

# Spatial Distribution of Insects from Order Lepidoptera in and around Proposed Nuclear Power Plant Site at Jaitapur, Maharashtra, India

Kadam GH, Chougule AA, Raut GA and Raut PD\*

Department of Environmental Science, Shivaji University, Kolhapur, India

\*Corresponding Author E-mail: [ganeshkadam88@gmail.com](mailto:ganeshkadam88@gmail.com), [drpdraut@yahoo.co.in](mailto:drpdraut@yahoo.co.in).

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## ABSTRACT

Invertebrates are an important component of native ecosystems. They are sensitive to changes in the habitat, and are easily sampled in large numbers. Therefore, a study is undertaken to study impacts of disturbance on fragmented habitats. India being a tropical country has a very rich insect fauna which comprises more than 80% of the known species of the world fauna. In the present study, during the period 2014-2017, a genuine effort has been made to document the invertebrate fauna from the proposed nuclear power plant site at Jaitapur, Maharashtra. The order Lepidoptera contains Butterflies and Moths (scaly winged insects). In the present study a total of 81 species belonging to 14 families, 73 genera were identified and recorded. The dominant butterflies like Common grass Yellow (*Eurema hecabe*), Comom bushbrown (*Mycalesis perseus*), Dined eggfly (*Hypolimnas misippus Linnaeus*), Chocalate Pancy (*Junonia lemonias*), Common Pierot (*Castalius rosimon*) were observed during the study. The percentage occurrences of the family from the study area were observed from the order Lepidoptera. The Nymphalidae family observed maximum 18 species (22%) in the study area, which is the predominant family. The spatial distribution of the observed species was shown with the help of GIS tool.

**Keywords:** Lepidoptera, Butterflies, GIS, Spatial Distribution, Jaitapur.

## INTRODUCTION

The order Lepidoptera encompass with Butterflies and Moths, which are the most common insects of the forest ecosystems and agricultural fields and are known as the biological indicators of the ecosystem. Lepidoptera is the second largest and the most diverse order of the class Insecta (Bharamal, 2015). The order Lepidoptera consists of 2, 55,000 - 2, 65,000 recognized species worldwide and only about 7.5% of them are butterflies (Jaret *et al.*, 2014). Approximately 1,800 species and sub-species of butterflies are found in India (Kunte *et al.*, 2014). Butterflies are considered as one of the best taxonomically studied group of insects (Nair *et al.*, 2014). They are present in

most terrestrial ecosystems, where some of the species play an important role in pollinating various species of plants and some butterfly species are economically important as pests of cultivated plants. Butterflies provide valuable information on the health and viability of natural ecosystems (Gajbe, 2016).

Owing to habitat destruction for developmental activities in urban environment and unscientific management of natural resources, much of our native butterflies are fast disappearing and at present, their survival is under threat. Unfortunately developmental activities and resulting habitat fragmentation create threats to the survival of butterflies' worldwide (Gaikwad *et al.*, 2015).

The current study area is around 30 km radius of the proposed nuclear power plant at Jaitapur (JNPP) Dist. Ratnagiri, Maharashtra, India. The study area is on the coastal region. The actual nuclear power plant installation process has been started in the Mithagavane village. Mithagavane village is situated in Rajapur tahasil of Ratnagiri district in Maharashtra state. The present study highlights on baseline survey of Order Lepidoptera around proposed JNPP site and spatial distribution with ArcGIS in study area.

## MATERIAL METHODS

### Study Area:

The actual location of the study area is proposed nuclear power plant N 16° 36' 18.6" and E 73° 19' 18.8" and average elevation is 80 meters. The site is adjoining the sea coast and is mostly a barren stretch of land with

sparse savanna vegetation. In 30 km radial area, various land uses like scrub forests, agriculture, and creeks are found. The highest annual rainfall of 4589 mm occurs in Rajapur Town. The main study area was divided in to 3 zones namely 0 – 5 Km (Core zone), 5 – 15 Km (Buffer zone-I) and 15 – 30 Km (Buffer zone - II) as per BRNS guidelines. For the present investigation Core zone was selected for 100 % survey to record the biodiversity while Buffer zone I and buffer zone II the area coverage was 10 % and 5 % respectively.



**Fig: 1 Study sites of Order Lepidoptera at JNPP Area**

### Methodology:

For sampling of butterflies, line transect of variable length is used widely. Generally, 500 m to 1 km transect laid in all the habitats. Butterflies seen 5 m on either side of this transect will collect with the net sweeps and noted down. Butterflies were photographed from different angles as often as possible to obtain sufficient photographs to enable positive identification of species. Photographs were taken with a DSLR Camera D90 with lens 18-105 mm.



