

Effectiveness and Importance of Butterflies as Pollinators to the Flowers of *Ixora Coccinea*

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1. INTRODUCTION

Pollination is one of the most important types of interaction between plants and animals in ecosystems because it is a key process in the sexual reproduction of most angiosperms and can affect directly the plant reproduction success (Dafni, 1992; Kearns and Inouye, 1993). The presence of different pollinators with different efficiencies influences the seed-set and the quality of descendants (Herera, 2000). This is an important issue, if we consider the possible variation in the assemblages of pollinators, due to the presence and spread of invasive introduced species. The process of transportation of pollens from stamens to the ovary is called pollination. A great majority of flowers that we see around us today are insect pollinated or entomophilous.

Flowers can attract pollinators by providing ample nectar of the right composition, and by advertising this nectar by deep shape and recognizable floral patterns, by providing excess pollen as food, or by providing shelter or a place to raise young (Faegri and Vander Pijl 1971).

“The shape and colors of the flowers, their scent, their location on the stalks, the season and duty schedule of their pollen and nectar offerings, as well as other qualities we admire but seldom understand, are adjusted precisely to attract particular species of insects; and those specialists in turn, whether beetles, butterflies, bees or some other group are genetically adopted to respond to certain kinds of flowers” (Wilson 1999).

North East India accounts for nearly a two-third (962 species) (Evans, 1932) of the India's total butterfly species. The present work is carried out in Nambor Wild Life Sanctuary of Assam.

Ixora is a genus of flowering plants in the Rubiaceae family. It consists of tropical evergreen trees and shrubs and holds around 500 species. Though native to the tropical and subtropical areas throughout the world, its centre of diversity is in Tropical Asia. Red *ixora* flowers are commonly used in Hindu worship, as well as in Indian folk medicine.

I. coccinea is a dense, multi-branched evergreen shrub, commonly 4–6 ft (1.2–2 m) in height, but capable of reaching up to 12 ft (3.6 m) high. It has a rounded form, with a spread that may exceed its height. The glossy, leathery, oblong leaves are about 4 in (10 cm) long, with entire margins, and are carried in opposite pairs or whorled on the stems. Small tubular, scarlet flowers in dense rounded clusters 2-5 in (5–13 cm) across are produced almost all year the flowers, leaves, roots, and the stem are used to treat various ailments in the Indian traditional system of medicine, the Ayurveda, and in various folk medicines. The fruits, when fully ripe, are used as a dietary source. long.

We studied (a) the number and diversity of visitors and pollinators, (b) behavioural aspects of visitors and pollinators (time spent in each flower, number of flowers visited), and (c) fruit-set, i.e., the proportion of flowers that set fruit, and seed-set, i.e., the number of viable seeds produced by fruit.

2. MATERIAL AND METHODS

2.1. Study Area

Study area is Nambor Wild Life Sanctuary, Assam. : Nambor Wild Life Sanctuary is a protected area located at Golaghat and Karbi Anglong district of Assam in India. This life sanctuary covers an are of 37 Km². This moderately sized sanctuary is 25 Km from Golaghat and 65 Km from the renowned Kazairanga National Park. This sanctuary is also bordered by other nearby wild life Sanctuary like Garampani Wild Life Sanctuary, Karbi Anglong Wilde Life Sanctuary and East Karbi Anglong Wild Life Sanctuary. The area was declared as a sanctuary on 27 July 2000. Its geographic location is 26⁰23'43'' N 93⁰52'57'' E coordinates.

2.2. Diversity and Abundance of Flower Visitors

The pollinating insect survey was done in each month of the year to find out the data for various analysis. The survey was carried out from March 2010 to December 2011 covering an area of 37 sq.km using the methods of Pollard et al. (1975). Butterflies observed in the line transects were either caught with aerial net or photographed for identification. The Butterflies were identified in the field condition using the keys of Evans (1932), Wynter-Blyth (1957), Haribal (1992) and Kehimkar (2008).

