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EVALUATING POLLINATOR EFFECTIVENESS ON *TAGETES PATULA* LINNAEUS

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INTRODUCTION

Genda (***Tagetes patula*** Linnaeus, Family Asteraceae) is an erect, branched and hardy annual, usually growing about 60 cm high. Flowers of one solid colour, the typical colour being lemon yellow, but it ranges from a light sulphur yellow to a deep orange. Recently, commercial cultivation of marigold in India has risen to an estimated 13,000 hectares with annual production of 200,000 tones of flowers, the highest for any flowers grown in India. This increasing demand of growing *Tagetes* is not due to only religious or social purposes but for its valuable essential oil components.

In view of above, a study was conducted in an unmanaged Marigold field in Bhaduri village, district Nadia, West Bengal. Altogether 32 species of 4 orders of insect flower visitors were recorded from the *Tagetes patula* of them Lepidoptera group had highest number of species followed by Diptera, Hymenoptera and Coleoptera (Table-1).

Pollinator efficiency of different insect pollinators may be evaluated on the basis of number of characteristics. This study reveals that lepidopterans are the effective group of pollinators on the basis of foraging speed followed by Diptera and Hymenoptera and hymenopterans are the effective pollinator group on the basis of foraging rate followed by Diptera and Lepidoptera. But if we consider both the criteria (foraging speed and rate) for evaluating the effectiveness for a pollinator species then Diptera as a whole may be the effective pollinator group of *Tagetes patula* Linnaeus.

MATERIALS AND METHODOLOGY

Diurnal abundance of insect flower visitors was monitored in three selected plots of each 144 sq ft area. The flower visitors were collected throughout the day from each study plot on November, 2007 and January, 2008. Flower visitors were counted by individuals collected by a sweep net of 30 cm radius. Insects were preserved for taxonomic identification in the laboratory of Zoological survey of India, Kolkata. In this study the measurement of effectiveness was considered on the basis of foraging speed (time spent per flower) and foraging rate (number of flowers visited per unit of time).

RESULTS AND DISCUSSION

Total 32 species of 4 different groups were recorded from the study area (Table-1). Lepidoptera group had highest number of species (19 species) followed by Diptera (6 species), Hymenoptera (5 species) and Coleoptera (2 species). The total numbers of individuals in the two study periods were added and the values were mentioned species-wise for different quadrats (Table-1).

Table-2 shows that group diversity in three different plots were almost same. Evenness values are almost same in three different plots, which clearly indicate that all the species reported here are also commonly distributed in three different plots. On the other way, it can be stated that the less numbered species group like Hymenoptera and Coleoptera and maximum numbered species group like Lepidoptera and Diptera are evenly distributed in all the three study plots.

Table-1 : List of insects as the flower visitor of *Tagets patula*

Group	Species	Q1	Q2	Q3
Lepidoptera	*Neptis sp*	15	13	9
	Moduza procris	11	8	6
	Hypolimnas misipus	6	7	8
	Danaus chrysippus	8	9	7
	Junonia almana	9	7	5
	Catopsilila pomona	4	4	2
	Précis atlites	10	10	9
	Nototcrypta curvifascia	7	5	5
	Euploea core	4	3	2
	Suastus gremius	8	8	8
	Barbo cinnara	4	2	1
	Euthalia aconthea	12	10	8
	Leptosia nina	6	4	3
	Ypthima huebneri	4	2	0
	Appias sp.	2	1	0
	Ariadne ariadne	4	1	2
	Danus genutia	5	6	6
	Eurema sp.	11	10	10
	Papilio polites	4	2	1
Hymenoptera	*Apis dorsata*	16	15	18
	Apis florae	12	10	9
	Ceratina sp.	3	1	0
	Eumerus sp	8	5	6
	Polites s.	12	8	9
Diptera	*Eristalinus arvorum*	12	17	16
	Mesembrius bengalensis	18	19	17
	Orthellia timorensis	14	12	8
	Musca ventrosa	8	7	3
	Lucilia sp.	13	11	12
	Eristalinus laetus	18	16	16
Coleoptera	*Menochilus sexamaculatus*	11	11	11
	Pullus pyrochilus	4	4	1

(Q1= Quadrat 1; Q 2= Quadrat 2; Q 3= Quadrat 3)

Table-2 : Diversity and evenness indices of different order and species in three study quadrats

Indices	Q1		Q2		Q3	
	Order	Species	Order	Species	Order	Species
Diversity	1.178	3.335	1.186	3.261	1.207	3.153
Evenness	0.209	0.591	0.215	0.591	0.224	0.586

Q1= quadrat 1; Q2= quadrat 2; Q3= quadrat 3

Considering the maximum time spends (group wise) on a single flower, the coleopterans are the predominant group. In the present study *Menochilus sexamaculatus*, *Pullus pyrochilus* of Coleoptera spend maximum time on the flowers, but they touched only one flower throughout the day (Fig. I and IV). Verma & Joshi (1983) and Sihag (1988) stated that, reliable and effective pollinators can be found out on their foraging efficiency on flowers and longer duration on the substrates. So, in this study the coleopterans couldn't be considered as pollinators. After Coleoptera, the order Lepidoptera and Diptera were spend more time on a single flower followed by Hymenoptera. Among the flower visiting species *Danaus chrysippus*, *Neptis sp.*, and *Euploea core* of Lepidoptera, *Apis dorsata* and *Eumerus sp.* of Hymenoptera, *Eristalinus arvorum* of Diptera spend much time on a single flower (Fig. I and II).

