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Impact of Indian Honey Bee on Pollination of Mustard at Ambikapur (Chhattisgarh)

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A B S T R A C T

The field experiment were conducted at Research Cum Instructional Farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) during *Rabi* 2019-20, to know the impact of Indian honey bee on pollination of mustard. The maximum no. of pods (309.4 pods/plant), length of per pods (4.69 cm), no. of seeds per pods (11.0 seeds/pods), seed weight) (4.3 gm), oil content (36.4 %), seed yield per plot (1572.9 gm) are obtained in T1 Open pollination (Uncaged crop) respectively. The minimum no. of pods (191.6 pods/plant), length of per pods (3.62 cm), no. of seeds per pods (9.4 seeds/pods), seed weight (2.9 gm), oil content (31.9 %), seed yield per plot (977.4 gm) are obtained in T3 pollinators exclusion (crop caged without any honey bee colony).

Introduction

Indian mustard (*Brassica juncea* L.) is an important oilseed crop next to sunflower. Mustard is commonly known as rai. Out of six cultivated oilseed species of genus *Brassica* more than 80% of total area occupied by Indian mustard (*Brassica juncea*) alone (Chandrashekhar *et al.*, 2013). Mustard seed have high energy content, having 28-32 % oil with relatively high protein content (28-36%), the amino acid composition of mustard protiens well balanced, it is rich in essential amino acid ,mustard oil has 20-28% oleic acid, 10-20% linoleic acid and 30-40% erucic acid, (sonvance and Pathak 2016). Presently rapeseed mustard sown area in India is 5.96 m ha, with a production of 8.32 million tonnes and average productivity is 1397 kg ha (Anonymous, 2018). in the country, mustard seed is mainly grown in north western parts of India, Rajasthan and Uttar Pradesh are the major producing states in the country. Total area under rapseed-mustard cultivation is 47542 ha while production is 26999 metric tones in Chhattisgarh (Solvance and Pathak,

2016) in Chhattisgarh state productivity is 564 kg ha (Annonymous, 2018).

Different bee species are commercial importance are found in India *viz*... *Apis dorsata* (Rock bee), *Apis cerana indica* (Indian hive bee), *Apis florea* (dwarf bee) and *Apis mellifera* (European or Italian bee). Rock bees are aggressive and cannot be maintained but are harvested from the wild. Honey from dwarf bees is also harvested from the wild as these are nomadic and produce very small yields. *Apis cerana* indica and *Apis mellifera* introduced from the temperate zone are more suitable to culturing in artificial bee boxes.

Pollination is an ecological service, a role an organism plays in its ecosystem that is essential to human life. Bees are some of the most important crop pollinators. They increase production of about 75 per cent of our crop species. Research revealed that habitat fragmentation due to human activity reduces bee diversity causing shifting of bee species in another natural climate which ultimately affecting the pollination services. We can overcome by this problems by planting fallow fields and road edges with flowering plants to support wild pollinators throughout the growing season, and by reducing pesticide use, especially during crop bloom when more bees are in their fields.

A standard method for capturing bees is the use of pan traps, also called 'bee bowls.' These are plastic cups painted white, fluorescent blue, and fluorescent yellow and that contain soapy water. Bees are attracted to the color, fall into the water and drown. As we know that the foraging area around a beehive extends for two miles (3.2 km), although bees have been observed foraging twice and three times this distance from the hive. Experiments have shown that beehives within 4 miles of a food source will gain weight, but beyond that the energy expended is greater than that gained during the foraging flight (Eckert, 1933).

Materials and Methods

A field experiment will be conducted during *rabi* season 2019 at Research Cum Instructional Farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) to know the impact of indian honey bee on pollination of mustard. The experiment will be laid out in randomized block design with three treatments and with seven replications.