**Plate 1: Butterfly collection and Light trap for the insect collection from the study area**

Light traps are generally used for sampling of moths. In the light trap, a high power florescent or mercury lamp is light behind 1m x 1m white cloth. The moths are attracted towards this light and can be handpicked. The duration of the sampling varies. If it is a high moth density area, then a shorter duration may be up to 1 hr is sufficient. If the area is less diverse and low abundance, then longer duration up to 5 hrs should be sampled.

## RESULTS & DISCUSSION

As the observations from the Lepidoptera order shows the maximum number i.e. 81, which consist of dominant butterflies like Common grass yellow (*Eurema hecabe*), Comom bushbrown (*Mycalesis perseus*), Dined eggfly (*Hypolimnas misippus Linnaeus*), Chocalate Pancy (*Junonia lemonias*), Common Pierot (*Castalius rosimon*). These butterflies observed throughout year in the study area. The percentage occurrences of the family from the study area were observed from the order Lepidoptera. The Nymphalidae family observed maximum 18 species (22%), which is a predominant family. Other families also observed subsequently like Erebidae 16 species (20%), Spingidae 9 species (11%), Lycaenidae 7 species (9%), Pieridae 6 species (7%), Pyralidae 5 species (6%), and Crambidae 5 species (6%). Remaining families were observed in the study area but species number is lower than 5 and percentage is also below 5.).

As zone wise study also carried out of Lepidoptera order, which consist of 14 families. In Core zone 40 species, Buffer zone –I 63 species, and Buffer zone –II 51 species were reported. Out of the 14 families of Lepidoptera 13 families were observed in the Core zone, and Nymphalidae family was predominantly recorded with 8 species i.e. 20%. In Buffer zone-I 63 species of Lepidoptera were reported from the 14 families and Nymphalidae family was predominantly recorded with 14 species i.e. 22%.

After completion of study from Buffer zone II for Lepidoptera order in all 14 families, Nymphalidae family was predominantly recorded with 10 species i.e. 20%. As the other zones like Core zone and Buffer zone – I Erebidae 8 species with 16%, Spingidae 6 species with 12%, Pieridae, Lycaenidae, Geometridae 4 species with 8%, Papilionidae, Crambidae, Eupterotidae 3 species with 6% the remaining families were observed 1 to 2 species with 2 to 4% respectively (Table 1).

Percentage of the relative abundance of top 10 predominant butterfly species have studied and shown in graphical form (Fig. 2). As the represented in graph Common grass Yellow (*Eurema hecabe*) shown the maximum percentage (31%) in study area, followed by Common bushbrown (*Mycalesis perseus*) 14%, Dined eggfly (*Hypolimnas misippus Linnaeus*) 11%, Chocalate Pancy (*Junonia lemonias*) 10%, Common Pierot (*Castalius rosimon*) and Yam fly (*Loxura atymnus*) 8%,

**Table: 1 Percent occurrence of Lepidoptera in different zones during the study period at Jaitapur.**

Family	Species	%	Core	%	BZ-I	%	BZ-II	%
Nymphalidae	18	22	8	20	14	22	10	20
Papilionidae	3	4	2	5	3	5	3	6
Pieridae	6	7	3	8	5	8	4	8
Lycaenidae	7	9	2	5	4	6	4	8
Riodinidae	1	1	1	3	1	2	1	2
Pyralidae	5	6	2	5	4	6	2	4
Crambidae	5	6	2	5	3	5	3	6
Eupterotidae	3	4	2	5	3	5	3	6
Saturniidae	1	1	0	0	1	2	1	2
Spingidae	9	11	5	13	6	10	6	12
Uranidae	1	1	1	3	1	2	1	2
Geometridae	4	5	6	15	4	6	4	8
Erebidae	16	20	5	13	12	19	8	16
Noctuidae	2	2	1	3	2	3	1	2
	<b>81</b>	<b>100</b>	<b>40</b>	<b>100</b>	<b>63</b>	<b>100</b>	<b>51</b>	<b>100</b>



**Plate 2: Photographs of the butterflies observed at JNPP Area**

**A.**Common Leopard, **B.** Common pierrot, **C.** *Cepora nerissa* **D.** *Cigaritis vulcanus*, **E.** *Rathinda amor*, **C.** *Caleta caleta*, **D.** *Junonia lemonias*, **E.** *Hypolimnas bolina* (M), **F.** *Hypolimnas misippus* (F), **G.** *Junonia orithya*, **H.** *Mycalesis perseus*, **I.** *Abisara echerius*, **J.** *Neptis hylas*, **K.** *Loxura atymnus* ,**L.** *Pachliopta hector*, **M.** Dart Spp., **N.** Palm Dart, **O.** Dart Spp, **P.** *Maxates* spp., **Q.** *Chiasmia eleonora*, **R.** *Eupterote mollifera*, **S.** *Cretonotos* spp., **T.** *Eupterote lineosa*

