CHAPTER 19

Synchronous and Rhythmic Light Display by a Panoramic Congregation of Fireflies at Varagaliar, Anamalai Tiger Reserve

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Abstract: Typically, the fireflies on the topmost part of the tree crown flash a yellowish green light, almost immediately followed by similar light flashes serially by the fireflies below. The flashing pattern in each tree repeated itself cyclically, and other neighbouring trees had similar but unique synchronous displays. After a few cycles, fireflies in all the trees flash three times in unison as if appreciating their spectacular performance. The whole forest landscape resonated with pulsating waves of multiple kaleidoscopic flashes of light from several clusters of fireflies until dawn. This annual spectacle is observed only during the month of April, before the onset of the south-west monsoon, perhaps coinciding with the mating season of the adult insect that lives for about a month. Such synchronous flashing of a large congregation of fireflies is observed at Varagaliar, located in the Anamalai Tiger Reserve in the Tamil Nadu part of Western Ghats (10° 25.09' N, 76° 51.94' E, Elevation 2100 ft). Synchronous fireflies have also been reported elsewhere from Southeast Asia, the Great Smoky Mountains National Park, Elkmont, USA, and Brazil. Conserving this unique phenomenon at Varagaliar for posterity, necessitates a better understanding of the species composition of the fireflies involved in this phenomenon, the reasons for their synchronous behaviour, the geographical area that is congregated by these insects, the unique plant species composition, and the ecology and ecoclimate of this habitat that makes it an exclusive niche for congregation of synchronous fireflies.

Keywords: Anamalai, annual spectacle, conservation, cyclic, ecotourism, glow worms, mating, monsoon, synchronous fireflies, vegetation, Western Ghats.

1. INTRODUCTION

The remnant forests of the Western Ghats provide a safe sanctuary for unique and amazing life forms that were once very common elsewhere. The ability of fireflies to bioluminescence has always fascinated mankind, and the understanding of the

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molecular basis of this remarkable phenomenon has had utile value in biotechnology. A number of anecdotal reports point to the decreasing population of fireflies in human habitations. This observational paper describes a chance sighting of the spectacular phenomenon of synchronous flashing by a panoramic congregation of fireflies (Lampyridae, Coleoptera) at Varagaliar, Anamalai Tiger Reserve, in Tamil Nadu, India.

2. CYCLIC PATTERN OF FIREFLIES AT VARAGALIAR

Varagaliar is approachable from Topslip near Pollachi in Tamil Nadu, and also from the Sholayar power house in Valparai, Tamil Nadu, and is located 5 km away from the Parambikulam reservoir near the Tamil Nadu- Kerala border. The two days visit to Varagaliar had been envisaged for assessment of vegetation as a part of the *Indian Council of Forestry Research and Education* (ICFRE) study on "Reassigning forest type of India for better management of forests in India". The sighting of the synchronous flashing by a large congregation of fireflies was observed in the late evening hours in front of the forest rest house at Varagaliar (10° 25.09' N, 76° 51.94' E, elevation 2100 ft).

It was around 6.30 pm, on 21st April 2012, in the immediate vicinity of the valley in front of the solar power -lit forest rest house at Varagaliar (Fig. **1**), when numerous fireflies (Lampyridae, Coleoptera) were observed flying around. Soon the innumerable fireflies had congregated on the trees, and then it was noticed that the flickering light emitted by the stationary fireflies had a cyclic and a synchronous pattern. These synchronous flash patterns had characteristic features. The firefly on the topmost part of the tree crown flashes a yellowish green light, almost immediately followed by similar light flashes serially by the fireflies below. This orchestrated flashing pattern repeated itself cyclically, and other neighbouring trees had similar but unique synchronous displays. The whole visible forest landscape resonated with pulsating waves of multiple kaleidoscopic light flashes from several clusters of fireflies. After a few cycles, fireflies in all the trees characteristically flashed three times in unison. Until before dawn, the whole forest seemed to be celebrating in anticipation of the advent of the southwest monsoon downpour in May, and the panoramic spectacle rivalled the splendour of flickering stars in the sky. The forest watcher, who stays very near to the forest guest house, observed that this annual spectacle was noticed only during the month of April, perhaps coinciding with the mating season of the adult insects that lives for about a month. Varagaliar is located in the transition zone of the Teak plantations and the pristine natural forests of the Anamalai tiger reserve. Few of the common trees found in and around the rest house included *Tectona grandis*

