated Gibbon eating figs.

Fig. 4. Black Giant Squirrel in typical fig-eating posture.

photograph the gibbons again, but they were shy of the platform and did not enter the tree while I was in it. The crop of figs, and their size, were not as large as the previous times, probably because this was near the end of the dry season.

The platform permitted excellent observation of birds, and I spent 2 days counting birds. On May 14, birds were enumerated from 0630 to 1730 h by noting the total number of all individuals of each species identified every 10 min. This list does not indicate all birds present in the tree or all those seen, but only those individuals positively identified with 10-power binoculars. The total number of observations for each species thus indicates the total amount of feeding activity, but not the total number of visitors, as birds were counted repeatedly during successive 10-min intervals if present. An effort was made to avoid counting the same bird twice in the same interval, but this was probably not fully successful. The number of trips birds made away from the tree might better reflect the value of each species as a disperser of seeds, but birds arriving and leaving were difficult to see and count because of the size of the tree and the central location of the platform. I noted whether each bird was seen feeding on figs or not.

The weather was slightly different on the morning of May 16, so I made an enumeration from dawn at 0530 to 0830 h.

Sound recordings were made with a Nagra SNN tape recorder at rather close range of the following species: Moustached Barbet *Megalaima incognita*, Blue-eared Barbet *M. australis*, Grey-eyed Bulbul *Hypsipetes propinquus*, and Buff-bellied Flowerpecker *Dicaeum ignipectus*. Copies of the tapes are stored in the Bioacoustic Archive of the Florida State Museum, University of Florida, Gainesville, Fla.

OBSERVATIONS

Mammals

During the July fruiting period the gibbons usually visited the tree twice a day, and after they were habituated to me in the tree, fed for about an hour each time (Fig. 3). The only other diurnal mammal feeding was a Black Giant Squirrel, *Ratufa bicolor* (Fig. 4) which remained in the tree feeding intermittently for several hours on one day during July. The Striped Tree Squirrel *Tamiops rodolphei* entered the tree on one day and the Variable Squirrel *Callosciurus finlaysoni* was common in the vicinity, but neither species was observed eating figs. A Binturong, *Arctictis binturong*, was seen near the base of the tree one morning and may have fed during the night. Piles of orange faeces were present on some of the large horizontal boughs, apparently deposited at night.

