

BUTTERFLY DIVERSITY IN THE JAFFNA PENINSULA AND THE SURROUNDING ISLETS

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ABSTRACT

Sri Lanka supports a rich butterfly fauna that comprise of 245 species of which 26 are endemic to the country. Northern region of Sri Lanka supports a unique butterfly assemblage, possibly due to its proximity to mainland India, with five butterfly faunal species being restricted to the northern region. However, there are only few studies on the butterfly fauna of the north as this region was not accessible for such studies for over three decades due to the armed conflict that prevailed in the north. This study was undertaken to document the butterfly fauna that inhabits Jaffna peninsula and the surrounding islets. This study was conducted between March 2010 and June 2010 during which 7 major locations in the Jaffna district were sampled. Altogether 10 major natural and man made habitats were observed within the study area. This study indicates that Jaffna peninsula and the surrounding islands support a rich butterfly assemblage, as nearly 20% (50 species) of the butterfly fauna of Sri Lanka was recorded in the region including three out of five species that are restricted to the northern region of Sri Lanka. None of the 50 species of butterflies recorded are endemic species. However, four species listed as Vulnerable and two species listed as Near Threatened species were recorded in the study area. Butterfly diversity was found to be highest in the Jaffna Peninsula that has a larger land area compared to the islands. The diversity in the islands was found to be strongly correlated to the size of the island. Further, butterfly communities were found to be similar in islands that are located close to each other.

KEY WORDS: Butterfly diversity, Habitat

INTRODUCTION

The study of butterflies dates back to 1861, where Emerson J Tennant has given a short account on the butterflies observed in Sri Lanka. Tennant's work has been followed by many others that has resulted butterflies being one of the best studied invertebrate groups in Sri Lanka. At present, the butterfly fauna of Sri Lanka stands at 245 species, including twenty-six endemic species (Van der Pooten, 2012). Sri Lanka shares most of its butterfly fauna with

peninsular India, with several species being regionally endemic to Southern India and Sri Lanka (Van der Pooten, 2012).

Most of the studies on butterfly fauna have taken place in the southern part of Sri Lanka as the northern area was not accessible for nearly three decades due to the armed conflict that took place over much of the northern area. However, the northern region of Sri Lanka supports a unique species assemblage, possibly due to its proximity to mainland India, with number of faunal species being restricted to the North, including several species of butterflies such as *Junonia hierta* (Yellow Pansy), *Azanus ubaldus* (Bright Babel Blue), *Colotis danae* (Crimson Tip), *Colotis fausta* (Large Salmon Arab) and *Byblia ilithyia* (Joker) (Van der Pooten, 2012). Because of their restricted distribution, all five species are listed as nationally Threatened species, with the first two species listed as Critically Endangered and the last three species listed as Vulnerable (MOE, 2012). Therefore, the main objective of this study has been to document the butterfly fauna that inhabits Jaffna peninsula and the surrounding islets.

Study Area

The study area, Jaffna peninsula and the surrounding islands, is located in the northern region of Sri Lanka and District of Jaffna. The Jaffna peninsula extends over 1,030 km² of land and is connected to the rest of the island by a small strip of land at Elephant pass. Jaffna peninsula is made of limestone as it was submerged under sea during the Miocene period. Jaffna peninsula is also surrounded by several islands that may range in size from 1 to 50 km² (see figure 1). The climate of Jaffna region is mainly governed by the monsoonal system. Annual precipitation ranges from 696 mm to 1125 mm and more than 90 % of this annual rainfall occurs due to the north-east monsoon that takes place between October and January (SL Meteorological Department, 2004). The temperature ranges from 26°C to 33°C.



Figure 1. The Jaffna peninsula and the surrounding islets.

Biogeographically, the Jaffna Peninsula and the surrounding Islands lie within the low country dry zone. Floristically, it is classified under floristic zones I (Coastal and marine belt) and II (Dry and arid lowlands). Marine mangroves, salt marshes, sand dunes and strand vegetation are the typical natural vegetation formations found in the floristic zone I (Coastal and marine belt) and Tropical dry mixed evergreen forests, Tropical thorn forests, Damana and Villu grasslands, Flood-plain wetlands, Riverine and gallery forests are the typical natural vegetation formations found in the floristic zone II (Dry and arid lowlands) (CEA, 2005).

