Roost Selection and Social Organisation in *Cynopterus horsfieldi* (Chiroptera: Pteropodidae)

K.H. TAN¹, ZUBAID AKBAR¹ and T.H. KUNZ²

Abstract: We examined the roosting behaviour and social organisation of the Larger Dog-faced Fruit Bat, *Cynopterus horsfieldi*. *C. horsfieldi* roosted in the marcescent-leaf shelter of the epiphytic bird's nest fern, *Asplenium nidus*. *C. horsfieldi* was found to possess a harem type of social organisation where each group consisted of one mature male, two to three mature females and their young. (Plate 1.)

INTRODUCTION

Like all animals, bats require shelter that provides adequate protection and allows them to rest and satisfy their social needs. Bats are largely dependent on existing shelters, including caves, rock crevices, tree hollows, tree branches, aerial roots, leaves and man-made structures (Kunz 1982; Phua and Corlett, 1989; Reid 1992; Balasingh *et al.*, 1993, 1995; Bhat, 1994; Kunz *et al.*, 1994; Bhat and Kunz, 1995). Some shelters such as caves and tree hollows provide relatively stable thermal environments but such sites are limited. Habitat destruction, degradation and alteration have serious implications for bats, as these anthropogenic factors can seriously reduce the availability of suitable roosting sites, which in turn affect population size and ultimately, species survival.

*Cynopterus horsfieldi* (Horsefield's Fruit Bat or the Larger Dog-faced Fruit Bat) is a relatively common frugivorous bat in Southeast Asia. Throughout its range, this species occupies a variety of habitats including primary forest, disturbed forest, mangrove, cultivated areas, orchards, gardens, and urban areas (Lim, 1966; Medway, 1983; Zubaid, 1993, 1994). This species is well adapted to anthropogenic influences. However, there is little information on its roosting behaviour or social organisation. Here we report some preliminary observations on roost selection and social organisation in *C. horsfieldi*.

METHODS

Our study was conducted on the campus of Universiti Kebangsaan Malaysia (UKM) in Bangi and Zoo Negara (National Zoological Park) in Hulu Kelang. Special

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¹ Department of Zoology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia (E-mail: zubaid@ukm.my)
² Department of Biology, Boston University, Boston, Massachusetts 02215, USA
attention was given to plant species which have previously been reported as roosts by other cynopterine bats (Cynopterus sphinx and Cynopterus brachyotis) including various species of palms, flower and fruit clusters, creepers, mast trees and man-made structures (Lim, 1966; Kunz, 1982; Medway, 1983; Phua and Corlett, 1989; Reid, 1992; Balasingh et al., 1993, 1995; Bhat, 1994; Kunz et al., 1994; Bhat and Kunz, 1995).

Roosting bats were captured in the morning (0900–1200h) using a large 0.5 m diameter hand-net, fitted with extendable aluminium poles. For each individual captured, its forearm length, body mass, sex and reproductive condition were noted. Identification of the bats was based on Medway (1983). Before release, each bat was marked with an aluminium band that carried an inscription ‘UKM’ and a unique serial number. Males were banded on the right forearm and females on the left.

RESULTS AND DISCUSSION

Roost Selection

Although our sampling was small, the roosts of C. horsfieldi appeared to be associated with the availability of the epiphytic bird's-nest fern, Asplenium nidus. A marcescent-leaf shelter is formed when the older and dried-out leaves of the fern drooped but persisting, form an umbrella of dead leaves beneath the fern (Plate 7, fig. 1). The diameter of the leaf shelters ranged from 50–60 cm. Unlike the sympatric C. brachyotis which modified palm leaves to construct tents (Tan et al., 1997) (Plate 7, fig. 2), none of the C. horsfieldi were found to do so. Lim (1966) noted that C. horsfieldi, in coastal regions, roosted in palms but did not indicate whether the leaves were modified. Payne et al. (1985) stated that C. horsfieldi roosted mainly in rock shelters or caves and occasionally in trees or palms whereas C. brachyotis roosted in trees, under leaves or brighter areas of caves. The leaf shelter of the fern may be considered analogous to a cave-like structure, which may be one reason why C. horsfieldi preferred this roost-type as opposed to the more open and exposed leaf tents. This leaf shelter protected the bats from inclement weather. Since C. horsfieldi is brownish in colour, the brown coloration of the basket may enhance crypsis, thus reducing risk of predation.

