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A case study of butterfly road kills from Anaikatty Hills, Western Ghats, Tamil Nadu, India

R.K. Sony [1] & P.R. Arun [2]

[1] Ashoka Trust for Research in Ecology and the Environment, Sriramapura, Jakkur Post, Bengaluru, Karnataka 560064, India
[2] Sálim Ali Centre for Ornithology and Natural History, Anaikatty (PO), Coimbatore, Tamil Nadu 641108, India
[1] sony.rk@atree.org (corresponding author), [2] eiasacon@gmail.com

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Abstract: Anaikatty Hills of the Western Ghats in Tamil Nadu witness the annual spectacle of mass movement of lakhs of butterflies. The present paper examines the impact of vehicular traffic on this 'butterfly migration' through a survey of butterfly mortality along a road stretch in Anaikatty Hills. A high rate of mortality due to road traffic was observed during the mass movement of butterflies. One-hundred-and-thirty-five butterfly road kills belonging to three families, nine genera and 12 species were recorded during the study. The proportion of nymphalid butterflies among the road kills (70%) was very high compared to their respective share in the background population (39%), indicating a higher road mortality risk for nymphalids. The conservation significance of the road traffic impact on butterfly assemblage and management options are discussed.

Keywords: Annual mass movement, impact of forest roads, insects, invertebrates, Lepidoptera, Nymphalidae, road traffic.

Habitat fragmentations due to roads have been a growing ecological concern (Seiler 2001). Road traffic is known to affect the population dynamics of vertebrates such as amphibians, reptiles and small mammals (Mckenna et al. 2001). However, comparatively few studies have attempted to understand the effects of road traffic on invertebrates, especially insects including butterflies. The impact is expected to be higher among the slow moving and less agile faunal groups. Different regions such as North America, Australia and Europe have given some attention to road kills and their impact on the animals. In India, the realization of road kills as a potential concern for wildlife conservation and management has gained attention only in the recent past (Rao & Girish 2007; Baskaran & Boominathan 2010).

Butterflies are very sensitive to environmental changes and are good bio-indicators of habitat quality and health (Spitzer et al. 1997). Roads that fragment different ecosystems have adversely affected butterfly populations in different parts of the world (Munguira & Thomas 1992; Mckenna et al. 2001; Rao & Girish 2007; Yamada et al. 2010; Skórka et al. 2013). There has been a remarkable increase in the length of the roads in India during the last 50 years (Rao & Girish 2007; Seshadri et al. 2009). This increase has proportionately raised the concern about possible detrimental effects of roads on animals that move or fly across these roads (Spitzer et al. 1997). In this study, we attempted to quantify the road kills of butterflies in the Anaikatty Hills along a selected stretch of road which connects Coimbatore of Tamil Nadu and Mannarkkad of Kerala via the small rural border town of Anaikatty.

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Study Area

We selected a 3.5km stretch of the state highway (SH-164) between Moongilpallam and Mangarai (between 11°05'35.22"N–76°47'34.26"E & 11°05'04.64"N–76°49'11.62"E, altitude 637–659 m) on the Coimbatore-Anaikatty road (Fig. 1). This selected stretch of the road passes through the Anaikatty Reserve Forest in the Western Ghats of Tamil Nadu State. The Anaikatty Hills are a part of the Nilgiri Biosphere Reserve of the Western Ghats; one of the biodiversity hot spots of the world. The forest types of the area are southern thorn forests and southern dry mixed deciduous forest. The Anaikatty Hills are a very good habitat for butterflies. Eswaran & Pramod (2005) had reported about a quarter of the total butterfly species diversity of the Western Ghats from this area. It was opportunistically observed while travelling on this road that there was a high mortality of butterflies due to vehicles. Therefore, we attempted to quantify the magnitude of these butterfly road kills from the area. The selected 3.5-km road stretch was sampled for two days in the last week of May 2013 (on 28 and 31) in order to record the butterfly mortality. An unusually early mass movement of butterflies towards the north-westerly direction through this area was ongoing (Similar mass movements are reported from this region generally during the post monsoon season (Kumar et al. 2012).

The vehicular traffic through this road is on the rise since the road connects Coimbatore with Anaikatty, a small rural village on the Kerala–Tamil Nadu border. Also being the major road from the Tamil Nadu side that leads to the Silent Valley National Park, one of the renowned ecotourism destinations in Kerala, a large number of tourists and nature lovers also travel on this road attracted by the forests, wildlife and scenic beauty of the Western Ghats.