MATERIALS AND METHODS

This short and rapid study was conducted between March 2010 and June 2010. Observations were undertaken in the morning, noon and evening, on sunny days with clear skies. Altogether, 30 days were spent on sampling during the study period, during which 7 major locations were studied. Altogether, 100 sampling sites were established within the seven locations studied. Selection of sampling sites was based on habitat variation and extent of each sampling location (Table 1). At each sampling location, a timed line transect was carried out for 15 min. Therefore, a total 1500 min of observation was carried out during the entire study period.

Table 1. Number of sampling sites per each of the seven major locations studied.

| Location | Area (km²) | Sampling Locations |
|-----------------|------------------------------|---------------------------|
| Jaffna | 1030 | 64 |
| Karaitivu | 22.95 | 07 |
| Eluvaitivu | 1.40 | 01 |
| Delft | 47.17 | 10 |
| Punkudutivu | 22.56 | 06 |
| Kayts | 64.01 | 10 |
| Mandativu | 7.56 | 02 |

Smaller butterflies were caught using a hand net and, after identification, the specimen was released into the same habitat from which it was caught. Species were identified using standard field guides (Banks & Banks, 1985; D'abrera, 1998 and Woodhouse, 1952). Butterfly nomenclature and national conservation status are based on National Redlist (MOE, 2012) and the global conservation status is based on IUCN Redlist (IUCN, 2014).

RESULTS AND DISCUSSION

Major habitat types observed in the study area

Altogether 10 major natural and man made habitats were observed within the study area. The natural habitats included scrublands, mangroves, salt marshes, mudflats, freshwater bodies, grasslands, beaches and sand dunes. The man made habitats were the predominant types observed in the study area that included home gardens, perennial crop (Palmyra and Coconut) cultivated lands and Seasonal crop cultivated lands. A brief description of these habitats is given below. The types observed in each of the seven locations sampled are given in Table 2.

Scrublands

This is essentially in a state of accelerated flux that develops in places where land has been abandoned after human use or due to excessive degradation of forest. Scrublands are characterized by having a single stratum of shrubs (2-4 m in height) forming dense thickets. Very often, scattered trees are found within the scrub, which are remnants of the original forest vegetation. The dominant species recorded in this habitat includes *Carissa spinarum* (Heen Karamba), *Phoenix pusilla* (Indi), *Vernonia zeylanica* (Pupula), *Maytenus emarginata*, *Diospyros ferrea*, *Euphorbia antiquorum* (Daluk), *Flueggea leucopyrus* (Katupila), *Jatropha gossypifolia*, *Cassia auriculata* (Ranawara), *Dichrostachys cinerea* (Andara), *Cassytha filiformis*, *Azadirachta indica* (Kohomba), *Syzygium cumini* (Madan), *Scutia myrtina*, *Ziziphus mauritiana* (Dembara), *Ziziphus oenoplia* (Heen Eraminiya), *Canthium coromandelicum* (Kara), *Catunaregam spinosa* (Kukurumanna), *Ixora pavetta* (Maha Ratambala), *Morinda coreia* (Ahu), *Toddalia asiatica* (Kudumiris), *Azima tetraantha*, *Gmelina asiatica* (Demata), *Lantana camara* (Gandapana) and *Cissus quadrangularis* (Heressa). The scrub ecosystem can be seen throughout the Jaffna Peninsula and many of the islands.

Mangroves

Mangroves occupy the land-sea interface or the inter-tidal zone which is influenced both by freshwater flowing from landward side and saline water brought in with tides. Due to the comparatively low tidal amplitude in the sea around Sri Lanka (the highest recorded tide is 89 cm above MSL) the inter-tidal zone is often restricted to a narrow belt. The dominant plant species observed in this habitat included true mangrove species such as *Lumnitzera racemosa* (Beriya), *Excoecaria agallocha* (Tela Kiriya), *Rhizophora mucronata* (Kadol), *Avicennia marina* (Kanna), *Acanthus ilicifolius* (Katu Ikili) and mangrove associates such as *Tamarix indica* (Kiri), *Premna obtusifolia* (Maha Midi), *Clerodendrum inerme* (Burenda) and *Derris trifoliata* (Kala Wel).

Salt Marshes

Salt marshes occur where salt water is received only during equinoxial tides. The arid climate that prevails in this area contributes to high soil salinities resulting from high evapo-transpiration rates. Such areas are occupied by salt-tolerant herbaceous plant species (saltworts) that are characteristic of salt marsh vegetation. Plant diversity in salt marshes therefore is relatively low. Extensive salt marshes were not observed in Jaffna Peninsula or the islands. However, salt marsh species such as *Halosarcia indica*, *Salicornia brachiata*, *Suaeda maritima*, *Atriplex repens*, *Cressa cretica* and other species such as *Blumea obliqua*, and *Sesuvium portulacastrum* (Maha Sarana) were found scattered around areas having high salinity.

