ranged between 74 and 100 per cent, while it was between 0 and 65 per cent along the inner squares. Almost no damage was evident in both the centre quadrates. In both the plots the Student's *t*-test and Analysis of Variance showed that the mean damaged grape bunches were significantly higher in outer quadrates than in the inner quadrates (Table 2).

As the grapevines are grown on net mesh supported by vertical poles, the canopy tends to form a continuous complex of leaves and branches that are sometimes impenetrable. When gaps exist due to poor branching of the vines, attempts of entry through these were also observed. Moreover, large numbers (5–16 individuals) of foraging short-nosed fruit bats preferred to feed on grape bunches that are not very far from the margins, ensuring quick escape on disturbance. The only disturbance the foraging bats encounter during nights is the presence of human beings guarding the crop. The non-random foraging techniques followed by depredatory species in crop-ecosystems are under the influence of strategies favouring predator avoidance[17]. A similar trend was also noted among our study bats.

During the 36 observation nights, a total of 1576 grape bunches, each weighing on an average 750 g, were damaged by short-nosed fruit bats amounting to a yield loss of 1182 kg of grapes. At a rate of Rs 20 per kg, the revenue loss due to short-nosed fruit bat depredation accounted to Rs 10,683 per hectare. Grape growers, usually, suffer heavy loss in yield due to bird damage[18,19] and also due to smaller fruit bats (including short-nosed fruit bat and Fulvous fruit bat *Rousettus leschnaulti*). In order to avoid bats and birds, the grape growers use a variety of control methods (mostly control netting and fire crackers) to reduce the loss.

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Copulatory behaviour of Indian flying fox *Pteropus giganteus*

Chiroptera is the second largest order of mammals that comprises about 950 species of bats in which the suborder Megachiroptera contains one family (Pteropodidae) that includes 175 species of mainly frugivorous bats[1]. Most of the fruit-eating bats roost in groups on branches of trees, leaves[2,3] and tents[4]. During mating season, both male and female bats in the colony move in tree branches and are often restless[2,5,6]. More information and data are available on the ecological aspects of bat reproduction[1,2,6] and sexual maturity of the fruit-eating bat, *Cynopterus sphinx*[7,8]. However, a little information is available on the behaviour of the Indian flying fox *Pteropus giganteus* even though this is the biggest and most conspicuous of all fruit bats[9,10]. This note presents data on the copulatory behaviour of *P. giganteus* in its natural habitat in Tamil Nadu, India.

A colony of about 150 individuals of both the sexes of *P. giganteus* was found on a *Ficus bengalensis* tree near a rice field at Chenniyanallur village, about 14 km from the town of Sirkali in Nagai District, Tamil Nadu. We have been monitoring the population size of the colony since March 1997 and found that the population is stable. Local people protect the bats from hunters. We visited the bat colony from 2 to 4 of October 1999 and accidentally observed copulatory behaviour of this species. Since our visit was unexpected, we were unable to photograph the mating behaviour. A field binocular (Minolta 10x40) was used to observe the copulatory behaviour and data were recorded using *ad libitum* sampling technique[11]. The number of copulations in *P. giganteus* was observed during the day, on the day roosting tree and was statistically analysed.

A total of 51 copulations was observed in the *P. giganteus* colony. The male bat was considerably larger than the adult female. The male frequently approached its selected mate, stretched and fanned the wing towards the female and sniffed her. The female always attempted to repel from the male by screaming and leaving the branch of the tree. However, the male followed her persistently for about 20–45 min till he copulated successfully. Although the female attempted to evade the male and did not appear to be receptive, the male followed persistently and approached the female from the rear silently by gripping the scruff of the female's neck in his teeth while holding her with his thumbs. During the copulation the female tried to release herself from the male using force and screams. However, the male never released his grip on the female until the copulation sequence was complete. When the female released herself from the male successfully, she was followed by the male who produced loud audible vocalization. After the copulation, both individuals were silent for the rest of the day. Copulation lasted for about 30–40 s. One way completely randomized ANOVA emphasized that the number of copulations at 1500 h was statistically more ($F_{9,10} = 15.6$; $P < 0.001$) compared to the rest of the day. The number of copulations under cloudy, dim sunlight was significantly more ($t = 2.91$; 9 *df*; $P < 0.005$) when compared to copulation under bright sunlight.

Grant[5] reported the mating screams during night hours at the mating season of *P. tonganus* in Samoa; however, no observatory evidence was available for this species. The effect of environmental factors like temperature in the bat roosting site on specific reproductive events was described in detail by Racey[12]. Moghe[13] found the spermatozoa in the lumen and uterus of the flying foxes in the late August and early September in Western India. He also described that the gestation period of flying foxes was believed to be 140–150 days and the parturition was taking place in early February. Even though we have not observed the act of parturition, it might also be synchronous, since the copulations that we have observed were so highly synchronized.

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Random selection

revisited

'Mean-field cluster model for the critical behaviour of ferromagnets'
Ralph V. Chamberlin
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About a hundred years ago, magnetism came to be partly understood on the basis of Curie's theory of paramagnetism, Langevin's theory of diamagnetism and Weiss' theory of ferromagnetism. Weiss' contribution to the then existing theories was introduction of 'molecular field' to take into account the strong interactions between atomic magnetic dipoles. Subsequently, Curie–Weiss' law got established which accounted for temperature dependence of ferromagnetic susceptibility. The mean-field theory of Weiss, however, could not explain the behaviour of ferromagnetic materials at very low temperature and near the ferro-para critical temperature. Over the years 'critical scaling theory' and 'cluster models' based on single cluster size have sought to improve Weiss' theory but with moderate success over limited ranges of temperature.

The paper cited here relaxes the cluster size restriction. In the words of the author, Chamberlin, 'here I consider clusters with unrestricted sizes, but use a mean-field expression for interactions between the clusters. . . . I use a mean-field cluster model based on finite size thermostatics to extend the range of mean field theory, thereby eliminating the need for a separate scaling regime'. The outcome is that the model provides results that match measured susceptibilities of several crystalline ferromagnets remarkably well even in the paramagnetic region thus 'providing a unified picture of both the critical scaling and Curie–Weiss' regimes'.