

Butterfly Species Abundance in Agricultural fields of Vadodara, Gujarat with Special Emphasis on the Conservation of Complementary Plantations

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Abstract: *Interdependent relationship of butterflies and plants is inevitable for their own successful co-existence. Agricultural fields of Vadodara, adjoining trees and shrubs serve as host complementary plants for butterflies. The objective of this study was to observe the abundance of butterfly species in the agricultural fields along with important implications for complementary plantations like shrub *Lantana camara* and *Calotropis procera* which serve as pollinating grounds and host plants for butterflies. Moreover, family wise distribution of butterflies was also documented to support the species abundance. The study was carried out for a period of two years i.e. June 2012 to June 2014. Results suggest that agricultural fields sustain butterfly species i.e. *Charaxes solon* which was found feeding on rotten, *Musa paradisiaca* in banana fields and outlined fenced complementary plantation, harbours *Graphium agamemnon* on *Alstonia scholaris*, *Ficus benghalensis*, *Mangifera indica*. The bed of *Alternanthera pungens* serves as basking cot for butterflies like *Danaus chrysippus*, *Junonia lemonias*. This study is a special attempt to accelerate the conservation campaign in cultivating more of such complementary plants for holding up life of butterflies.*

Keywords: Agricultural fields, Butterflies, Complementary plantations, Chhani, Gujarat

1. Introduction

Among all diverse insects, butterflies are one of the most common and colourful insects known from kids to adults, naturalists and budding researchers. Butterflies serve as functional pollinators and pollination is important process in all most all productive terrestrial ecosystems [9]. These flying jewels also bag importance in performing ecological roles in various habitats.

Butterflies and plants share a unique inter-relationship with each other and hence possess specific host specificity. Co-evolutionary studies were carried out between butterflies and plants and thus highlight the inevitable interrelationship between them [11]. Similarly, butterflies are peculiar for its habitat too. But, habitat fragmentation has led to the patchy distribution of butterflies. Among such fragmented habitats, agricultural fields and its surrounding complementary vegetation avail plant resources to butterflies. Agro-landscape butterflies reflect the transformations which take place in nature and thus are characterised by few species which are successfully adapted [10]. Thus, there is a need to set up an objective related to agricultural landscape to maintain and enhance biodiversity [12]. Essential ecosystem services like recycling of nutrients (N, P, K) highly required by crops are carried out by butterflies [1] which were previously absorbed and up taken from plants. Leaves of wild plants located in the agricultural systems are fed by larval stages of these butterflies and hence the faeces released by them contain important nutrients [8].

Thus, The present study is an attempt to study butterfly abundance in agricultural fields and to encourage the cultivation of inter-related complementary plantations.

2. Materials and Methods

2.1 Study Area

The present study on butterflies and complementary plantations were carried out in the agricultural fields of Chhani. Chhani is situated 15 kms to the north in Vadodara city located in Gujarat state of India. The average temperature at the study site was 36 °C maximum and 19° C minimum with 55-65 % relative humidity. The study sites were visited once a month for a period of two years. The cultivated crops in the agricultural fields were observed during the study period. The outline fencing plantations were also noted during the same.

2.2. Observations and Collection of Butterflies

Agricultural fields were visited once a month for observations on butterfly abundance. Observations were made in the morning hours between 9:00am -12:00 noon and 3:00-6:00 pm. Butterflies were observed along the pedal paths which separate two agricultural fields and were observed on both the sides of the paths. Visual observations and aerial net method were used to monitor butterflies. Depending on the number of sightings, abundance of butterfly species were categorised into Very Common (>25 sightings during the entire study period), Common (10-25 sightings) and Rare (1-5 sightings). Butterflies were identified on the field site itself and if not identified were collected using aerial sweep net. The butterflies were identified using standard field guides and references [2], [5-7].