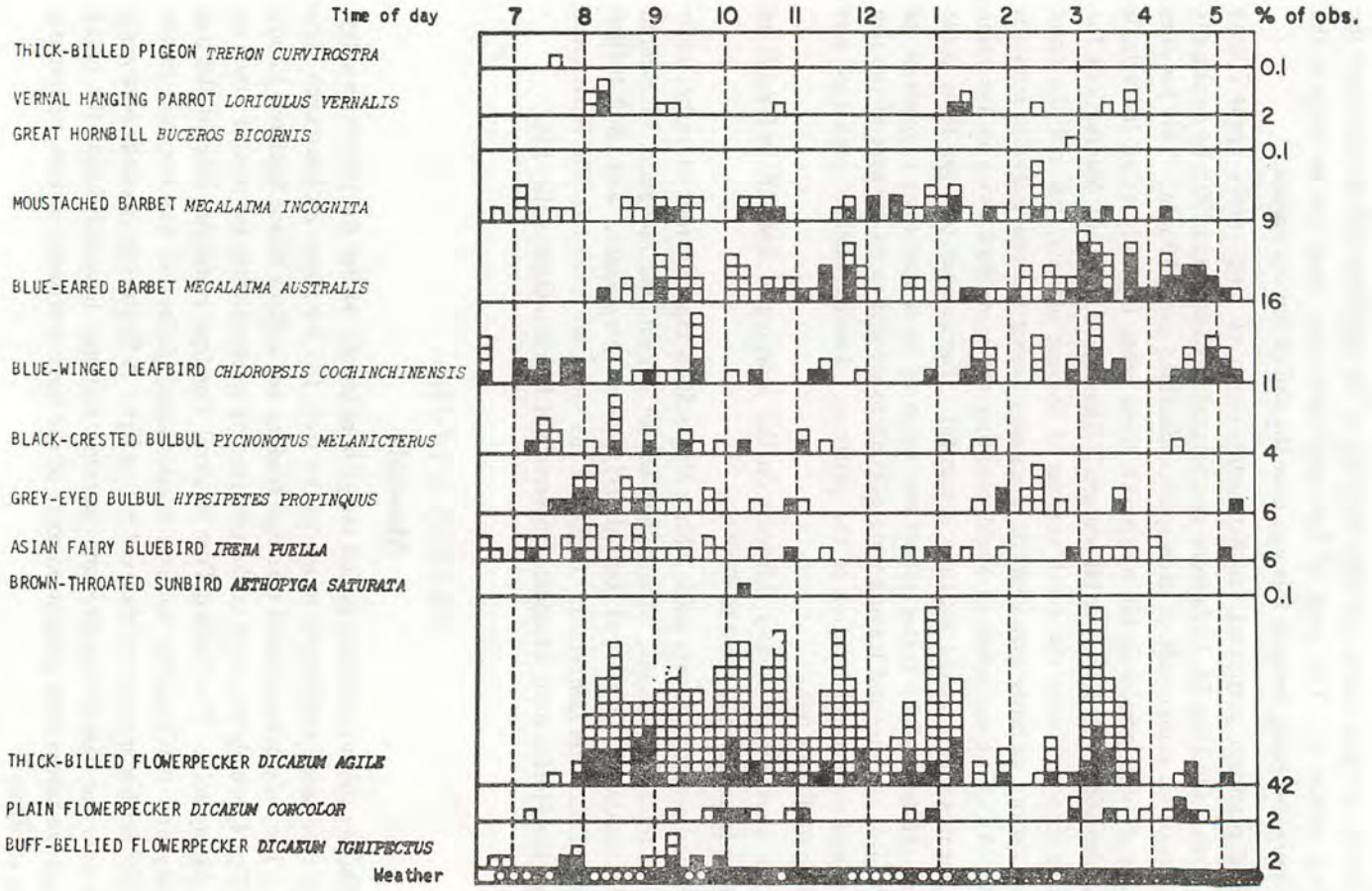

Fig. 5. Numbers of fruit-eating birds identified in fig tree during 10-min intervals throughout the day on May 14, 1980. Solid black squares indicate birds seen feeding; open squares indicate birds not feeding when seen. Weather shows sunlight falling on tree (light circles) or tree in shade (dark circles) at the end of every 10-min interval.

Birds

Species and Relative Abundance

In July 1979, approximately 12 species were observed consuming figs, including most of those on the May 14, 1980, list (Fig. 5) plus the Scarlet Minivet *Pericrocotus flammeus* and a Banded Kingfisher *Lacedo pulchella*. The flowerpeckers were not all identified because they fed mostly in the top of the canopy and were silhouetted against the sky. The dominant feeders were Blue-eared Barbets and Thick-billed Pigeons *Treron curvirostra*. Both species were flock feeders and often as many as 50 of each species were present in the tree. The barbets were present virtually all day; the pigeons were most visible in late afternoon and early evening when came to roost in the upper branches. A few Great Hornbills fed in the tree while I was not in it.

During May 1980, the species and their relative abundances were roughly similar to those during the last July. Because the platform was within 4 m of the top of the canopy, flowerpeckers could be readily identified. They comprised approximately half of all individual birds seen (Fig. 5), and were probably underestimated because of their size. The numbers of Blue-eared Barbets were also probably underestimated because of their lethargic behaviour; when not feeding they usually sat perfectly still, and even while singing they did not appear to move their heads or open their bills. I had the impression that there were about 20-50 Blue-eared Barbets and 50-100 Thick-billed Flowerpeckers in the tree at most times of the day. Only the species observed feeding on figs are included in Fig. 5.

Feeding activity began somewhat late on May 14 because a heavy mist hung in the air during early morning which soaked all the branches and foliage. On May 16, the cloud cover was higher during the morning and the foliage drier, and feeding began at dawn (Fig. 6). Temperatures ranged from 25° to 30° C on both days.

