Research Article

KAIROMONAL FACTORS ENHANCING THE PARASITIZING EFFICIENCY OF THE LARVAL ECTO-PARASITOID, *Braconhebetor* SAY ON PIGEONPEA POD BORER, *Helicoverpa armigera* (HUBNER)

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Abstract- The present experiment was carried out in the Bio-control laboratory, Department of Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, during 2017-18, in which six kairomonal factors namely; fresh larval extract, larval body wash in distilled water and hexane, larval frass (excreta), matured larvae and maintaining field condition as control, were tested to look for the factors enhancing the parasitizing efficiency of *Braconhebetor* say. (Hym: Braconidae) against pigeonpea pod borer, *Helicoverpa armigera* (Hubner). Results revealed that, mature larvae and larval frass (excreta) were highly preferred by *B. hebetor* as compared to larval extract, body wash in distilled water, body wash in hexane and over control.

Keywords- Pigeonpea, Pod borer, *Braconhebetor*, Parasitization

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Introduction

Pigeonpea (*Cajanus cajan* L.) is considered as one of the most important legume crop of India, belonging to the genus *Cajanus* of family Fabaceae. It provides high quality vegetable protein to human beings and is one of the sources of animal feed and fire wood. Carbohydrates (67%) and protein (22%) are main constituents of pigeonpea seeds [1]. Pigeonpea is the second most important pulse crop of India after chickpea. India is the largest producer and also the largest consumer of pulses in the world. It accounts for 33 percent of the world area and 25 percent share in global production [2].

The yield levels of this crop are not very encouraging. Among the factors responsible for low yield, the damage caused by insect pests is one of the major factors in pigeonpea. It is attacked by several insect pests from seedling stage till harvesting. Alarming pests array of more than 250 insect pests is surely an area of concern in pigeonpea pest management [3]. Total of 30 insect pests were found feeding on pigeonpea. Among the borer complex of pigeon pea, one pest *Helicoverpa armigera* (Hubner) was recorded as major pests on this crop by causing approximately more than 51 percent damage to the crop, but *Exelastis atomosa* (Walsingham), *Melanagromyza obtusa* (Malloch), *Marucavitrata* (Fabricius), were recorded as moderate pests by causing damage between 31 to 50 percent [4].

Indiscriminate use of pesticides in pigeonpea under intensive agriculture has led to many problems like health hazards, environmental pollution, adverse effect on beneficial organisms and development of resistance in insect pests towards chemicals resulting in an unsustainable and non-profitable farming system. This led to the introduction of various biological aspects to avoid problems faced by the farmers.

The braconid (Hymenoptera: Braconidae) is a cosmopolitan, gregarious, idiobiont polyphagous, ecto-parasitoid which lays large, yolk eggs on the integument of its host and parasitizes the larvae of Lepidoptera, Coleoptera and Diptera. Braconid is an important biological control agent for several insect pests [5,6]. It occurs,

naturally, throughout the world. There is growing evidence that *B. hebetor* can also be an important bio-control agent of *Helicoverpa armigera* [7]. Minimum and maximum developmental days of female was recorded 17.06 and 18.10 days in pea and pigeon pea reared larvae, respectively [8].

Kairomones are inter-specific semio-chemicals which mediate interactions beneficial to organisms that detect them. The use of kairomones for biological control of insect pests has been of interest for several decades [9]. The present investigations were, therefore, undertaken to search for kairomonal factors enhancing the parasitisation efficiency of larval parasitoids on pigeonpea pod borer, *Helicoverpa armigera*.

Materials and Methods

The experiments were carried out in the Bio-control laboratory, Department of Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, during 2017-18.

Rearing of the larval parasitoid *Braconhebetor*:

Braconhebetor was mass multiplied using sandwich technology on laboratory reared *Corcyra* larvae. Newly emerged adults of *B. hebetor* were paired (male and female) in small plastic container (100 ml). A small drop of honey was put in the wall of the container as food. Few full grown larva of *C. cephalonica* were released on the muslin cloth covering the container and covered again by a piece of muslin cloth (sandwiched) and tied securely with the help of a rubber band, and allowed the parasitoid to oviposit on the host larva for 24 hours. After parasitization parasitized larvae were collected and placed individually into a petridish (90 mm in diameter) for cocoon formation.

For testing the kairomonal factors enhancing the parasitizing efficiency of larval parasitoid, *B. hebetor* on pigeonpea pod borer, *H. armigera*, six treatments [Table-1] were tested on plastic basin (28.3cm) covered muslin cloth under laboratory conditions. 20 pairs of *B. hebetor* were collected with the help of an aspirator and released inside the plastic basin and covered with muslin cloth and tied securely

with the help of a plastic string. On the upper surface of the muslin cloth different treatments (matured larvae of *H. armigera*, were released in all the treatments) were placed and covered with the help of a small petridish to prevent the escape of the larvae. Observations were recorded after 48 hrs. and the number of egg laid on the larvae were counted in each treatment. On the basis of the number of eggs laid, preference of *B. hebetor* was computed. The experiment was repeated five times