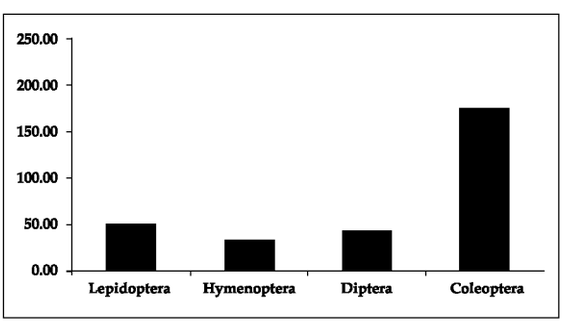

Fig. I. Maximum time spend (in second) by different insect flower vistors order

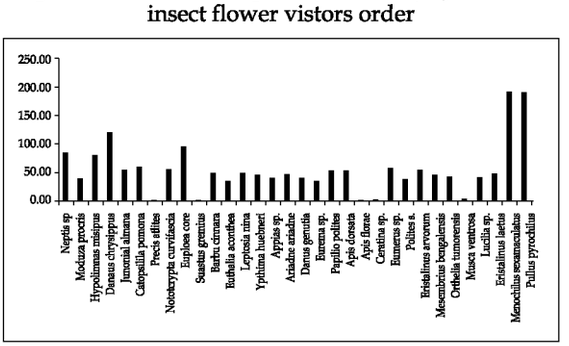

Fig. II. Maximum time spend (in second) by different insect flower visitor species

Fig. IV showed the average number of flower visited by single species in per unit of time (3 minutes). Group wise Hymenoptera visited maximum number of flowers in per unit of time followed by Diptera, Lepidoptera and Coleoptera. Among the species, *Moduza procris* (Lepidoptera), *Apis florae* (Hymenoptera), *Eristalis laetus* (Diptera) were touched highest number of flower in the unit of time with respect to the other species.

Mani and Sarvanan (1999) reported that, among the insect visitors of Asteraceae, butterflies predominate, representing 75% of all visitors. In other study, Mitra & Roy (2006) showed that a large number of dipterans also visited the flower heads of Asteraceae.

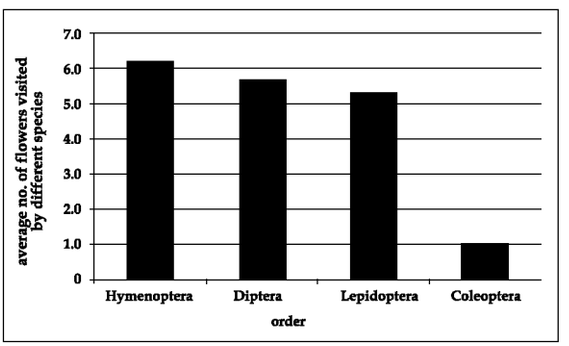

Figure III: Average number of flowers visited in each 3 minutes by different insect orders

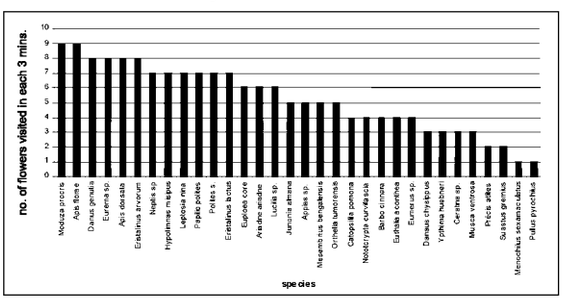

Figure IV: Average number of flowers visited in each 3 minutes by different insect visitor species of *Tagets patula*

If we consider spending time on substrates will be the determining factor of the effectiveness for the pollinator species, then Lepidoptera is the effective pollinator group and *Danaus chrysippus* is the effective pollinator species. But if we consider the effectiveness on their number of flower touches in per unit of time then Hymenoptera is the effective pollinator group and *Moduza procris* (Lepidoptera), *Apis florae* (Hymenoptera) are the effective pollinator species of *Tagetes patula*.

But if we consider both foraging speed and rate for evaluating the effectiveness for a pollinator species then Diptera as a whole may be the effective pollinator group of *Tagetes patula* Linnaeus.

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