Feeding on figs continued unabated during all hours of the day, though it was slightly less during the hottest midday hours. Most species fed throughout the day, but there were some slight differences among species. Blue-eared Barbets started late in the morning on both days, and fed most actively during 1500-1700 hrs. Moustached Barbets were most in evidence during 0700-0900 hrs in the morning. A pair of this species were nesting in a hole in a dead limb of the tree and most of the observations were of this pair. The two bulbuls (Fig. 5), Fairy Bluebirds and Buff-bellied Flowerpeckers were also active primarily in the morning. The Plain Flowerpeckers had peaks of activity during mid-morning and mid-afternoon. The Thick-billed Flowerpeckers did not begin feeding until the foliage had dried off, but then they fed

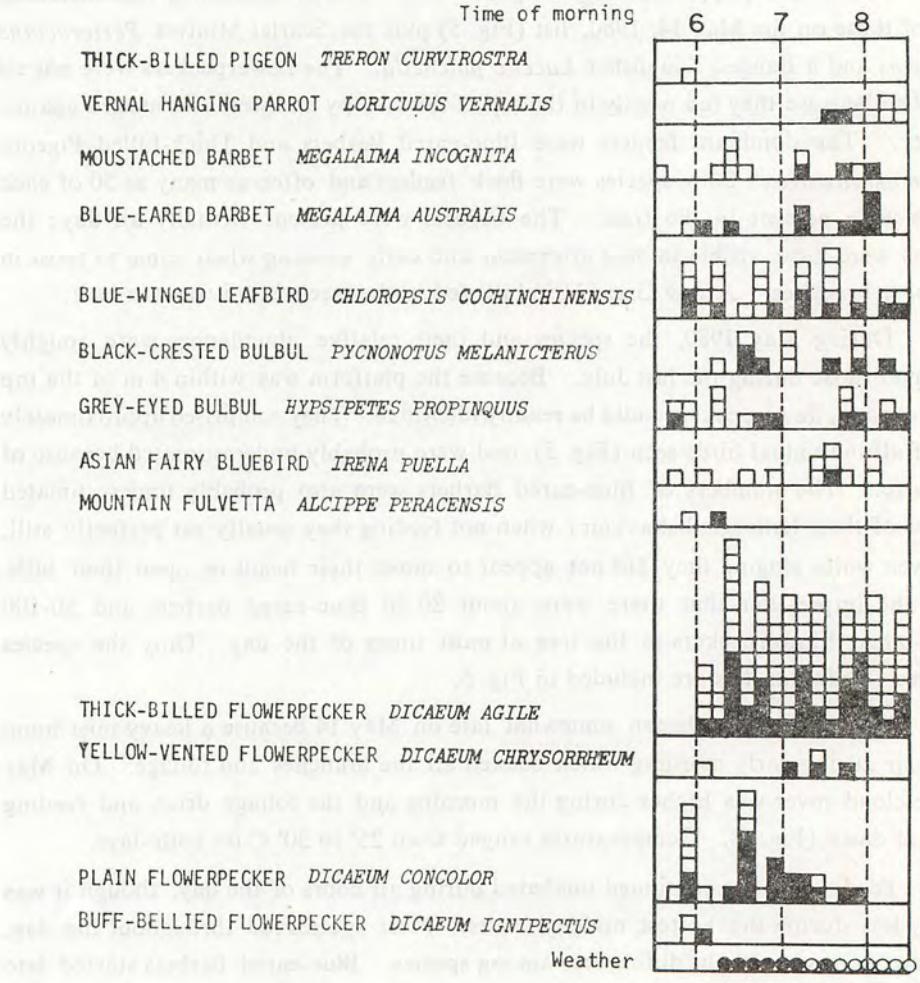

Fig. 6. Numbers of fruit-eating birds in fig tree during the first 3 hr of the day on May 16, 1980. Symbols as in Fig. 5.

steadily all morning. Feeding diminished during the afternoon but there was a briefer period of activity during 1500-1540 h. Small feeding peaks may simply indicate the chance arrival of a flock.

My conspicuousness on the platform prevented hornbills and pigeons from entering the tree in July. On one day a flock of about 100 Thick-billed Pigeons flew into the tree but immediately left upon seeing me.

Social Behaviour

The species, except those seen only rarely, fall rather clearly into two foraging categories: flocking birds and those present as individuals or pairs. The Blue-eared Barbets were in a loose flock which would swoop up and down, a few individuals at a time, between the fig tree and the neighboring trees below. A large concentration remained in the neighborhood at all times.

When feeding in large numbers these barbets often made an incessant rapid ticking sound, like *ti-ti-ti-ti-ti-ti-ti...*, which could be heard clearly only within about 20 m. The purpose of this sound was not clear to me. They also gave three different loud song types, all of which were recorded. The song patterns are unlike those of any other species of barbet in Thailand.

