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EFFECT OF HONEY BEE *APIS MELLIFERA* L. POLLINATION ON OILSEED RAPE

Rabiul Islam[1*], Fahriya Yasmin[2], Antara Samiha[1] and Saleh Adnan[3]

[1]Oilseed Research Centre; [2]Tuber Crop Research Centre,
Bangladesh Agricultural Research Institute, Gazipur, Bangladesh
[3]Research Horticulturist Entomology, NSW Department of Primary Industries, NSW 2477, Australia
*Email: rabientom@gmail.com (corresponding author): ORCID ID 0000-0002-1700-269X

ABSTRACT

An experiment was conducted to survey insect visitors and the effect of different modes of pollination on quantity of oilseed rape. Survey revealed that a wide range of insect species, including honey bees, and hover flies, house fly and ensign fly were frequent on oilseed rape flowers where honey bees (*Apis dorsata* and *Apis mellifera*) were dominant. Effect of pollination revealed that in bee pollinated (BP) plants the number of pods/ plant, number of seeds/ pod, weight of 1000 seeds (g) and yield/ ha were 16.38, 20.18, 6.75 and 14.27% higher than open/naturally pollinated (NP) plants, respectively. Without (WP) pollinators the number of pods/ plant, number of seeds/ pod, weight of 1000 seeds (g) and yield/ ha were the 19.38, 37.05, 8.10 and 32.63% lower than naturally pollinated (NP) plants, respectively. Bee pollination is the most effective and cheaper device for seed production in rapeseed and mustard.

Key words: Rapeseed, cruciferous, survey, pollination, honey bee, house fly, ensign fly, transect survey, flower visitor, yield number of seeds pods, 1000 seed weight

The majority of flowering plants around the world rely on pollinating insects for reproduction (Ollerton et al., 2011). Additionally, they are necessary for the pollination of a wide range of global crops (Klein et al., 2007). Crops belonging to family Brassicaceae are predominantly dependent on insect pollination. Increase in seed quality and quantity is possible through pollination (Abrol, 2007). The role of cross-pollination between cruciferous crops is majorly played by honey bees. Absence of cross-pollination generally reduces seed number and size, and viability, and lead to decrease in yield (Delaplane et al., 2000). Oilseed rape (*Brassica rapa* L.) is widely cultivated in Europe, the United States, Canada, Brazil, and China including Bangladesh. The crop is grown for the production of edible oil and due to its higher demand its growing areas are expanding globally especially Bangladesh. The area under this crop has increased by 33% than the previous year (Bangladesh Bureau of Statistics, BBS, 2022. Oilseed rape produces large quantity of nectar and pollen and is visited by a variety of insects, although it is self-fertile and only partially wind pollinated (Williams et al., 1986; Bommarco et al., 2012). So objectives of the study were to reveal the pollinator fauna of oilseed rape in local agroecosystems and to determine the benefit of honey bee (*Apis mellifera*) in yield of oilseed rape.

MATERIALS AND METHODS

The study was conducted in 2017-18 at the Oilseed Research Centre (ORC) of Bangladesh Agricultural Research Institute (BARI). Experimental plots were kept free from insecticidal sprays during the flowering period. BARI Sarisha 14 was used as a variety, experiment was conducted with three treatments laid out in a Completely Randomized Design. The unit plot size was 5x4 m. The distance between plots and blocks was 50 cm and 100 cm, respectively. Fertilizer was applied according to recommended dose of ORC, BARI. There were 3 treatments 1) open/ natural pollination (NP); 2) plot covered with mosquito net (mash was 1.2 mm) with three frames beehive/ bee pollination (BP); and 3) plot covered with mosquito net/ without pollination (WP). After pod set all mosquito nets covers were removed from the plots. Observational surveys conducted by same plots slowly walking a transect within 4 sq m transect 1 m set path on open plot in three replications and collected unidentified flower visiting insects by aerial sweep using a hand net (Westphal et al., 2008). The transect survey was conducted between 10:00 hr to 16:00 hr and repeated at seven day intervals over a three week period during peak bloom. Each transect walk was conducted over a 10 min