Mudflats

In lagoon areas during the dry periods exposed mudflats can be seen. These are colonized by salt loving herb species such as *Cynodon dactylon*, *Cressa cretica*, *Blumea obliqua*, *Atriplex repens*, *Fimbristylis* spp. and *Cyperus stoloniferus*.

Water Holes, Tanks, freshwater marshes and Canals

These are habitats that are mainly dependent on rain water. As they have a lower capacity these water bodies become completely or partially dry during the dryer season that prevails in the area from April to September. As these are fairly shallow water bodies, rooted aquatic vegetation such as *Nymphaea pubescens* (Olu), *Nelumbo nucifera* (Nelum), *Nymphoides hydrophylla* (Kumudu), *Bacopa monnieri*, *Fimbristylis* spp., *Cyperus* spp., *Hygrophila schulli* (Niramulliya), *Panicum repens* (Etor), *Clerodendrum inerme* (Burenda), *Typha angustifolia* (Hambupan), *Tamarix indica* (Kiri) and *Premna obtusifolia* (Maha Midi) establish easily in and along the banks of these water bodies. As these water bodies dry up, the exposed areas become covered with grass. These seasonal water bodies function as important biological repositories.

Grasslands

Scattered grasslands were observed in many places within the study area containing grass species such as *Cynodon dactylon*, *Cressa cretica*, *Blumea obliqua*, *Cyperus stoloniferus* and *Phyla nodiflora* (Hiramanadetta).

Beach, Sand Dunes and Associated Vegetation

Beyond the direct impact of waves and tides, a carpet of densely growing creepers, comprising mainly of *Ipomoea pes-caprae* (Muhudu Bin Thamburu), are present. These creepers help consolidate the surface sand by restricting wind induced erosion and preventing removal of sand by sea water. Beyond the carpet of creepers a zone of low shrubs occurs on

the more stabilized sand and sand dunes. In these habitats the dominant plant species observed include *Ipomoea pes-caprae* (Mudu Bin Thamburu), *Scaevola taccada* (Takkada), *Spinifex littoreus* (Maha Ravana Revula), *Clerodendrum inerme* (Wal Gurenda), *Ipomoea macrantha*, *Wedelia biflora*, *Calotropis gigantea* (Wara), *Launaea sarmentosa*, *Pedaliium murex* (Et-nerenchi), *Tridax procumbens*, *Phyla nodiflora* (Hiramanadetta), *Cyperus stoloniferus*, *Aloe vera* (Komarika), *Pupalia lappacea* (Wel Karal Heba), *Citrullus colocynthis* (Yak Komadu), *Premna obtusifolia* (Maha Midi), *Sesuvium portulacastrum* (Maha Sarana) and *Catharanthus roceus* (Mini Mal).

Home Gardens

Jaffna Home Gardens are agroforestry based land-use systems where multipurpose trees and shrubs are found in close association with perennial or annual agricultural plants near human dwellings. Home gardens are characterized by multi-storied structures with mixed but compatible species. such as *Cocos nucifera* (Pol), *Borassus flabellifer* (Tal), *Areca catechu* (Puwak), *Mangifera indica* (Amba), *Phyllanthus emblica* (Nelli), *Gliricidia sepium* (Weta Mara), *Tamarindus indica* (Siyambala), *Thespesia populnea* (Suriya), *Azadirachta indica* (Kohomba), *Moringa oleifer* (Murunga), *Musa x paradisiaca* (Kesel) and *Commiphora berryi*.

Seasonal Crop Cultivated Lands

This is the land use type is observed commonly in urban areas where a variety of seasonal crop plants such as *Nicotiana tabacum* (Tobacco), *Musa x paradisiaca* (Kesel), *Vitis vinifera* (Midi), *Carica papaya* (Gas Labu), *Manihot esculenta* (Manioc), *Zea mays* (Bada Iringu) and vegetables like *Abelmoschus esculentus* (Bandakka), *Vigna unguiculata* (Me Karal), *Momordica charantia* (Karawila), *Cucurbita maxima* (Wattakka), *Beta vulgaris* (Beet Root), *Capsicum annum* (Miris), *Lycopersicon esculentum* (Takkali), *Allium cepa* (Lunu) and *Allium ampeloprasum* (Leeks) are grown. In many places cultivated lands contain a mixed vegetation except in paddy fields where *Oryza sativa* (Paddy) is grown as a monoculture.

