P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-4* ISSUE-12* March- 2020
E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Natural Pollinators and Pollen Load Carried Out By Them in *Allium cepa L.* (Alliaceae)

Paper Submission: 18/03/2020, Date of Acceptance: 28/03/2020, Date of Publication:30/3/2020

A. S. Dahat
Assistant Professor,
Dept. of Botany,
Art, Commerce and Science College,
Arvi, Wardha, (M.S.) India

Abstract

The present investigations are being carried out for three consecutive year at Amravati. The plant species were visited daily or on alternate day, for to count visit of pollinatorst in Allium cepa L. The important flower pollinators in A.cepa were Xylocopa spp., Apis dorsata, A.florea, Trigona spp., A. cerana indica, Ceratina spp. and moth.

Keywords: Arvi, Allium cepa L., pollinators, Apis dorsata.

Introduction

Pollination is an important and essential stage in the sexual reproduction of flowering plants. It involves the transfer of pollen from anther to the receptive stigma of the flower. As such pollination is an essential prerequisite to seed and fruit set. Plants in general are classified on the basis of their floral biology as adapted to self and cross-pollination, either by wind or by animals, a majority of these being insects (Deodikar and Suryanarayana, 1977).

Bees are considered to be the most important pollinators because they are the only insects whose immature stages are reared exclusively on pollen and nectar (Crane, 1990). From the pollination point of view, honey bees are the potential pollinators and their frequent visits increase their efficiency to be as pollinators (Free, 1993). The foraging mode of the insect visitors determines them as pollinators or non-pollinators. Insect visitors are characterized as pollinator, if it transfers pollen intentionally in a foraging attempt or unintentionally (Sihag, 1988). Pollen collecting bees are better pollinators than nectar collectors (Free, 1993). Pollination by insects is called entomophily which includes cantherophily by beetles, myophily by flies, mellitophily by bees, psychophily by butterflies and phalanophily by moths. Obtaining adequate pollination in crops that must be pollinated by insects has become a problem in our agricultural economy (Tewari and Singh, 1983). During the present investigation detail study of natural insect pollinators was carried out.

Materials and Methods

The present investigations are being carried out during three consucative year at Arvi (North latitude 20 0 18 | to 700 30 | and East longitude 290 22 | to 190 15 |) situated in Wardha district of Maharashtra State.The observations were taken from different cultivated fields around Aavi city. Three different study sites were selected for study.

Blooming Phenology

The plant species were visited daily or on alternate day, for collection of blooming phonological. The timing of onset, progress, termination and blooming were observed.

Pollen Load Carried Out by Insect

Pollen load carried out by insect was estimated as per method proposed by (Dafni, 1992).

Flower Visitors Dynamics, Census and Activity

The flower visitors were observed for their visit timings at the different study sites during the flowering period of plant. During the initial, peak and final phases of the blooming period, the types and timings of the visitors were noted.

Flower Visitor Behaviour

The conduct of insect visitors was observed at different hours of the day during the flowering period at each study sites. The observations were also made on their mode of approach. The observations of the type

of forage they collect, contact of the visitor's body with the essential organs of the flower and the activities of the forager during a visit were noted. At the time of insect visit, photographs were taken with the help of Digital Camera (Sony Make). .

Results and Discussion

The present research work was started with the aim to know the role of insects in general and bees in particular in pollination of the A.cepa the crop plants cultivated in Vidarbha and thus to enhance the yield of crops. It was proposed to study the population of pollinators, their activity, behavior and their role in crop pollination.

To fulfill the above said objectives observations on different aspects of pollination and the flower visitors were undertaken for three consecutive years. Insect/pollinator census, period of pollinator activity, behavior of the pollinator, floral rewards, pollen load carried out by pollinator, were undertaken during the investigations at different study sites and seasons.

The continent Asia carries about three fifth of world population. However crop production in the Asian countries is still low and not enough to supply sufficiently feed to the people and deviling them. One of the major reasons for low crop production is the ignorance to modern agricultural technology and insufficient facilities for research and development. Asia represents a wide variety of climatic zones and accordingly several kinds of crops are grown; many of these are cross-pollinated and required external agents for pollination for increased fruit/seed production (Sihag, 1995).

It is important to study the process of pollination and pollinators in crop plant because more than 80 % of all flowering plants species relay on different animals for pollination (Torchio, 1990 and Nabhan and Buchmann, 1997).