Crop	: Mustard (*Brassica juncea)*
Variety	: Chhattisgarh Sarson
Plot size	: 7m x 3.5m
Date of sowing	: 20-9-2019
Treatments	: 3
Replication	: 7
Design	: Randomized Block Design (RBD)

Treatment details

Three pollination studies will be taken

T_1- Open pollination (uncaged crop)
T_2- Intensive pollination (crop caged with one *Apis indica* 3 frame colony)
T_3- Pollinators exclusion (crop caged without any honey bee colony)

Observation to be recorded

Observation will be recorded from randomly selected and tagged per 10 plants in each plot replicated three times. The details are following:

1. Number of pods per plants
2. Length of per pods.
3. Number of seed per pods.
4. Seed yield per plant.

5. 1000 seed weight.
6. Seed Germination %

Statistical analysis

The data obtained from the individual plant observations from RBD experiment will be analyzed statistically as per the standard procedure**.**

Results and Discussion

Pods plant^{-1}

The impact of honeybee on pollination of mustard was showed in Table 1. The results revealed that maximum no. of pods were obtained in T_1 open pollination (uncaged crop) (309.4 pods/plant) followed by T_2 intensive pollination (crop caged with one *Apis indica* 3 frame colony) (229.5 pods/plant). Whereas, minimum no. of pods was obtained in T_3 pollinators exclusion (crop caged without any honey bee colony) (191.6 pods/plant).

Pod length (cm)

The results revealed that maximum length of per pods was obtained in T_1 open pollination (uncaged crop) (4.69 cm) which were at par with T_2 Intensive pollination (Crop caged with one *Apis indica* 3 frame colony) (4.17 cm). Whereas, minimum length of per pods was obtained in T_3 pollinators exclusion (crop caged without any honey bee colony) (3.62 cm).

Seeds pod^{-1}

The results revealed that maximum no. of seeds per pods was obtained in T_1 open pollination (uncaged crop) (11.0 seeds/pods) followed by T_2 Intensive pollination (crop caged with one *Apis indica* 3 frame colony) (9.7 seeds/pods). Whereas, minimum no. of seeds per pods was obtained in T_3 pollinators exclusion (crop caged without any honey bee colony) (9.4 seeds/pods).

1000 seed weight in gm

The results revealed that maximum seed weight was obtained in T_1 open pollination (uncaged crop) (4.3 gm) followed by T_2 Intensive pollination (Crop caged with one *Apis indica* 3 frame colony) (3.6 gm). Whereas, minimum seed weight was obtained in T_3 pollinators exclusion (crop caged without any honey bee colony) (2.9 gm).

Seed yield plot^{-1} (gm)

The results revealed that maximum seed yield per plot was obtained in T_1 open pollination (uncaged crop) (1572.9 gm) followed by T_2 intensive pollination (crop caged with one *Apis indica* 3 frame colony) (1330.0 gm). Whereas, minimum seed yield per plot was obtained in T_3 pollinators exclusion (crop caged without any honey bee colony) (977.4 gm).

Seed germination (%)

The results revealed that maximum seed germination was obtained in T_1 open pollination (uncaged crop)) (91.4 %) followed by T_2 Intensive pollination (crop caged with one *Apis indica* 3 frame colony) (86.5 %). Whereas, minimum seed germination was obtained in T_3 pollinators exclusion (crop caged without any honey bee colony) (67.8 %).

More or less the present findings are agreement with the findings of Khan and Khan (2004) who studied impact of bees on apple plant at their blooming stage. He observed that bees play a significant role in pollination in apple. The role of honey bees foraging activities in apple fruit production was significantly more. The fruit quality (Fruit size and number of seeds) were also

observed superior which is benefited with pollinizers. There was a significantly high yield (140-170kg) in uncaged starkrimson and kala kullo as compared with caged (35-42kg). The present findings are also similar with the findings of Thakur and Rana (2008) studied the effect of honey bee pollination, open pollination and hand pollination on quantity and quality of cucumber was also studied. Significant increase in fruit set was observed; highest being in hand pollination (75.68%) followed by honey bee (74.96%) and open (62.09%) pollination. Percentage of misshapen fruits was maximum in open pollination (20.05) followed by hand (14.1%) and honey bee (8.05%) pollination. Honey bee pollination resulted in significantly highest percentage of healthy fruits (92.22%) as compared to hand (85.85%) and open pollination (79.64%). Similarly weight of fruits (1184.5 g), number of seeds per fruit (472.8), fruit size (28.8 cm) and weight of 1000-seeds (29.14 g) was highest in honey bee pollination as compared to other modes of pollination.