Table-1 Treatment details for enhancing the parasitization efficiency of larval parasitoid *Braconhebetor* on pigeonpea pod borer

S. no.	No. of Treatments	Treatments
1.	T ₁	Larval extract obtained from freshly crushed larvae
2.	T ₂	Larval body wash in distilled water
3.	T ₃	Larval body wash in hexane
4.	T ₄	Larval excreta/frass
5.	T ₅	Mature larvae
6.	T ₆	Control (pigeonpea leaves+ buds+ flowers+ 1-2 larvae)

Result and Discussion

Table-2 Effect of different kairomonal factors on the parasitizing efficiency of the larval ecto parasitoid *B.hebetor* on larvae of pigeonpea pod borer, *H. armigera*

S. no.	Treatments	Egg laid
1	T ₁	3.4 (1.89)
2	T ₂	3.2 (1.67)
3	T ₃	1.6 (1.51)
4	T ₄	12.6 (3.65)
5	T ₅	14.6 (3.93)
6	T ₆	0.7 (1.26)
	SEm ±	0.63
	CD at 5%	0.72
	C. V. (%)	33.14

Note: Figures in parenthesis are square root transformed values.

T₁: Larval extract obtained from freshly crushed larvae

T₂: Larval body wash in distilled water

T₃: Larval body wash in hexane

T₄: Larval excreta

T₅: Mature larvae

T₆: Control (pigeonpea leaves+ buds+ flowers+ 1-2 larvae)

Fig-1 Testing of kairomonal factors enhancing the parasitizing efficiency of the larval ecto-parasitoid, *Braconhebetor* Say on pigeonpea pod borer, *Helicoverpa armigera* (Hubner)

Fig-2 Egg layed by larval ecto-parasitoid, *Braconhebetor* Say on pigeonpea pod borer, *Helicoverpa armigera* (Hubner)

The application of different factors (treatments) to the host larvae affected the oviposition behavior of female parasitoid for egg laying. Ovipositing females locate their host through kairomonal effect of their host. Results exhibited that highest there were significant difference among the treatments. Highest number of egg laying by *B. hebetor* was seen in T₅(14.6) followed by T₄ (12.6), T₁(3.4), T₂(3.2), T₃(1.6) and least in control T₆(0.7) showing that presence of mature larvae and larval frass (excreta) increased the egg laying by *B. hebetor* in comparison to larval extract, body wash in distilled water, hexane and control. Deviation from the present studies were reported by[10]stating that the ectoparasitoid female *B. hebetor* parasitoid of Mediterranean flour moth *Ephestiakeuhniella* larvae, responded to hexane extract and the parasitization rate increased significantly over control.

Ovipositing females were found to locate their hosts probably via trails containing semiochemicals produced in the mandibular gland of the host larvae. Once the host was located, the female *B. hebetor* injected venom, which resulted in complete paralysis of hostlarvae within 15 minutes, the venom blocks neuromuscular transmission at a presynaptic site and apparently has no effect on heartbeat or midgut function. After the host was paralyzed, the female oviposited, usually placing a clutch of several eggs on the ventral surface of the host or on the side that was in contact with the substrate [11].

Thus, collection and placing mature *H. armigera* larvae and its frass in holed plastic containers in pigeonpea fields at different spots can be done to enhance the parasitizing efficiency of *B. hebetor*. The results need further confirmation in field.

Conclusion:

Pod borer complex is the main point of decline in the production of pigeonpea, for the management of which the farmers directly use insecticides, which is not right for humans and the environment. Therefore, to overcome these problems, the use of living organism as natural enemies leads to sustainable production of this crop. In current research work, the larval-ectoparasitoid (*Braconhebetor* say,) of pigeonpea pod borer [*Helicoverpa armigera* (Hubner)] was tested in laboratory for kairomonal factors enhancing the parasitizing efficiency of *Braconhebetor* on their host insect to maximize production level of this crop. In which the mature larva and larval excreta/ frass were most effective as kairomonal effect, while the larval extract, body wash in distilled water, body wash in hexane were less effective, compared to the mature larva and larval excreta/ frass.

Application of research: This research is also useful in protecting the production of pigeonpea in lower costs, as well as to protect the environment against the losses done by over use of insecticides.

Research Category: Parasitizing efficiency

Abbreviations:

C.D.-Critical difference
C.V.-Coefficient of variation
SEm-Standard error of the mean
ml-Mililiter
mm-Milimeter
cm-Centimeter

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Author Contributions:

Shimla Gupta- Design of the experiment, data collection, data analysis and interpretation, drafting the article, Critical revision of the article and final approval of the version to be published.

Dr Navneet Rana- Design of the experiment, data analysis, guidance in interpretation and facilities to conduct the experiment.

Dr Jayalaxmi Ganguli- In-charge of the Bio-control laboratory where the experiment was conducted, designed the experiment helped in data analysis, guidance in interpretation and facilities to conduct the experiment, Critical revision of the article and final approval of the version to be published.

Rashmi Gauraha- Data collection

Dr Sonali Deole :Guideline for article

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