Allium cepa L. is commonly cultivated for its bulb through out the plans of India. It is economically important cash crop used as a vegetable. It is commonly known as "bulb flower are numerous in globose umbel,3-8 cm in diameter and fistular 30-90 cm tall. Bract spathaceous, membranous, ovate, lanceolate, 3-4 cm long, pedicles slender, 2-4 cm long. Perianth white, lobes 6, distinct oblong-lanceolate, 6-8 mm long. Stamen 6, ovary trigonous, style short

The important flower visitors in A.cepa were Xylocopa spp., Apis dorsata (Fig. No.5), A.florea (Fig. No.3), Trigona spp. (Fig. No.2), A. cerana indica (Fig. No.6) and moth (Fig. No.4). Occasionally, wasp and house fly (Fig. No.1) also visited the flower. The activity of visitors was more from 09.30 hrs. to 13.30 hrs. The flower visitor activity was less during the afternoon time, however, from 15.30 hrs. onwards towards the evening hours activity was again more. Xylocopa spp. visited the flower regularly through out the day time. Xylocopa spp. visited one to ten flowers in a single bout. Duration of the visit was two to eighteen seconds per flower. Bees visited one to seven flowers in a single bout and the duration was four to sixty seconds per flower (Table No.1).

Bees visit the flower to collect pollen and nectar is found to be most valuable process in the pollination. Their frequent visit from one flower to other flower may perhaps help transfer of pollen (Deodikar and Suryanarayana, 1977). During the present investigation several insect foragers were found to be visiting on A.cepa.

Flowers of A.cepa are white, having landing platform on petals. A number of insect species were visited the flowers (Table No.1). The activity of pollinators starts after the opening of the flowers. The insect activity diminished during cloudy days. The bright yellow flowers represent flag type blossom. Insect visits the flower to collect pollen and nectar. A. dorsata, A. florea, Trigona spp., A. cerana indica and Ceratina spp. lands on petals and enter inside to collect the pollen in their pollen basket. Xylocopa spp. was found to be hovering around the blossom. They alight on the petal and thrust the mouth between the anther filaments to collect the nectar. During this activity style emerges out and the stigma touches the underside of the abdomen of Xylocopa. When Xylocopa leaves the flower after tripping, the floral parts resume their original position and pollen transfer take place. Thrips were commonly found within glued petals. The wasp also found hovering around the flower. The foraging rate of this bee was more than others bees. It visited many flowers within short period than the other bees. The peak period of bee visits was found to be between 09.30 hrs. to 13.30 hrs. and 15.30 to 17.30 hrs. On single flower Xylocopa spp. spent 2 to 18 seconds, A. dorsata spent 5 to 57 seconds, A. florea spent 4 to 60 seconds, Trigona spp. spent 6 to 60 seconds, A. cerana indica spent 4 to 45 seconds, Ceratina spp. spent 4 to 55 seconds and moth spent 2 to 6 seconds. The wasp and house fly spent 4 to 21 and 2 to 4 seconds respectively during their visit to the flower (Table 1).

According to Deodikar and Suryanarayana (1977) red gram (Tur) is a very important honey source in several states of India and frequently visited by bees as a food resources.

Many agricultural and horticultural crops grown in India are either dependent or are benefited by insect pollination of crop. Many pollen collecting insects harvest pollen from several flowering species. The estimation of pollen load carried by the pollinators is one of the traditional methods of measuring constancy (Dafni, 1992). Priti and Sihag (1997) reported the number of loose pollen grains that adhered to the body of the insect visitors. A. florea carried out the pollen load 6578.90 ± 755.31, A. dorsata carried the pollen load 9891.10 ± 901.13, A. mellifera carried the pollen load 9002.15 ± 849.09 and also reported that maximum number of pollen grains were carried by A. dorsata among all the insect visitors.

During the present investigation maximum pollen load carried out by Xylocopa spp. was found to be 27687.8 to 101722.5; The pollen load carried out by bees A. dorsata 17928.5 to 39769.3; A. florea 4483.8 to 19675.2 and Trigona spp. 9513.0 to

11923.0 (Table No. 1) number of pollen grains respectively. During the present investigation bees are found to be dominant amongst all foragers. Bees forage on the flower to collect the pollen and nectar. The maximum pollen load was found to be carried out by Xylocopa spp. and A. dorsata as compared to other foragers.

The amount of loose pollen on the body of insect varies on different body parts. Usually there is about twice as much on a bee thorax as on its abdomen and pollen gathers tend to have more pollen than nectar gathers (Free and Williams, 1972 and Kendall and Solomon, 1973). Positive correlations between pollen load and reproductive success have been attributed to several related phenomena.

