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NOTE

Notes on a communal roosting of two oakblues (Lepidoptera: Lycaenidae: *Arhopala*) and the Common Emigrant (Pieridae: *Catopsilia pomona*) butterflies in Uttarakhand, India

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Communal roosting, a type of aggregation has been observed in different types of animals, including birds, bats, and primates (Ward 1965; Soini 1987; Lewis 1995; Merkel & Mosbech 2008), and is particularly common in insects, especially in bees, wasps, beetles, dragonflies, butterflies, and moths (Pearson & Anderson 1985; DeVries et al. 1987; Salcedo 2010). Communal roosting of butterflies has been described as a behaviour in which individuals aggregate inertly in close vicinity to each other at a site for more than a few hours (DeVries et al. 1987). Roosting behaviour has been reported for a few of the migratory and non-migratory species of butterflies in India (Antram 1924; Smetacek 2002; Tigers et al. 2014; Patil 2016; Sondhi et al. 2017).

Here, we report the roosting behaviour of three butterfly species, two species of *Arhopala* genus, *A. atrax* and *A. amantes*, and one species of *Catopsilia* genus, *Catopsilia pomona*, on an Elephant Apple tree *Dillenia indica* (an evergreen medium to large-sized tree, native to southern Asia) in the Forest Research Institute Campus, Dehradun, Uttarakhand, India.

The New Forest Campus (Figure 1) (30.34°N & 71.00°E, 660m) lies in the 'tropical moist deciduous' Sal *Shorea robusta* forest sub-type (Champion & Seth 1968) and provides a unique assemblage of natural forest and human habitations. The campus, comprising an area of 4.45km^2 lies in the Doon Valley of Uttarakhand State, India. The area receives an annual rainfall of over 2,000mm, and the temperature fluctuates between 0°C and 42°C from winter to summer, with a mean of 20°C. The natural forest is dominated by *Shorea robusta* with 267 species of trees, 214 species of shrubs, 446 species of herbs, 83 species of grasses, 41 species of woody climbers, 32 varieties of bamboos, and 186 species of fungi in the New Forest Campus (FRI 2019). The campus harbours a botanical garden (400 species), an arboretum (85 species), a bambusetum (32 species), big undulating fields, nurseries, tree, bush avenues, and canals. The plant species are either distributed in mixed or pure patches. Providing a mosaic of both natural and human-made habitats, the campus nurtures a wide range of larval host plants to support almost all butterflies species reported from the campus (Singh 1999).

On 15 October 2018 at 17.00h we first observed 17

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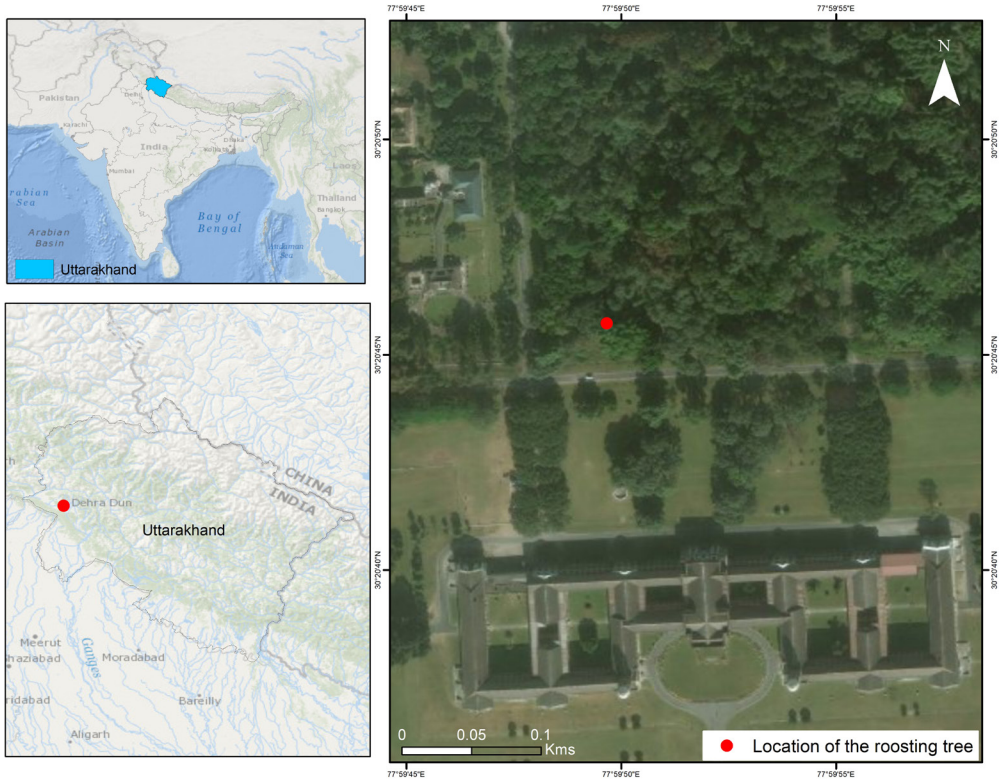