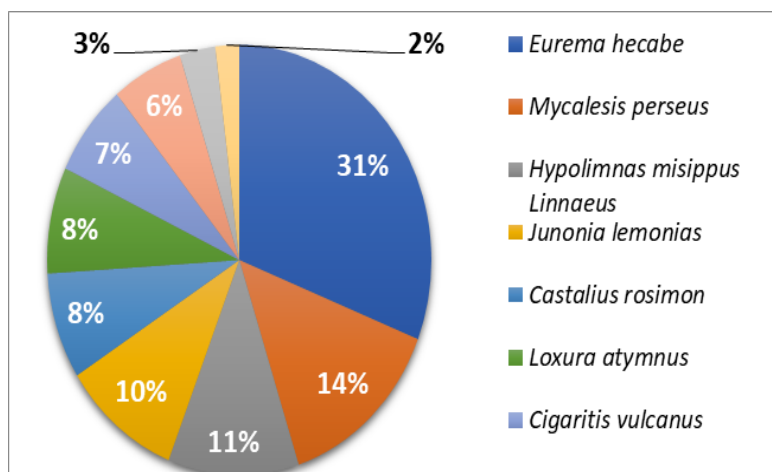


Fig. 2: Relative abundance of Predominant species of Butterfly recorded during the study period.

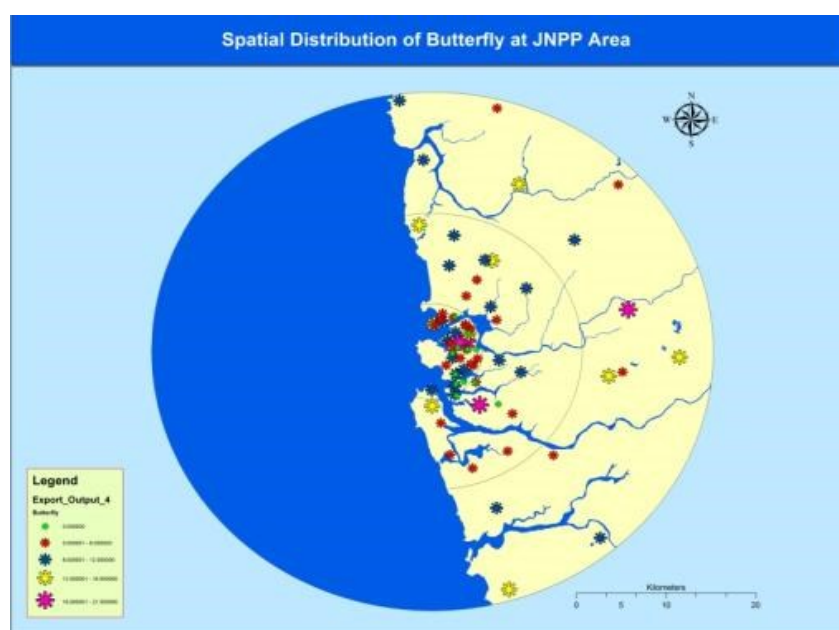


Fig. 3 Spatial Distribution of Order Lepidoptera observed at the JNPP

Crimson Rose (*Cigaritis vulcanus*) 7%, Comom gull (*Cepora nerissa*) 6%, Common Silverline (*Cigaritis vulcanus*) 3%, Blue Pancy (*Junonia orithya*) 2% were observed.

Geographical information systems (GIS) can provide the appropriate technology to organize and analyze the complex spatial data essential for a more complete understanding of species habitat requirements. In present study the spatial distribution of Lepidoptera order from the study region shown with ArcGIS Software. The image shown 5 classes of lepidoptera from study area with the classes of 0 to 21 numbers of species observed during study period. The spatial observations made clear idea about the observations of the Order Lepidoptera in various zones of study area.

## CONCLUSION

The findings of the present study underline the importance of Lepidopteron in the developmental activities from region and as a preferred habitat for butterflies. Butterfly diversity varies with seasons. The study provides to establish the butterfly and moth from study region. Study highlight on the total number observed before activity and also provides baseline data to the future study. This data will help to understand status of butterflies and moths activity in study area before establishing the proposed Nuclear Power Plant at Jaitapur (JNPP) Dist. Ratnagiri, Maharashtra, India. This study will also add to our future attempts in understanding the complex nature of mutualistic

interaction between butterflies and environment that is essential for continuity of ecosystem services.

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