Table No. 1: Visitor censes during three consecutive year.

Forager	Forage type	Length of visit in sec	Time of visit	Pollen load			visit per bout	Visit frequency
Years				1st year	2nd year	3rd year		
(Site-1)								
Xylocopa spp.	P	02 - 03	09.00-17.30	27687.8	101722.5	99346.5	01 - 10	VF
A. dorsata	P/N	05 - 10	09.30-17.30	17928.5	25800.3	26421.9	02 - 03	VF
A. florea	P/N	05 - 08	08.30-17.30	4483.5	19675.2	15741.0	01 - 04	VF
Trigona spp.	P/N	04 - 06	09.30-17.30	9513.0	11923.0	4545.0	02 - 04	VF
Wasp	P	03 - 04	10.00-17.30	-	-	-	01 - 03	VO
Ceratina spp.	P	04 - 09	08.30-17.30	-	-	-	01 - 03	VF
House fly	N	02 - 04	10.00-17.30	-	-	-	1	VO
A.cerana indica	P/N	04 - 07	09.30-17.30	-	-	-	02 - 04	VF
Moth	N	02 – 04	09.30-17.30	-		-	02 - 03	VF
(Site-2)								
Xylocopa spp.	P	02 - 03	10.00-17.30	96530.5	98527.5	92359.4	03 - 08	VF
A. dorsata	P/N	04 - 10	10.00-17.30	25443.8	28669.3	24641.9	01 - 04	VF
A. florea	P/N	04 - 09	10.00-17.30	16441.1	13417.1	12392.4	01 - 03	VF
Trigona spp.	P/N	05 - 08	09.00-17.30	3247.8	4577.3	6266. 4	01 - 04	VF
Wasp	P	04 - 06	09.30-17.30	-	-	-	01 - 04	VO
Ceratina spp.	P	04 - 08	08.30-17.30	-	-	-	01 - 03	VF
House fly	N	02 - 03	10.00-17.30	-	-	-	1	VO
A.cerana indica	P/N	04 - 08	09.30-17.30	-	-	-	01 - 04	VF
Moth	N	02 - 04	09.30-17.30	-	-	-	02 - 03	VF
(Site-3)								
Xylocopa spp.	P	02 - 03	09.00-17.30	92560.7	83598.7	87475.7	04 - 05	VF
A. dorsata	P/N	02 - 09	09.30-17.30	22741.9	25368.5	24881.9	01 - 04	VF
A. florea	P/N	04 - 09	10.00-17.30	14757.2	18895.2	16345.5	01 - 03	VF
Trigona spp.	P/N	03 - 07	10.00-17.30	4473. 3	3564.7	3465. 2	01 - 04	VF
Wasp	P	03 - 05	10.00-17.30	-	-	-	01 - 04	VO
Ceratina spp.	P	04 - 08	08.30-17.30	-	-	-	01 - 03	VF
House fly	N	02 - 03	10.00-17.30	-	-	-	1	VO
A.cerana indica	P/N	03 - 08	09.30-17.30	-	-	-	01 - 04	VF
Moth	N	02 – 04	09.30-17.30	-	-	-	02 - 03	VF

Fig. 1 - Red colour wasp visiting the flower

Fig.2 - Trigona spp. Collecting pollen from anther

Fig. 3 - A florea foraging on flower

Fig.4 - A dorsata foraging on flower

Fig. 5 - Green bee visiting flower

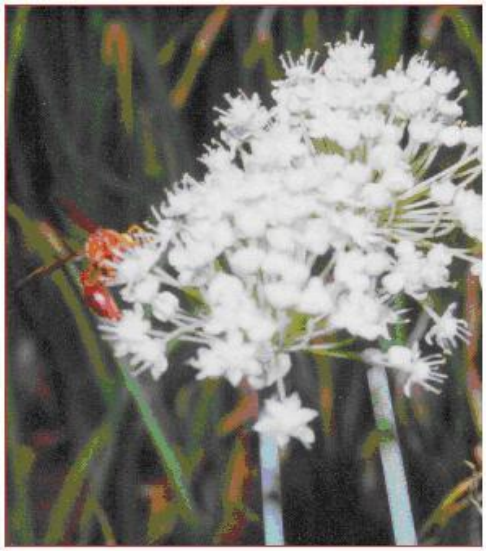

Fig.6 - Red colour wasp visiting the flower

Fig. 7 - Butterfly visiting the flower

Fig.8 - Danaus chrysippus collecting nectar

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