Perrineal Crop Cultivated Lands

This is another common land use type observed on all the sampling locations. Such perrineal perennial ? plantations are comprised of either *Borassus flabellifer* (Palmyra) or *Cocos nucifera* (Coconut) or a mixture of the two.

Table 2. Major habitat types observed in Jaffna peninsula and its islets (SC - Scrublands, MN - Mangroves, SM - Salt Marshes, MF - Mud Flats, WH - Water Holes, GR - Grassland, BS - Beach and Sand dunes, HG - Home Gardens, SC - Seasonal Crop cultivated lands, PC – Perrineal Perennial Crop cultivated lands)

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| Location | SR | MN | SM | MF | W | GR | BS | HG | SC | PC |
|--------------|----|----|----|----|---|----|----|----|----|----|
| Jaffna | + | + | + | + | + | + | + | + | + | + |
| Karaitivu | + | | | | | + | | + | + | + |
| Eluvaitivu | + | | | | + | | | + | | + |
| Delft | + | | | | + | + | + | + | | + |
| Punkuduthivu | + | + | | + | + | | | + | | + |
| Kayts | | + | + | | | + | | + | | + |
| Mandathivu | + | + | + | | + | + | | + | | |

Butterfly fauna:

A total of 50 butterfly species belonging to 4 families were observed in Jaffna Peninsula and surrounding islands. Further, three of the five butterfly species restricted to the northern region, *Colotis danae* (Crimson Tip), *Colotis fausta* (Large Salmon Arab) and *Byblia ilithyia* (Joker) were recorded in the study area during the survey. The butterfly assemblage recorded did not include any endemic species. However, four species listed as Vulnerable and two species listed as Near threatened species (MOE, 2012) were recorded during the study.

Species richness was found to be highest in the Jaffna Peninsula followed by Punkudutivu, Delft, Kayts, Eluvaitivu, Karaitivu and Mandathivu islands (Table 4). There is a strong positive correlation between species richness and extent of the land area ($r = 0.916$).

Table 3. Butterfly species richness of the seven study locations.

| Location | Area (km ²) | Species Richness |
|-------------|-------------------------|------------------|
| Jaffna | 1030 | 47 |
| Kayts | 64.01 | 15 |
| Delft | 47.17 | 17 |
| Karaitivu | 22.95 | 6 |
| Punkudutivu | 22.56 | 22 |
| Mandativu | 7.56 | 6 |
| Eluvaitivu | 1.40 | 7 |

A pair-wise comparison of the butterfly assemblages between each of the seven study sites showed that there is a higher degree of similarity among the islands in the southern cluster (Delft, Punkuduthivu and Kayts) and islands in the northern cluster (Karaitivu and Eluvaitivu). However, there was little similarity between the butterfly assemblage between the northern

and southern islands. Likewise the butterfly assemblage in the Jaffna Peninsula showed a high degree of similarity to butterfly assemblage in the southern island cluster compared to the northern island cluster (Table 3).

Table 4. Pair-wise comparison of butterfly assemblages recorded in the Jaffna Peninsula and surrounding islands using Jacards Community Similarity Coefficient (JP - Jaffna Peninsula; KA - Karaitivu Island; EL - Eluvaitivu Island; DL - Delft Island; PU - Punkudutivu Island; KY - Kayts Island; MA - Mandativu Island.

| | JP | KA | EL | DL | PU | KY | MA |
|----|-------|-------|-------|-------|-------|-------|----|
| JP | | | | | | | |
| KA | 0.128 | | | | | | |
| EL | 0.149 | 0.300 | | | | | |
| DL | 0.361 | 0.150 | 0.143 | | | | |
| PU | 0.380 | 0.167 | 0.115 | 0.444 | | | |
| KY | 0.319 | 0.235 | 0.100 | 0.455 | 0.370 | | |
| MA | 0.128 | 0.091 | 0.182 | 0.211 | 0.217 | 0.167 | |

This study indicates that Jaffna Peninsula and the surrounding islands support a rich butterfly assemblage as nearly 20% of the butterfly fauna of Sri Lanka was recorded in the region including three out of five species that are restricted to the northern region of Sri Lanka. Butterfly diversity was found to be highest in the Jaffna Peninsula that has a larger land area compared to the islands. The diversity in the Islands were found to be strongly correlated to the size of the island. Further, butterfly communities were found to be similar in islands that are located close to each other.