Thick-billed Pigeons nearly always travelled in tight flocks, feeding and roosting together. Vernal Hanging Parrots *Loriculus vernalis* usually arrived in small flocks but the difficulty of spotting them in the foliage caused only one or two to be seen in any one 10-min period. Thick-billed Flowerpeckers arrived in flocks of about 10-20 individuals, flying across the forest canopy from other tall trees nearby. Plain Flowerpeckers *Dicaeum concolor* tended to be mixed in with Thick-billed Flowerpeckers; I could not determine if they formed their own flocks or not.

Blue-winged Leafbirds *Chloropsis cochinchinensis* were sometimes in small groups of up to four, but usually in pairs. The Grey-eyed and Black-crested Bulbuls *Hysipetes propinquus* and *Pycnonotus melanicterus*, Fairy Bluebirds *Irena puella* and Buff-bellied Flowerpeckers *Dicaeum ignipectus* were usually in pairs. The leafbirds, Fairy Bluebirds, Grey-eyed Bulbuls and Buff-bellied Flowerpeckers frequently engaged in chases about the fig tree and neighboring foliage, and I had the impression that they were territorial pairs or small groups.

Only one instance of interspecific aggression was noted–the Blue-eared Barbets sometimes harrassed the pigeons, apparently trying to drive them away. When the barbets were numerous they succeeded in preventing the pigeons from feeding peacefully and the pigeons frequently flew to other perches.

Feeding Behaviour

The most interesting finding about *Ficus drupacea* is the way birds eat its oblong figs. Birds of all species except the Great Hornbills pecked through the skin and gobbled up the flesh while the figs were attached. When ripe the figs were firm but not hard, and birds usually pecked quite vigorously at them, often causing a mess with pieces of flesh flying about and the ripped skin hanging outward. Flowerpeckers usually selected the ripest figs, including those beginning to turn purplish. No bird other than a hornbill was ever seen to pick off a fig and swallow it.

DISCUSSION

One would think that moderately large figs would attract mostly large birds, but *Ficus drupacea* primarily attracts birds of medium to tiny size. The Blue-eared Barbet, about 16-18 cm in total length, is the smallest barbet in the forest.

Flowerpeckers (Family Dicaeidae) are known to specialize on mistletoe (*Loranthus*) and other small berry-like fruits (RIDLEY, 1930; CHASEN, 1939; SMYTHIES, 1953; DOCTORS VAN LEEUWEN, 1954), but a few instances of fig-eating have been reported, in RIDLEY (1930) and by R.R. KERSLEY & V.M. KERSLEY in WELLS (1975). The KERSLEYS reported that the flowerpeckers *Prionochilus thoracicus*, *P. percussus and Dicaeum chrysorrheum* fed on *Ficus microcarpa* in Malaya by puncturing the figs with the bill and moving the jaws and throat in what appeared to be a sucking motion. *Ficus drupacea* figs may be too firm to feed this way, but both methods permit small birds to feed on figs larger than they can swallow.

The most abundant species of flowerpeckers and the Thick-billed Pigeon were flock foragers, which should increase the chances of more effective distance dispersal. Such flock foragers may tend to be specialists on figs and other trees with large fruit crops because they can cover a wider area and, being more social, find asynchronously fruiting trees more efficiently. The frequent loud calls of Blue-eared Barbets doubtless attracted other individuals. Birds that feed in twos and threes within their territories must be more opportunistic feeders and cannot regularly depend on, or fully utilize, crops of figs within their territories. They are probably less efficient dispersers because of their smaller numbers and range sizes. It thus may not necessarily be true that fig trees rely on more opportunistic and less reliable dispersers (HOWE & ESTABROOK, 1977) than tree species that offer smaller amounts of fruit. one must consider the social behaviour of the species attracted and the sizes of their ranges in relation to the distribution of their preferred food species. We have much to learn about the ranging and foraging behaviour of tropical forest birds.

The number of species of birds seen feeding on *Ficus drupacea*, 17, is not very large for fig tree, even though the bird fauna in Southeast Thailand is fairly rich. In Taman Negara, Malaya, 42 species of birds were reported by the KERSLEYS feeding on a *Ficus microcarpa* during 6 days of observation (WELLS, 1975). More opportunistic species would doubtless have been seen on *F. drupacea* with longer observation, but the most significant aspect is that two species, on May 14, accounted for 58 percent of all observations. Flowerpeckers alone accounted for 46 percent. They are very small birds, to be sure, but their frequent flights over the canopy of the forest may make them effective dispersers.