Although there has been considerable discussion in the literature with respect to the loss of biological diversity in Malaysia due to habitat loss, destruction or degradation, little attention has been paid as to how the affected species may benefit from such altered environments (Kiew 1991; Kumari 1995). This study, although based on a limited sample size, suggests that planting of the epiphytic bird's-nest ferns on trees, could increase the number of roosting sites for C. horsfieldi. It should be emphasised that not all the bird's-nest ferns examined in this study were used as roosts. More studies need to be undertaken to identify which factors make some ferns more suitable than others as roosting sites for these bats.

Social organisation

Four complete groups were captured from their daytime roosts. Each group consisted
of one mature male, two to three mature females and their young (Table 1). Harem males have a more intense orange colour on their shoulders and throats and are larger in size than females. These characteristics make it possible to visually distinguish males from adult females in roosting situations. Subadults are distinguished from adults by their smaller size and greyish pelage. The harem male tended to roost separately from the more tightly clustered females and subadults.

Table 1. Group composition of *Cynopterus horsfieldi*

<table>
<thead>
<tr>
<th>Location</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>adult</td>
<td>subadult</td>
<td></td>
</tr>
<tr>
<td>Zoo</td>
<td>1</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>UKM</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>UKM</td>
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<td>2</td>
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<tr>
<td>UKM</td>
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<td>2</td>
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</table>

This is the first description of a harem-type of social organisation for *C. horsfieldi*. Harem mating systems have been described by Bradbury (1977) and reported for several other species of bats under different conditions (Morrison, 1979; McCracken and Bradbury, 1981; Morrison and Morrison, 1981; Kunz et al., 1983; Brooke, 1987, 1990; Timm and Clauson, 1990; Balasingh et al., 1995; Bhat and Kunz, 1995; Kunz and McCracken, 1996; Tan et al., 1997). Emlen and Oring (1977) suggested that the harem mating systems can evolve only where it is economically feasible for one male to defend females or some limited critical resource used by females. In this study, the availability of the epiphytic ferns in which the bats roosted appeared to be limited. Morrison (1979) described a resource-defence polygyny social organisation in *Artibeus jamaicensis* where single males defend tree hollows that are used by females and their dependant young, and suggested that such a system is feasible only where a limited number of roosts are available. Kunz and McCracken (1996) suggested that leaf tents may provide critical and defendable resources for some neotropical species of the family Phylllostomidae.

ACKNOWLEDGEMENTS

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REFERENCES


Fig. 1. The dried out leaves droop downward and encircle the ‘basket’ of Asplenium nidus to form a marcescent-leaf shelter (arrow) in which Cynopterus horsfieldi is known to roost.

Fig. 2. A harem group of Cynopterus brachyotis roosting in the palmate umbrella tent of Livistona rotundifolia.
Fig. 1. *Tylophilus spinifer* (Pat. & Baker) Watling & Lee, *comb. nov.* A large fungus which has been reported from Malaysia, Singapore and Brunei.

Fig. 2. *Cortinarius cf. violaceus* (L.: Fr.) Fr. This fungus is coloured reddish violet in contrast to the blue-violet European *Cortinarius violaceus*.

Fig. 3. *Pulveroboletus frians* (Corner) Watling & Lee, *comb. nov.* A widespread and common fungus in Pasoh Forest Reserve, Negeri Sembilan, easily recognised by its strong chrome yellow colour and powdery scales on the surface of the cap.
Fig. 4. *Psathyrella verrucispora* Corner. This fungus grows gregariously or in tufts from the forest humus.

Fig. 5. *Boletus aureomycelinus* Pat. & Baker. A common bolete in the grounds of the Forest Research Institute Malaysia, Kepong, and in the Greater Templer Park area, Selangor.
Fig. 1. *Periplaneta americana* in Chamber A (photo by H. Steiner).

Fig. 2. *Periplaneta australasiae* (photo by Shaharin Yussof).

Fig. 3. *Periplaneta* sp. moulting, under the roof of Chamber A walkway (photo by H. Steiner).