This study was conducted over a short period of time and therefore the main focus has been to document the baseline conditions with respect to butterfly fauna. This study has not examined the relationship between land use and butterfly abundance as well as abundance and distribution of butterfly food plants which are critical determinants of butterfly assemblages in a given landscape. These types of studies would be required to determine the impact of rapid land use changes that are taking place in Jaffna district after the culmination of the armed conflict in 2009, which could have a significant negative impact on the abundance and diversity of butterfly fauna in Jaffna district.

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Table 5. Detailed list of butterflies recorded in Jaffna Peninsula and Surrounding Islands

Abbreviations used: TS - Taxonomic Status; N - Native species; NCS - National Conservation Status; LC - Least Concern; NT - Near Threatened; VU - Vulnerable, JP - Jaffna Peninsula; KA - Karaitivu Island; EL - Eluvaitivu Island; DL - Delft Island; PU - Punkudutivu Island; KY - Kayts Island; MA - Mandativu Island.

| Family | Scientific Name | Common Name | TS | NCS | JP | KA | EL | DL | PU | KY | MA |
|-------------|----------------------------|--------------------|----|-----|----|----|----|----|----|----|----|
| Lycanidae | <i>Azonus jesous</i> | African Babul Blue | N | LC | | | | | + | | |
| Lycanidae | <i>Castalius rosimon</i> | Common Pierrot | N | LC | + | | | | | | |
| Lycanidae | <i>Chilades lajus</i> | Lime Blue | N | LC | + | | | | | | |
| Lycanidae | <i>Euchrysops cnejus</i> | Gram Blue | N | LC | | | | | + | | |
| Lycanidae | <i>Leptotes plinius</i> | Zebra Blue | N | LC | + | | | | | | |
| Lycanidae | <i>Prosotas nora</i> | Common line blue | N | LC | + | | | | | | |
| Lycanidae | <i>Rathinda amor</i> | Monkey-puzzle | N | LC | + | | | | | | |
| Lycanidae | <i>Spindasis vulcanus</i> | Common Silverline | N | LC | + | | | | + | | |
| Lycanidae | <i>Tarucus nara</i> | Striped Pierrot | N | LC | + | | | + | | | |
| Lycanidae | <i>Zizeeria karsandra</i> | Dark Grass Blue | N | LC | + | | | | | | |
| Lycanidae | <i>Zizina otis</i> | Lesser Grass Blue | N | LC | + | | | | + | | |
| Lycanidae | <i>Zizula hylax</i> | Tiny Grass Blue | N | LC | + | | | + | | | |
| Nymphalidae | <i>Acraea violae</i> | Tawny costor | N | LC | + | | | + | + | | |
| Nymphalidae | <i>Ariadne ariadne</i> | Angled castor | N | LC | + | | | | | | |
| Nymphalidae | <i>Byblia iliti</i> | Joker | N | VU | + | | | + | | | |
| Nymphalidae | <i>Danaus chrysippus</i> | Plain tiger | N | LC | + | | | + | + | | + |
| Nymphalidae | <i>Danaus genutia</i> | Common tiger | N | LC | + | | | | | | |
| Nymphalidae | <i>Euploea core</i> | Common crow | N | LC | + | | | | + | | + |
| Nymphalidae | <i>Hypolimnas bolina</i> | Great eggfly | N | LC | + | | | + | | | |
| Nymphalidae | <i>Hypolimnas misippus</i> | Danaid Eggfly | N | LC | + | | | | | | |

| Family | Scientific Name | Common Name | TS | NCS | JP | KA | EL | DL | PU | KY | MA |
|----------|---------------------------|-------------------------|----|-----|----|----|----|----|----|----|----|
| Pieridae | <i>Deltias eucharis</i> | Jezebel | N | LC | + | | | | + | + | |
| Pieridae | <i>Eurema blanda</i> | Three-spot grass yellow | N | LC | + | | | | | | |
| Pieridae | <i>Eurema hecabe</i> | Common grass yellow | N | LC | + | + | + | | + | | + |
| Pieridae | <i>Hebomoia glaucippe</i> | Great orange tip | N | LC | + | | + | | | | |
| Pieridae | <i>Ixias marianne</i> | White orange tip | N | LC | + | | | + | | + | |
| Pieridae | <i>Leptosia nina</i> | Psyche | N | LC | + | | | + | + | | + |