period along the transect line. The captured specimens were pinned, labeled and later identified with the help of experts from the BARI, and Bangladesh Agricultural University (BAU). All collected specimens are stored in the Entomological lab, Oilseed Research Centre (ORC) of BARI, Gazipur, Bangladesh. Data were analysed with the software R, version 3.5.1 in order to examine the impact of *Apis mellifera* on plant yield characteristics (the number of pods/ plant, the number of seeds/ plant, 1000 seed weight, and seed weight/ plant).

RESULTS AND DISCUSSION

Within the *B. rapa,* variety BARI Sarisha plots, a total 694 insects from 11 insect species from 8 families and 4 orders were observed (Table 1). The families Apidae, Muscidae were more and the most numerous order being Hymenoptera. Four species were most numerous. Also individuals from three families of Diptera including a large number of Muscidae were collected. There were also few Coleoptera.

Table 2 shows the effect of *A. mellifera* on the yield and yield contributing characteristics of rapeseed variety BARI Sarisha 14 compare to other pollination mode i.e., open pollination, covered with mosquito net cover and inflorescences that covered with mosquito net with three frame beehives. The number of seeds/ pod in the plots with *A. mellifera*, open pollinated plants and cover pollination were 38.53, 32.06 and 31.33%, respectively. With *A. mellifera* treated plot 20.18% more seeds were produced. Effect of *A. mellifera* pollination on weight of 1000 seeds revealed that the seeds proceed were about 6.75% heavier. Yield/ ha was found higher (14.27%) due to *A. mellifera* pollination. Bommarco et al. (2012) conducted an experiment to observe the effect of open and bagged pollination on the seed yield and market value in oilseed rape. They used two treatments: (1) all flowers were accessible to insects, self and wind pollination, and (2) flowers enclosed in tulle net bags (mesh: 1 X 1 mm) were accessible only to wind and self pollination. Finally they found that insect pollination increased seed yield/ plant by 18% in oilseed rape in Sweden. Bartomeus et al. (2014) stated that insect pollination enhanced crop yield between 18 and 71% depending on the crop. Yield quality was also enhanced in most crops. For instance, oilseed rape had higher

Table 1. Insect identified from *Brassica rapa* (Variety BARI Sarisha 14, 2017-18)

Common name	Scientific name	Family	Order	No. of insects (3 replications)
Honeybee	*Apis dorsata*	Apidae	Hymenoptera	320
	A. mellifera	Apidae	Hymenoptera	210
	A. cerana	Apidae	Hymenoptera	10
	A. florea	Apidae	Hymenoptera	20
Sweat bee	*Halictus* sp.	Halictidae	Hymenoptera	1
Ant	*Camponotus* spp.	Formicidae	Hymenoptera	5
House fly	*Musa domestica*	Muscidae	Diptera	101
Nine spotted moth	*Amata bicincta*	Calliphoridae	Diptera	3
Ensign fly	*Sepsis fulgens*	Sepsidae	Diptera	10
Hover fly	*Syrphid* sp. 1.	Syrphidae	Diptera	10
Lady bird beetle	*Coccinella septumpunctata*	Coccinellidae	Coleoptera	4

Table 2. Effect of honeybee pollination on the yield characteristics of *Brassica rapa,* variety BARI Sarisha 14 (2017-18)