3. Results and Discussion

3.1 Butterfly species abundance

A total of 33 different species of butterflies belonging to 23 genera and 4 families were recorded in agricultural fields of Vadodara (Table 1). Amongst all, butterfly species belonging to family Nymphalidae were maximum i.e. 12 species of butterflies (36.36%), followed by Pieridae i.e. 11 species (33.33%). 5 species of butterflies each belonging to Papilionidae (15.15%) and Lycaenidae (15.15%) were recorded in Table 2 & represented in Figure-1. During the study, 13 species of butterflies were found to be common, 12 species to be very common and 8 species of butterflies to be rare as depicted graphically in Figure 2. Amongst Nymphalids, Plain tiger (*Danaus chrysippus*), Common Indian Crow (*Euploea core*) and the castors (*Ariadne ariadne* and *Ariadne merione*) were found to be very common. *Catopsilia pomona* and *Catopsilia pyranthe* were found to be very common amongst the pierids. Low flying Grass yellows were prominently observed during active early mornings. In Papilionidae family, *Graphium agamemnon* and *G. doson* were the frequent visitors searching for nectar.

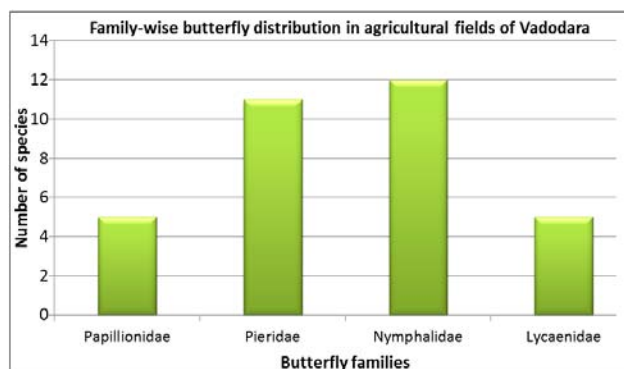


Figure 1: Family-wise butterfly distribution in agricultural fields of Vadodara

3.2 Agricultural crops at Chhani

The major agricultural crops cultivated in Chhani are listed in Table-3. Along with the agricultural crops, the complementary plantations like trees and shrubs were also observed which are listed in Table-4. Agricultural fields of Chhani serve as good source for fresh green leafy vegetables and cotton crops.

A total of 13 different species of vegetables and agricultural crops were cultivated in agricultural fields. Members of Brassicaceae like Cabbage, Cauliflower and Radish are consumed more often by people and thus cultivated as edible crop in Chhani region of Vadodara, Gujarat.

Leafy vegetables like Spinach, Fenugreek and Coriander belonging to families like Amaranthaceae, Fabaceae and Apiaceae dominate the winters. Among fruits, Papaya (*Carica papaya*) and Banana (*Musa paradisiaca*) belonging to Caricaceae and Musaceae were cultivated in the fields (Table 3). Fruits like Mango, Guava, Chikoo and Custard Apple were also cultivated as complementary plantations surrounding the agricultural fields.

3.3 Complementary Plantations and Butterflies at Chhani

A total of 15 different species of plants were observed fencing the outline of agricultural fields of Vadodara as systematically listed in figure 4. *Azadirachta indica*, *Ficus benghalensis* and *Ficus religiosa* were found all year around surrounding the agricultural fields. Seasonal bloom of *Cassia fistula* gives the visually pleasant occurrence of emigrants. *Aegle marmalos* commonly known as Bael serves as the host plant for Lime butterfly (*Papilio demoleus*). *Lantana camara* one of the most invasive plant species serves as important source of nectar for *Catopsilia pomona*, *Catopsilia pyranthe*, *Cepora nerissa* and *Colotis amata*. Moreover, presence of *Calotropis procera* as one of the complementary plantation also serves as host plant for *Danaus chrysippus*. Nymphalid butterfly Black Raja *Charaxes solon* exhibited the tendency to over ripen fruits like *Musa paradisiaca*. It is said that fruit feeding butterflies use their odour cues to locate the fruits and fermented products [4]. Amongst the wild vegetation, *Tridax procumbens* and *Alternanthera pungens* serves as basking sites for butterflies like *Junonia lemonias* and *Danaus chrysippus*.