Methods

The butterfly numbers were quantified through transect counts. The method used here was modified from Skórka et al. (2013). Road killed butterflies were counted along two road transects of 500m each. Each transect walk consisted of two parallel lines, one on either side of the road (the second one was walked in the opposite direction). The two sets of transects were one kilometer apart. Sampling was done between 09:00–11:00 hr. Butterfly kills were counted and identified up to the species level. The kills were removed from the count area to eliminate the chance of repeat counting during the next survey. Along with the counting of dead butterflies live butterflies observed within 2m from the observer were also counted along these transects. This

Figure 1. The study area (The road stretch within the red square)

was done in order to compare the species composition of the live and road killed butterfly populations.

The vehicular traffic on the selected road stretch was also quantified between 09:00–11:00 hr during which butterflies were usually most active. All the vehicles plying in both directions on the road were counted. Overall average vehicular density was 50.75 vehicles/hr, considering two days. This included 23 light motor vehicles, followed by 20.25 two wheelers and 7.5 heavy motor vehicles.

Results

Butterflies belonging to three families, (Nymphalidae, Papilionidae and Pieridae), 12 genera and 15 species were recorded during the present study (Table 1). A total of 412 individuals was recorded from the two transects, in which 135 individuals (32.8%) were road kills and 277 individuals (67.2%) were live (Fig. 2). Among the live butterflies, Dark Blue Tiger (n=68) was more abundant followed by Common Mormon (n=40), Common Gull (n=38) and Common Crow (n=26). Common Grass Yellow (n=1) was the least recorded live butterfly.

Out of the 135 road killed individuals recorded, 24.4% was from the first transect and the remaining 75.6% was from the second transect (Fig. 3). The recorded road kills belonged to three families, nine genera and 12 species (Images 1–11). Among the road kills, Dark Blue Tiger (n=82) registered the highest abundance followed by Common Gull and Common Jay (n=10). Spot Swordtail (n=1) had the least mortality, Common crow, Common Beak, Common Emigrant, and Lemon Pansy were represented by two individuals each. No road kill was recorded for three butterfly species, viz., Common Leopard, Plain Tiger and Common Grass Yellow. Dark Blue Tiger showed a high susceptibility for getting killed on the road with 55% of the total individuals of this species recorded during the present counts (live + road kill) were in the form of road kills.

Discussion

This study shows that there is a high risk of mortality for the butterflies on the specific stretch of the road that passes through the forest during the time of mass movement (local migration) of the Nymphalid butterflies. Migrating Nymphalidae were highly prone to getting killed on the roads, compared to other families. The data presented here is from a very short period of time during which the mass movement of butterflies occured. A detailed study outside the migratory season might give a different picture which shows the normal mortality rate in this area when there is a usual density of butterflies. Nevertheless, it is important for the motorists on this road to be aware and cautioned about the high mortality rate of butterflies during the migratory movement since it is a recurring phenomenon.

The high number of butterfly road kills observed during this study highlights the importance of the impact of road mortality on butterfly populations and their conservation and management implications. The results also point towards the magnitude of road kills on butterfly assemblages in other roads, especially those passing through protected areas in the Western Ghats. A comprehensive long-term monitoring and

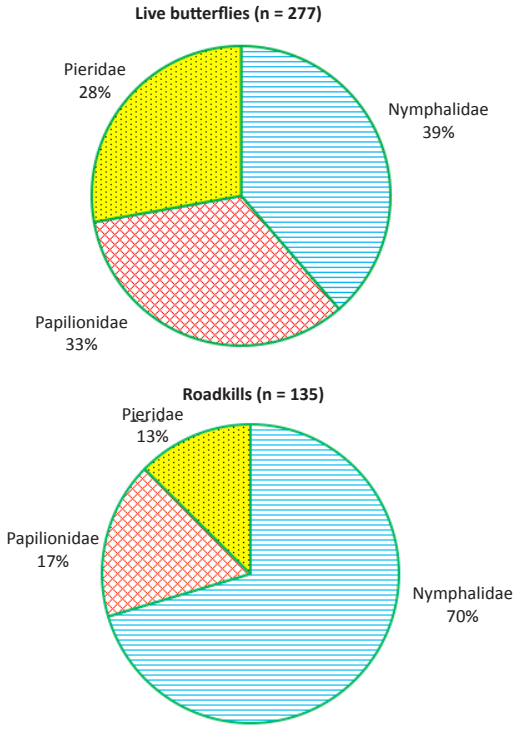

Figure 2. Composition of live and road-killed butterflies

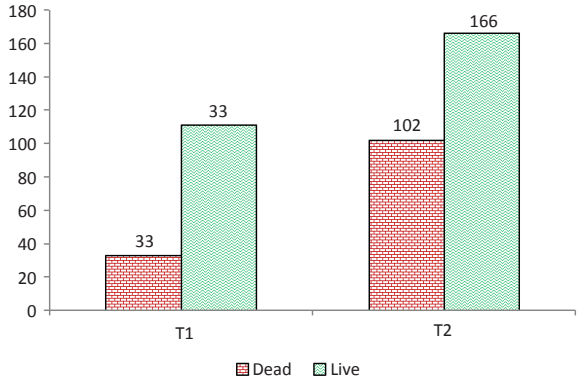

Figure 3. Live and dead (Road killed) butterflies recorded along the two transects