Table.1 Impact of Indian honey bee on pollination of mustard

Treatment	Pods plant^{-1}	Pod length (cm)	Seeds pod^{-1}	1000 seed Weight (gm)	Seed yield Plot^{-1} (gm)	Seed germination (%)
T_1 Open pollination (uncaged crop)	309.4	4.69	11.00	4.30	1572.90	91.40
T_2 intensive pollination (crop caged with one *Apis indica* 3 frame colony)	229.5	4.17	9.70	3.60	1330.9	86.5
T_3 pollinators exclusion (crop caged without any honey bee colony)	191.60	3.62	9.40	2.90	977.40	67.80
Total	730.5	-	-	-	-	-
SEm±	2.098	0.194	0.229	-	110.011	0.227
C.D.(P=0.05)	8.46	0.783	0.925	-	443.522	0.92

Fig.1 Number of pods per plant in different treatments during *rabi* 2019-20

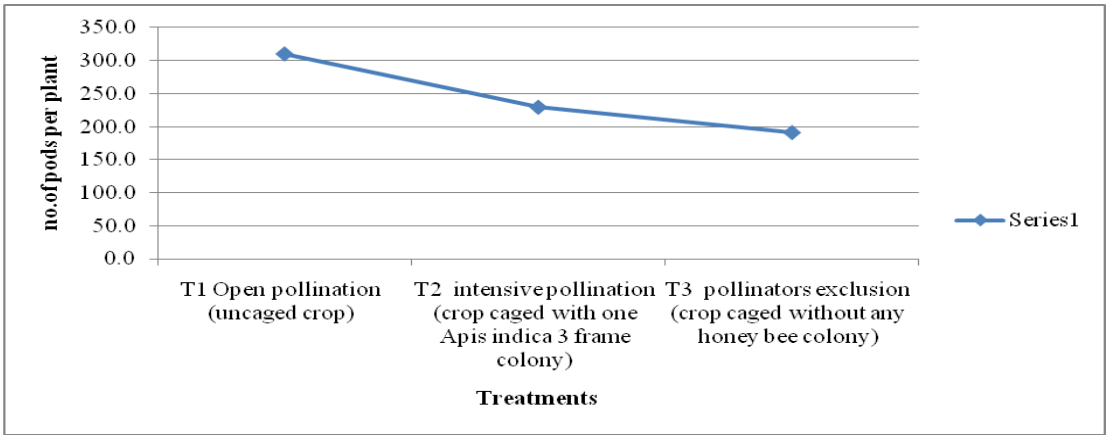


Fig.2 Pod Length in different treatments during *rabi* 2019-20

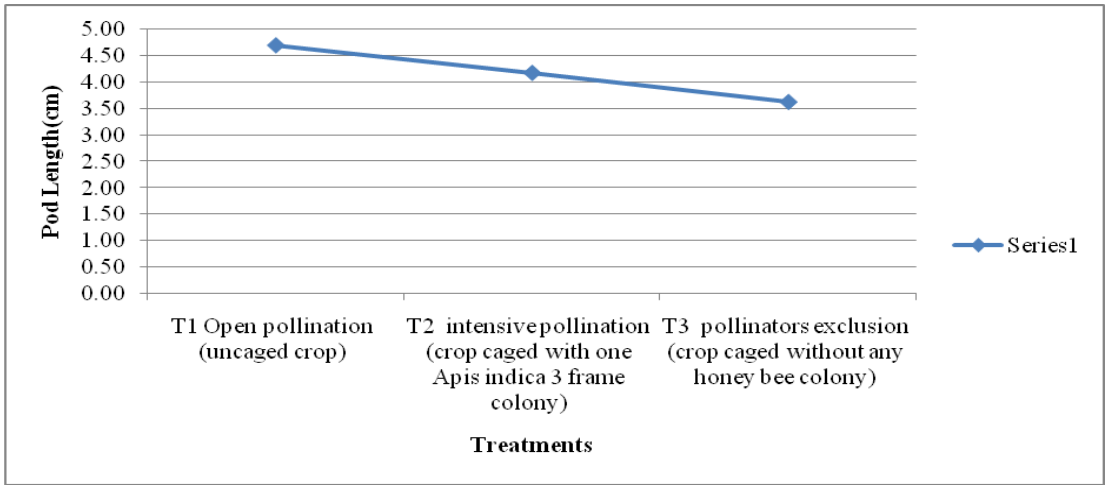


Fig.3 No. of seeds per pods in different treatments during *rabi* 2019-20