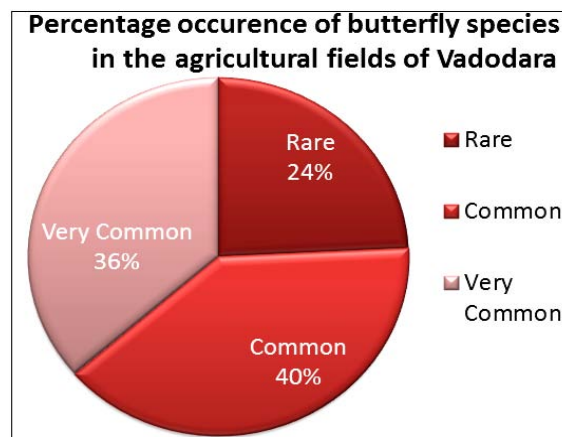


Figure 2: Percentage occurrence of butterfly species in agricultural fields of Vadodara

The presence of such complementary plantations functions as suitable ground for butterfly abundance. Moreover, these plantations serve as substitution for insect pests and thus have the tendency to divert them from the main agricultural crop to these outline vegetation. This in turn, prevents the loss of crop production. Looking to the other side, such corresponding plantations especially huge trees like *Azadirachta indica* and *Mangifera indica* provide shade to the local farmers during summers. Apart from complementary plantations, agricultural sites prove to be good abode for wild vegetation that keeps up the butterfly and other insect abundance.

Table 1: Genus & Species composition of butterflies in agricultural fields of Vadodara

Family	Genus	Species
Papilionidae	3	5
Pieridae	7	11
Nymphalidae	8	12
Lycaenidae	5	5
Total	23	33

Table 2: List of documented butterfly species in agricultural fields of Vadodara

Sr. No.	Family	Scientific name	Common name	Occurrence
1	Papilionidae	<i>Pachliopta aristolochiae</i> Fabricius	Common Rose	Rare
2		<i>Graphium doson</i> C& R Felder	Common Jay	Common
3		<i>Graphium agamemnon</i> Linnaeus	Tailed Jay	Very common
4		<i>Papilio demoleus</i> Linnaeus	Lime butterfly	Common
5		<i>Papilio polytes</i> Linnaeus	Common Mormon	Very common
6	Pieridae	<i>Catopsilia pomona</i> Fabricius	Common Emigrant	Very common
7		<i>Catopsilia pyranthe</i> Linnaeus	Mottled Emigrant	Very common
8		<i>Eurema hecabe</i> Linnaeus	Common Grass Yellow	Very common
9		<i>Eurema brigitta</i> Stoll	Small Grass Yellow	Very common
10		<i>Delias eucharis</i> Drury	Common Jezebel	Common
11		<i>Cepora nerissa</i> Fabricius	Common Gull	Very common
12		<i>Belenois aurota</i> Fabricius	Pioneer or Caper White	Very common
13		<i>Ixias marianne</i> Cramer	White orange tip	Common
14		<i>Ixias pyrene</i> Linnaeus	Yellow Orange tip	Common
15		<i>Colotis danae</i> Fabricius	Crimson tip	Common
16		<i>Colotis amata</i> Fabricius	Small salmon arab	Common
17	Nymphalidae	<i>Acraea violae</i> Fabricius	Tawny coster	Common
18		<i>Danaus chrysippus</i> Linnaeus	Plain Tiger	Very common
19		<i>Euploea core</i> Cramer	Common Crow	Very common
20		<i>Ariadne ariadne</i> Moore	Angled Castor	Very Common
21		<i>Ariadne merione</i> Cramer	Common Castor	Very Common
22		<i>Hypolimnas bolina</i> Drury	Great Eggfly	Rare
23		<i>Hypolimnas misippus</i> Linnaeus	Danaid Eggfly	Rare
24		<i>Junonia almana</i> Linnaeus	Peacock Pansy	Rare
25		<i>Junonia lemonias</i> Linnaeus	Lemon Pansy	Common
26		<i>Junonia orithya</i> Hubner	Blue Pansy	Rare
27		<i>Melanitis leda</i> Linnaeus	Common Evening Brown	Common
28		<i>Charaxes solon</i> Fabricius	Black rajah	Common
29	Lycaenidae	<i>Spindasis vulcanus</i> Fabricius	Common Silverline	Rare
30		<i>Castalius rosimon</i> Fabricius	Common Pierrot	Rare
31		<i>Chilades pandava</i> Horsfield	Plains Cupid	Common
32		<i>Leptotes plinius</i> Fabricius	Zebra blue	Common
33		<i>Curetis thetis</i> Drury	Indian Sunbeam	Rare