plantations, *Bambusa bambos, Terminalia crenulata, Dalbergia latifolia, Lagerstroemia speciosa, Trewia polycarpa, Cassia fistula, Swietenia mahagoni, Hydnocarpus pentandra, Alstonia scholaris, Cycas circinalis, Macaranga peltata* and *Calophyllum* sp. The birds observed include *Ocyceros griseus*, *Gracula religiosa, Vanellus indicus, Pycnonotus* spp. and *Acridotheres fuscus.* Less than half a km from the rest house is a small stream frequented by Gaur and Sambar deer herds.

Figure 1: The forest landscape canvas in front of the Varagaliar Forest Rest house.

This phenomenon is also known to occur near the Parambikulam reservoir in Kerala (report based on personal communications with forest staff), which is just 5 km away from the forest guest house at Varagaliar. It would however, be pertinent to record that synchronous flashing was not noticed the previous night in the small number of fireflies found near the Sholayar power house (10° 21.45' N, 76° 52.679' E, elevation 1963 ft), which is about 7.5 km from Varagaliar. Synchronous fireflies have also been reported elsewhere from Southeast Asia [1], the Great Smoky Mountains National Park, Elkmont, USA [2], and Brazil [3]. The common Southeast Asian species of synchronous fireflies include *Pteroptyx malaccae*, *P. tener* and *P. valida,* and in North America they include *Photinus carolinus*, *P. pyralis*, *P. consimilis*, and *P. jamaicensi* [4]. Along the mangrove

forests in the estuary of the Selangor River at Kuala Selangor, Malaysia, the nectaries of the young trees of *Sonneratia caseolaris*, provide the required nutrition for adult *P. tener* [5].

The Morse-code like species specific synchronous flashes have been associated with the behaviour of a cluster of male fireflies courting the same female [4], a plausible reason cited for synchronous fireflies to migrate away from human habitations polluted with more powerful artificial lights. Synchronous behaviours are common in cicadas, crickets and frogs, which use synchronized sound to communicate amongst the individuals. Mathematical models like the Kuramoto model have been used to capture such biological synchronous behaviour in congregating individuals [6]. Elsewhere in the world, synchronous light display of fireflies draws numerous visitors to the Great Smoky Mountains National Park, Elkmont, USA, and to the Kuala Selangor National Park, Malaysia. In Malaysia, the local village cooperatives operate boat service for the visitors to view the spectacle. Making Varagaliar as an excursion spot for the public to experience this biological marvel would rather be a contentious issue, considering the fact that such phenomenon happens only in few parts of the world, in addition to anecdotal reports of decreasing firefly populations near human habitations.

CONCLUSIONS

Conserving this phenomenon at Varagaliar for posterity, necessitates a better understanding of the species composition of the fireflies involved in this phenomenon, the reasons for their synchronous behaviour, the geographical area that is congregated by these insects, the unique floral and faunal composition, and the ecology and ecoclimate of Varagaliar that makes it an exclusive niche for congregation of synchronous fireflies. Any decision for the present generation to view the spectacle should be made only after taking into consideration the findings from such a detailed study, and after provision of appropriate minimalistic, non- polluting (light/ sound/ air/ water) infrastructure and arrangements that do not make the unique fauna of Varagaliar to migrate elsewhere.

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CONFLICT OF INTEREST

The author(s) confirm that this chapter contents have no conflict of interest.

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