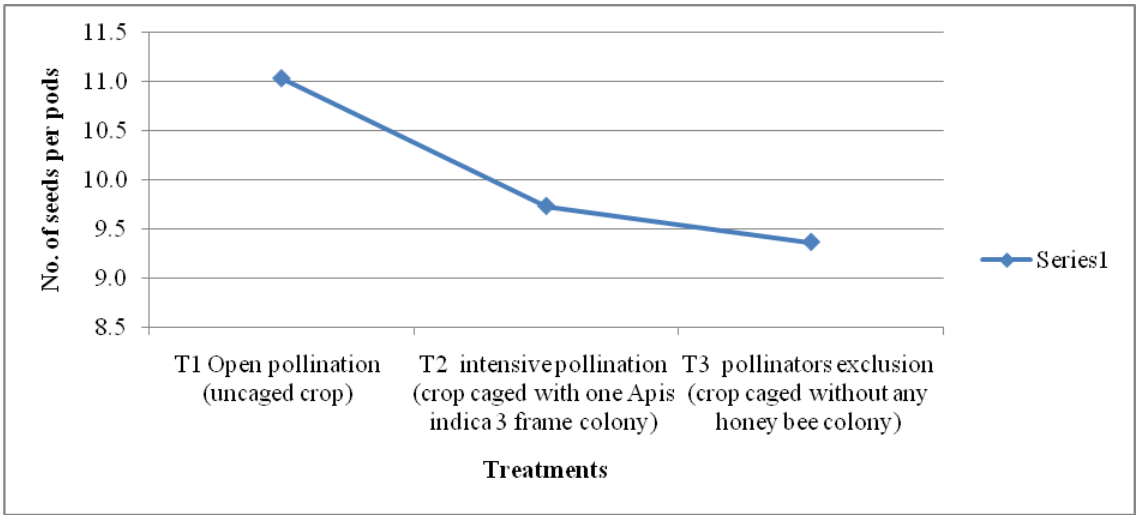


Fig.4 1000 seed weight in gm in different treatments during *rabi* 2019-20

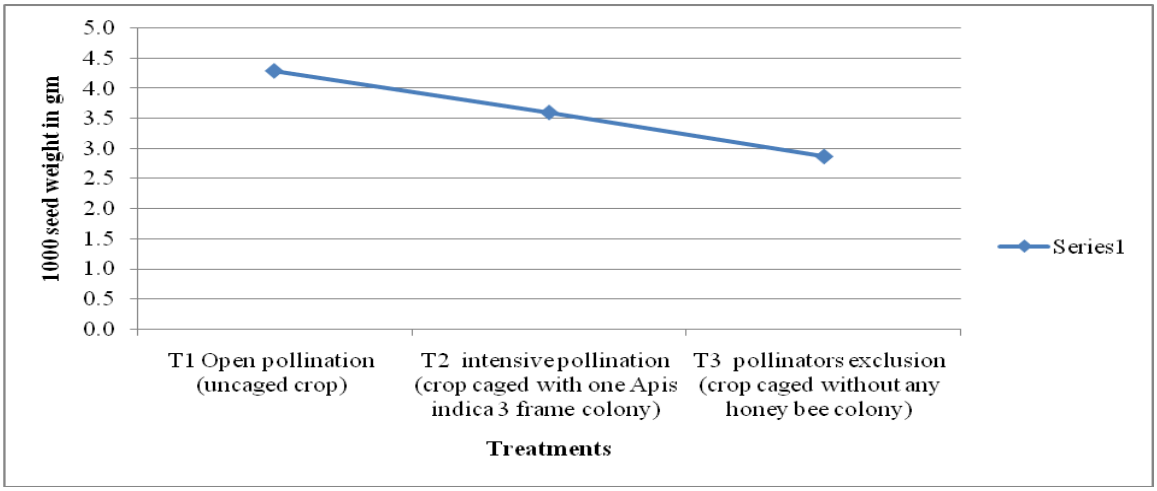


Fig.5 Seed yield per plot (gm) in different treatments during *rabi* 2019-20

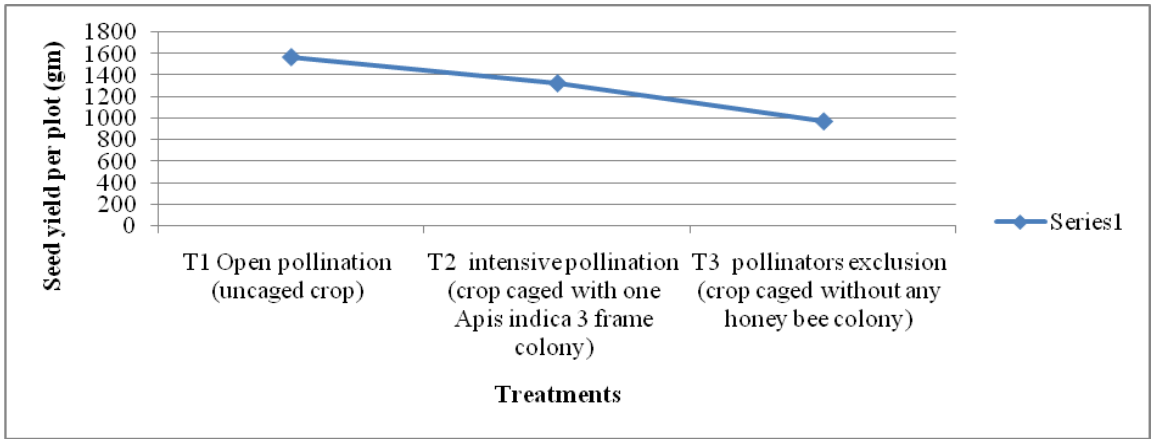
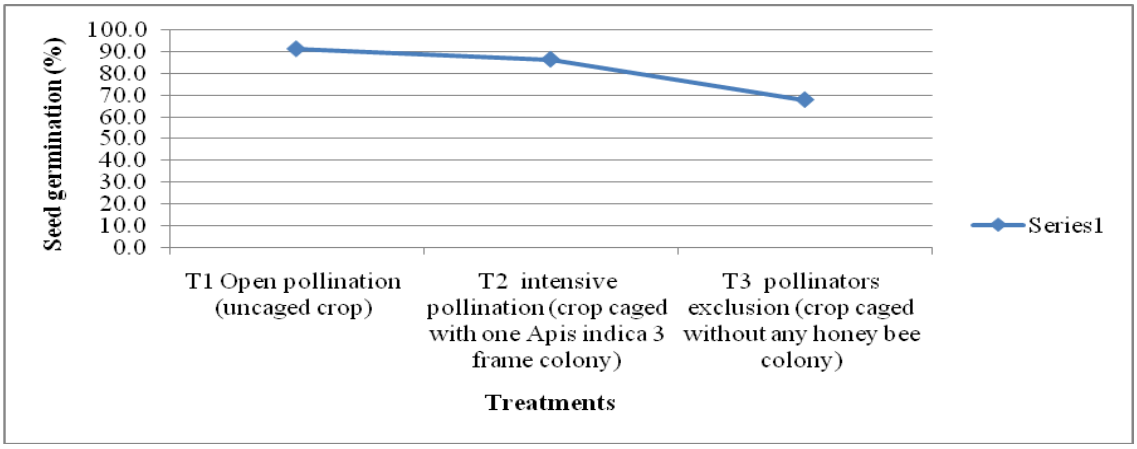


Fig.6 Seed germination (%) in different treatments during *rabi* 2019-20



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