2.3. Fruit-Set and Seed-Set

Effectiveness of insect pollinators was measured by number of fruits produced by plants that exposed to pollinators compared with fruits produced by covered plants. Before flowering, some plants were covered by using insect screen, while some other plants were uncovered. After 30 days of fruiting period, the number of fruits per plant, fruits per bunches, fruit diameters, seeds per fruit, and seeds weight were counted

3. RESULTS

3.1. Diversity and Abundance of Flower Visitors

Table 1. Butterflies along with their family associated with *Ixora coccinea* plants in Nambor Wildlife Sanctuary, Assam

Common name	Scientific name	Family
Common mormon	<i>Papilio polytes</i>	Papilionidae
Yellow helen	<i>Papilio nephelus</i>	Papilionidae
Common blue bottle,	<i>Graphium serpedon</i>	Papilionidae
Common batwing	<i>Atrophaneura varuna</i>	Papilionidae
Lime butterfly	<i>Papilio demoleus</i>	Papilionidae
Great mormon	<i>Papilio memnon</i>	Papilionidae
Common mime	<i>Chilasa clytia clytia</i>	Papilionidae
Common birdwing	<i>Triodes helena</i>	Papilionidae
Common rose	<i>Atrophaneura astolochiae</i>	Papilionidae
Tailed jay	<i>Graphium agamemnon</i>	Papilionidae
Common jay	<i>Graphium doson</i>	Papilionidae
Common raven	<i>Papilio castor</i>	Papilionidae
Monarch	<i>Danaus plexippus</i>	Nymphalidae
Common grass yellow	<i>Eurema hecabe</i>	Pieridae
Yellow orange tip	<i>Ixias pyrene</i>	Pieridae
Great orange tip	<i>Hebomoia glaucippe</i>	Pieridae
White orange tip	<i>Ixias marianne</i>	Pieridae
Mandarian Blue	<i>Charana mandarinus</i>	Lycaenidae
Lesser grass blue	<i>Zizina otis</i>	Lycaenidae

Some of the photographs are given



3.2. Fruit-Set and Seed-Set

Table 2. Comparison of covered and uncovered fruit set of some plants

Sl. No	Plant component	Field Plant	
		covered	uncovered
1	Fruit/bunch	2.11b	9.42a
2	Fruit/plant	8.13b	26.30a
3	Seed set/plant	232b	826a
4	Seed weight/plant	20.41b	119.39a

The different alphabet in some row showed significant different with T-test level 95%.

4. DISCUSSION

From the above study it is seen that the butterflies of papilionidae family were seen in highest number associated with the flowers of *I.coccinea*. Butterflies have Siphoning mouthparts, the proboscis consist of paired galea which during feeding fit together to form a tube that is used to suck up nectar. *I.coccinea* flowers are Tubular flowers, which are up to 5cm (2 inch) long and fiery red, open at the month into four petals arranged in the form of a cross about a centimetre (0.4 inch) wide. The entire flower head has a diameter of 8-12cm (3-5 inch). So the butterfly mouthpart fits with the flower structure, this is in conformity with the findings reported by Muthoka and Mananze, Schemske, (1976); Weiss (1995), who stated that butterflies were most potent pollinator of flowers like Lantana and *Ixora*. Flowers produce nectar to ensure insects visit them and in doing act as pollinators for the plant moving.

The flowers that were left uncovered show high seed and fruit set compared to the covered ones. This is because the pollinators were able to nectar on the uncovered ones and during nectaring perform the process of pollination. It showed that seeds set from xenogamy have a higher potential germination than from geitonogamy pollination. Xenogamy pollination enabled the mixed of genetics material from two different plants, resulted high genetics diversities and maximize its fitness. Mohr et al. (1995) reported genetics diversities result the hybrid vigor to maximize the growth and crops. Our result concluded that butterfly pollination increasing the number of fruits per plant and fruits per bunch.

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