Treatments (mode of pollination)	Number of pods/ plant	Number of seeds/ pod	Weight of 1000 seeds (g)	Seed yield (kg/ ha)
Bee pollination (BP)	87.46	38.53	3.95	1866.22
Without pollination (WP)	60.66	31.33	3.40	1100.00
Open/ Natural pollination (NP)	75.15	32.06	3.70	1633.15
% increase over NP	16.38	20.18	6.75	14.27
% decrease over NP	19.38	37.05	8.10	32.63
SEm (±)	4.34	1.78	0.482	51.1
CD (p=0.05)	2.1	3.2	0.51	7.32

oil and lower chlorophyll contents when adequately pollinated; the proportion of empty seeds decreased in buckwheat; and strawberries' commercial grade improved. Sanas et al. (2014) conducted an experiment to observe the effect of honey bee (*Apis cerana indica* F) in mustard. They placed hives before the initiation of flowering. This study contained 3 pollination treatments, viz., plants kept open to all pollinators (T1), Plants caged with *Apis* hives (T2) and plants caged without access to any pollinators (T3). The difference in siliqua/ plant, seeds/ siliqua, thousand seed weight, seed yield/ plant and plot were found significant ($p<0.05$) and highest values were obtained from open pollination, followed by plants caged with honey bee hives and plants caged without access to any pollinators. Hossain et al. (2018) conducted an experiment with *Apis mellifera* colony covered with mosquito net compared with plot covered with mosquito net (without pollinators) and they observed higher yield (2.5 t/ha) from honey bee treated plot in *B. rapa* var. Tori 7 in Bangladesh.

It is apparent from the above findings that rapeseed crop needs cross pollination for maximum yield. Aims should be made to preserve current pollinators especially *A. mellifera* in Bangladesh agriculture and increase their numbers in order to continue current pollination services.

AUTHOR CONTRIBUTION STATEMENT

Study conception and design, data collection, analysis and interpretation of results, draft manuscript preparation by the author 1. Finally author 1, 2 and 3 reviewed the results and approved the final version of the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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REFERENCES

Abrol D P. 2007. Studies on abundance, diversity, behaviour and importance of native pollinators for crop production in Jammu and Kashmir, India. Korean Journal of Apiculture 4: 25-40.

Delaplane K S, Mayer D F. 2000. Crop pollination by bee. Wallingford, UK: CABI Publishing (2000). pp. 344.

Bartomeus I, Potts SG, Steffan-Dewenter I, Vaissière BE, Woyciechowski M, Krewenka KM, Tscheulin T, Roberts SPM, Szentgyörgyi H, Westphal C, Bommarco R 2014: Contribution of insect pollinators to crop yield and quality varies with agricultural intensification. PeerJ 2:e328 https://doi.org/10.7717/peerj.328

Bommarco R, Marini L, Vaissière B. 2012. Insect pollination enhances seed yield, quality, and market value in oilseed rape. Oecologia 169: 1025-1032.

Hossain M I, Rahman M M, Hossain M S, Chakraborty R, Amin R. 2018: Role of ways of insect visitors foraging for pollination in yield contributing traits of mustard. Journal of Biological Research 91: 69-82.

Klein A M, Vaissiere B E, Cane J H, Steffan-Dewenter I, Cunningham S A, Kremen C T, Tscharntke,T. 2007. Importance of pollinators in changing landscapes for world crops. Proceeding of Royal Society B- Biological Sciences 274: 303-313.

Ollerton J, Winfree R, Tarrant S. 2011. How many flowering plants are pollinated by animals? Oikos 120: 321-326.

Sanas AP, Narangalkar AL, Godase SK, Dalvi VV 2014: Effect of honeybee pollination on quantitative yield parameters of mustard (*B. juncea*) under Konkan condition of Maharastra. Green Farming 5: 241-243.

Westphal C, Bommarco R, Carre G, Lamborn E, Morison N, Petanidou T, Potts S G, Roberts S P M, Szentgyorgyi H, TscheulinT, Vaissiere B E, Woyciechowski M, Biesmeijer J C, Kunin W E, Settele J, Steffan-Dewemter I. 2008. Measuring bee diversity indifferent European habitats and biogeographical regions. Ecological monographs78(4): 653-671.

Williams I H. 1985. The pollination of Swede rape (*Brassica napus* L.) Bee World 66: 16-22.

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