Table 3: List of Agricultural and Vegetable crops in Agricultural fields of Vadodara

Sr. No.	Family	Botanical Name	Common Name
1	Amaranthaceae	<i>Spinacia oleracea</i> L.	Spinach
2	Apiaceae	<i>Coriandrum sativum</i> L.	Coriander
3	Brassicaceae	<i>Brassica oleracea</i> L. var. <i>capitata</i> L.	Cabbage
4	Brassicaceae	<i>Brassica oleracea</i> var. <i>botrytis</i> L.	Cauliflower
5	Brassicaceae	<i>Raphanus sativus</i> L.	Radish
6	Caricaceae	<i>Carica papaya</i> L.	Papaya
7	Euphorbiaceae	<i>Ricinus communis</i> L.	Castor
8	Fabaceae	<i>Trigonella foenum-graecum</i> L.	Fenugreek
9	Malvaceae	<i>Abelmoschus esculentus</i> (L.) Moench	Okra
10	Malvaceae	<i>Gossypium hirsutum</i> L.	Cotton
11	Musaceae	<i>Musa paradisiaca</i> L.	Banana
12	Poaceae	<i>Triticum aestivum</i> L.	Wheat
13	Solanaceae	<i>Solanum tuberosum</i> L.	Potato

Table 4: List of complementary plantations around agricultural fields of Vadodara

Sr. No.	Family	Botanical name	Common name
1	Anacardiaceae	<i>Mangifera indica</i> L.	Mango
2	Annonaceae	<i>Annona squamosa</i> L.	Custard Apple
3	Apocynaceae	<i>Alstonia scholaris</i> L. R. Br.	Indian Devil tree
4	Asclepidiaceae	<i>Calotropis procera</i>	Milkweed Plant
5	Fabaceae	<i>Albizia saman</i> L. Muell	Rain tree
6	Fabaceae	<i>Tamarindus indicus</i> L.	Indian Date
7	Fabaceae	<i>Cassia fistula</i> L.	Golden shower
8	Meliaceae	<i>Azadirachta indica</i> A. Juss.	Indian Lilac
9	Moraceae	<i>Ficus benghalensis</i> L.	Indian Banyan
10	Moraceae	<i>Ficus religiosa</i> L.	Sacred Fig
11	Myrtaceae	<i>Psidium guajava</i> L.	Common Guava
12	Rutaceae	<i>Aegle marmalos</i> (L.) Correa	Stone apple
13	Rutaceae	<i>Murraya koenigii</i> (L.) Sprengel	Curry tree
14	Sapotaceae	<i>Manilkara zapota</i> (L.) P. Royan	Chikoo
15	Verbenaceae	<i>Lantana camara</i> L.	Wild sage

4. Conclusion

The drift of butterfly abundance from the mainland agricultural fields to the outlined plantation fencing is due to the irregular pesticide usage by the local farmers. Farmers use pesticide to an extent to get immediate rid from insect pests. But in such practices, the beneficial insects like butterflies and bees are targeted. Thus, along with habitat fragmentation, pesticide utilization has also become one of the factors in declining of butterfly population [13].

Along with that, nectar resource and host plant requirements are fulfilled by such complementary plantations. Thus, Conservation strategies should be put forward to prevent the chopping of such trees that serve as host plants for butterflies. Thus, there is a need to encourage ecologically sound and sustainable management practices in agriculture [3]. Henceforth this study is a special attempt to accelerate the conservation campaign in cultivating more of such complementary plants for holding up life of butterflies.

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