Table 1. Butterfly road kills and encounter rate (individuals/500m) in different transects

	Species	Status*	Transect 1		Transect 2		Total	
			Road killed	Live	Road killed	Live	Road killed	Live
	Nymphalidae							
1	Plain Tiger *Danaus chrysippus*	C	0	0	0	1	0	1
2	Common Crow *Euploea core*	C	3	15	1	11	4	26
3	Chocolate Pansy *Junonia iphita*	C	1	2	4	1	5	3
4	Lemon Pansy *Junonia lemonias*	C	0	3	2	3	2	6
5	Common Beak *Libythea lepita*	C	0	0	2	0	2	0
6	Common Leopard *Phalanta phalantha*	C	0	0	0	3	0	3
7	Dark Blue Tiger *Tirumala septentrionis*	C	20	27	62	41	82	68
	Papilionidae							
8	Common Jay *Graphium doson*	LC	2	0	8	21	10	21
9	Spot Swordtail *Graphium nomius*	LC	0	2	1	7	1	9
10	Lime Butterfly *Papilio demoleus*	VC	1	10	4	13	5	23
11	Common Mormon *Papilio polytes*	VC	1	26	6	14	7	40
	Pieridae							
12	Common Emigrant *Catopsilia pomona*	C	2	7	0	12	2	19
13	Common Gull *Cepora nerissa*	C	3	9	7	29	10	38
14	Common Grass yellow *Eurema hecabe*	C	0	0	0	1	0	1
15	Yellow Orange Tip *Ixias pyrene*	C	0	10	5	9	5	19
	Total		**33**	**111**	**102**	**166**	**135**	**277**

*Distribution status of butterflies based on Kehimkar (2008). C - Common; LC - Locally Common; VC - Very Common.

estimation of mortality rates is required for the roads passing through protected areas, so that appropriate management options including traffic management may be developed for these roads. The proposed forest roads such as Achenkovil-Konni-Chittar-Pallappally road which goes through 1.6km stretch of forests in Ranni Forest Division and the proposed highway to connect Mysore (Karnataka) and Kozhikode (Kerala) cities to Coimbatore City (Tamil Nadu) via Masinagudi, Anaikatty, Sigur and Bhavanisagar (Baskaran & Boominathan 2010) also may be of higher concern from the point of wildlife conservation in this context. The road mortality of butterflies can possibly be reduced by providing alternate open areas with mud puddling sites away from the roads. Local enhancement in mud-puddling behavior by using artificial puddles moistened with NaCl was successfully done for butterflies elsewhere (Otis et al. 2006). The artificial mud-puddling sites can be made more attractive for the butterflies by providing cattle urine, fruits and faecal matters. Traffic regulations and awareness creation among drivers also can help in reducing the number of road kills of butterflies and other species.

There are no previous reports on butterfly mortality from the present study area. A Molecular phylogeny study from Mukkurthi National Park and adjoining areas of Mudumalai Wildlife Sanctuary and Avalanche Forest by Vadivalagan et al. (2012) reported 163 road kills belonging to five species. However, the data was not comparable with our data because of methodological differences. Kumar et al. (2012) reported the mass movement of milkweed butterflies in the study area during November. A similar mass movement was observed during the present study also, but in the last week of May. Considering the mass death of butterflies on the road reported by this study during the local migration, steps should be taken to ensure appropriate regulation of the vehicular movement along such roads especially during such occasional events. Although the present study was initially planned to track the road kill data for a longer duration, we could not continue since the butterfly mass movement ceased abruptly. A detailed study of the traffic and butterfly abundance patterns at different times and seasons is needed for a better understanding of the relationship between the road traffic intensity and the butterfly mortality on the roads.

Images 1–11. A view of butterfly road kills strewn along the sides of Anaikatty Road
1 - Chocolate Pansy; 2 - Common Beak; 3 - Yellow Orange Tip; 4 & 5 -Dark Blue Tiger; 6 & 7 - Spot Swordtail; 8 - Common Jay; 9 - Common Mormon; 10 & 11 - Butterfly road kills.

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