ACKNOWLEDGEMENTS

I am indebted to Sompoad Srikosamatara for his discovery of the fig tree, and to Phil Round and David R. Wells for comments on the manuscript.

REFERENCES

CHASEN, F.N. 1939. *The birds of the Malay Peninsula*, Vol. IV. *The birds of the low-country jungle and scrub*. H.F. Witherby. London.

CHIVERS, D.J. 1974. The siamang in Malaya : a field study of a primate in tropical rain forest. *Contr. Primatol.* 4 : 1-335. Karger, Basel.

CHIVERS, D.J. *In press.* Feeding and ranging in gibbons : a review. *In* H. PREUSCHOFT, D.J. CHIVERS, W.Y. BROCKELMAN and N. CREEL (eds.), *The lesser apes : evolutionary and behavioural biology*. Edinburgh Univ. Press, Edinburgh.

DOCTORS VAN LEEUWEN, W.M. 1954. On the biology of some Loranthaceae and the role birds play in their life-history. *Beaufortia* (Amsterdam) 4 : 105-208.

GITTINS, S.P. and J.J. RAEMAEKERS. 1980. Siamang, lar and agile gibbons. Pages 63-105 *in* D.J. CHIVERS (ed.), *Malayan forest primates : ten years' study in tropical rain forest*. Plenum Press, New York.

HOLDRIDGE, L.R., W.C. GRENKE, W.H. HATHEWAY, T. LIANG and J.A. TOSI, JR. 1971. *Forest environment in tropical life zones : a pilot study*. Pergamon Press, Oxford.

HOWE, H.F. and G.F. ESTABROOK. 1977. On intraspecific competition for avian dispersers in tropical trees. *Am. Nat.* 111 : 817-832.

JANZEN, D.H. 1979. How to be a fig. *Ann. Rev. Ecol. Syst.* 10 : 13-51.

LECK, C.F. 1971. The impact of some North American migrants at fruiting trees in Panama. *Auk* 89 : 850.

MACKINNON, J.R. and K.S. MACKINNON. 1978. Comparative feeding ecology of six sympatric primates in West Malaysia. Pages 305-321 *in* D.J. CHIVERS and J. HERBERT, (eds.), *Recent advances in primatology*, Vol. 1. *Behaviour*. Academic Press, London.

MACKINNON, J.R. and K.S. MACKINNON. 1980. Niche differentiation in a primate community. Pages 167-190 *in* D.J. CHIVERS (ed.), *Malayan forest primates : ten years' study in tropical rain forest*. Plenum Press, New York.

MCCLURE, H.E. 1966. Flowering, fruiting and animals in the canopy of a tropical rain forest. *Malay. For.* 29 : 182-203.

MCKEY, D. 1975. The ecology of coevolved seed dispersal systems. Pages 159-191 *in* L.E. GILBERT and P.H. RAVEN (eds.), *Coevolution of animals and plants*. Univ. Texas Press, Austin.

RAEMAEKERS, J.J. 1979. Ecology of sympatric gibbons. *Folia Primatol.* 31 : 227-245.

RIDLEY, H.N. 1930. *The dispersal of plants throughout the world*. L. Reeves and Co., Kent, England.

SMYTHIES, B.E. 1953. *The birds of Burma*. Oliver and Boyd, Edinburgh.

SNOW, D.W. 1981. Tropical frugivorous birds and their plant foods : a world survey. *Biotropica* 13 : 1-14.

SRIKOSAMATARA, S. 1980. *Ecology and behaviour of the pileated gibbon* (Hylobates pileatus) *in Khao Soi Dao Wildlife Sanctuary, Thailand*. M.Sc. thesis, Mahidol Univ., Bangkok.

SRIKOSAMATARA, S. *In press*. Ecology of the pileated gibbon in South-East Thailand. *In* H. PREUSCHOFT, D.J. CHIVERS, W.Y. BROCKELMAN and N. CREEL (eds.), *The lesser apes : evolutionary and behavioural biology*. Edinburgh Univ. Press, Edinburgh.

WELLS, D.R. 1975. Bird report : 1972 and 1973. *Malay. Nat. J.* 28 : 186-213.