Figure 1. Map showing the location (red dot) of the Dillenia indica tree in Forest Research Institute campus.

individuals of the Indian Oakblue *Arhopala atrax*, Large Oakblue *Arhopala amantes*, and Common Emigrant *Catopsilia pomona* on a *Dillenia indica* tree (Image 1) in the New Forest Campus, FRI (Figure 1). The height of the tree was approximately 20m, and other species like *Coffea arabica, Reinwardtia indica, Echinochloa colonum, Kyllinga brevifolia, Crape jasmine* and *Suregada multiflora* were present nearby. There were five other individuals of *Dillenia indica* in different locations of the campus. After the aforementioned initial record, regular observations were made twice a day to ensure the butterflies are found throughout the day and not at any specific time of the day (once in the morning at 09.00h and once in the evening at 16.30h, 04 November –07 December 2018) to find out the regularity of the observed roosting behaviour. Butterflies were identified using standard identification keys suggested by Wynter-Blyth (1957), Kunte (2000), and Kehimkar (2008). Field guides by Singh (2011) and Smetacek (2017) were used to identify photographic records. Moreover, Kunte et al. (2019) was also consulted for proper identification. To check the site fidelity of the three above mentioned species: (a) we regularly searched other trees near the *Dillenia indica,* (b) we checked other *Dillenia indica* in the surrounding area for other roosting incidents, and (c) we disturbed the leaves on which the butterflies roosted to check if they left the site to roost elsewhere on a different individual of the same tree species that existed nearby. We also documented butterflies that were observed near the tree.

Throughout the observation period, *Arhopala amantes* were the highest in number (Maximum=19, minimum=14) followed by *Arhopala atrax* (Maximum=14, minimum=10), and *Catopsilia pomona* (Maximum=5, minimum=4). *A. atrax* and *A. amantes* were observed roosting together on the same leaves (Image 2), whereas individuals of *C. pomona* (Image 3) were observed roosting on different leaves of the same tree. There were species of butterflies other than the study species (viz., *Junonia lemonias*, *Pareronia valeria*, *Phalanta phalantha*, *Neptis hylas*, *Ypthima baldus*, *Pieris* sp.) near the tree during the period of study. Roosting, however, was not observed in any of those species.

Apart from documenting diversity and richness, there is no mention of observing any behavioural characteristics of the butterflies from the study area (Singh 1999). The amount of aggregation increased in terms of individuals as the days of observation increased. Even after providing mechanical disturbance, the butterflies were seen to roost on the leaves of the

Image 1. The *Dillenia indica* tree where the roosting behaviour was observed.

same *Dillenia indica* tree. No change in the species number was observed throughout the study period, and no roosting instances were found on the nearby trees in the same area. Apart from the regularly monitored tree, no other individual of the species in close proximity is recorded with any events of aggregation of butterflies, however, we have not observed any individual of the three species on fruits throughout the study period. Also, the species is not a host plant of any of the three studied species. The studied tree has been preferred as a suitable roosting site as it is located in a shady area, which may provide a favourable resting spot to the butterflies, safe from predators, unlike other individuals. The claim can be justified as the butterflies are mostly found roosting on the underside of the leaves or towards the base of the leaves. The study period coincides with the fruiting period of the tree species, which may be the reason to attract butterflies for feeding, but this may not be the specific reason for roosting in the particular tree. If this may have been the only reason, roosting incidences may have been observed from the nearby trees as well.

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Image 2. Roosting of *Arhopala* sp. on the leaves of *Dillenia indica.*

Image 3. *Catopsilia pomona* on the leaves of *Dillenia indica.*

Image 4. Other observed species near the tree (Common Five-ring, *Ypthima baldus*) on the fruit of *Dillenia indica.*

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