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Management Strategies for *Aphis craccivora* in Broadbean (*Vicia faba*)

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ABSTRACT

Aphis craccivora Koch is a polyphagous aphid and a major pest of legume crops. The yield losses of broad bean due to *Aphis craccivora* Koch is huge. Field trials were conducted during two cropping seasons at Churachandpur district, Manipur to determine the effectiveness of two insecticides including yellow sticky trap in broadbean against *A. craccivora* population and yield of broadbean. The population of the aphids were significantly reduced when the plants received Imidachloprid @ 0.4ml/l and Buprofezin 15% + Acephate 35% WP in broadbean. On the other hand, yellow sticky trap installed treatment significantly decreased the aphid population and increased yield against the untreated plot. The result of the study indicated that that neonicotinoid and organo phosphorus groups of insecticides can be used for management of *Aphis craccivora* population in broadbean against *A. craccivora* and increased the yield.

Key Words: Broadbean, *Aphis craccivora* Koch, Yellow sticky traps, Yield.

INTRODUCTION

Faba bean, commonly known as the broad bean (*Vicia faba*), is widely cultivated as a crop for human consumption, and also as a cover crop. The faba bean is a meat substitute (Ebadah *et al*, 2006) and a major source of plant protein for human use. *V. faba* has a very low content of saturated fatty acids and is an excellent source of proteins, complex carbohydrates and dietary fiber (Crepon *et al*, 2010 and Ofuya *et al*, 2005). Broad bean is grown extensively in both the valley and hilly terrains of Manipur basically in localized pockets on marginal and poor land without any proper care. It is hardy and grown as sole, mixed or intercrops. The crop is grown mostly grown on residual moisture without any assured water supply system in general except in kitchen gardens. However, productivity is far below the national average (Juliana *et al*, 2012). Insect pest species attack faba bean plants at various stages of growth development, of which aphids being the most destructive, resulting in a loss in seed yield of 12.79 to 61.07 percent (El-Defrawi and El-Harty, 2009). Among the insect pest *A. craccivora* Koch a polyphagous aphid species a major pest of legume crops was found the major pest causing direct damage to the plant by sucking the sap deforming it with toxic saliva. Moreover, this pest excretes a large amount of honeydew that attracts ants and encourages the growth of sooty mould, which impart photosynthesis and respiration, resulting in plants deformed and indirect viral disease transmission (Aly, 2014, El-Sarand *et al*, 2019; Khodeir *et al*, 2020). Rekha and Mallapur (2007) reported *A. craccivora* as a serious pest of leguminous crop, which suck the sap from tender shoots, inflorescence and pods resulting in drying up of tender shoot and premature fall of flower buds, flowers and tender pods.

Biotic factors like insect and pests are the major constraints in achieving the potential yield of pulses. The sucking pests which were earlier recognized as minor pests in pulses with lesser economic significance are attaining a status of major pests (Saxena *et al*, 2018). So the management of these sucking pests with chemical

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Table 1. Description of insecticide used

Commercial product	Active ingredient	Application rate	Chemical sub group	Mode of action
Confidor	Imidacloprid 17.8 % SL	0.4 ml/ha	Neonicotinoid	Systemic
Tapuz	Buprofezin 15% + Acephate 35% WP	1250 gm/ha	Organo phosphorus	Systemic and contact

insecticides is neither eco-friendly nor recommended. Reasonable application of insecticides is the basis. Therefore, the insecticides should be applied at the proper rate and at the correct time for controlling aphids successfully (Roy *et al*, 2014). Installation of yellow sticky traps at 1-2 traps per 50-100 m^2 slightly above crop canopy helps to bring down the active flying adult populations of whiteflies, leafhoppers in green gram, black gram and cowpea (Srinivasan, 2014). Pulse productivity and quality has been severely threatened by increasing difficulties in managing these sucking pests due to their ability to evolve resistance to insecticides, resurgence and their secondary outbreak due to indiscriminate and injudicious application of synthetic insecticides (Khatake *et al*, 2023). Thus, the objective of this experiment was to investigate the efficacy of insecticides against *A. craccivora* infestation and to determine the most effective treatment to manage aphid infesting broadbean in relation to yield.

MATERIALS AND METHODS

The present investigation was carried out under the agro-climatic condition of Churachandpur district, Manipur. The experiment was laid out in Randomized Block Design (RBD) and each treatment was replicated five times. Four different treatments modules consisting of T_1 = Buprofezin 15% + Acephate 35% WP, T_2 = Imidachloprid @ 0.4ml/l, T_3 = Yellow sticky trap, including T_0= Untreated control were used against *Aphis craccivora* Koch. All the standard agronomic practices were strictly followed for managing the crop. The crop was raised with recommended package and practices in 2 m x 3 m plots at a spacing of 30 cm x 20 cm. Counts of *Aphis craccivora* were done from three randomly selected leaves (upper, middle and lower)/plant from five randomly selected plants/ plot before and after spray (very next day, third day seventh day and ten days after spray). Observation was taken during early morning hours. The collected data on incidence were subjected to ANOVA after transformation of data. The commercial yellow sticky sheets 20cm (height) x 15 cm (width) size were used. These traps were installed in the field seven days after germination of the crop using bamboo sticks. One trap per treatment plot was installed. Also, care was taken that the height of the trap was one feet above the crop canopy, throughout the experimentation. Observations were recorded at 10 days interval. After recording the data, the yellow sticky trap was changed. The yield of broadbean was recorded from each plot during harvest. The data of pests' population and yield recorded of two years were statistically analyzed and B:C ratio was calculated.

RESULTS AND DISCUSSION

The findings during the two consecutive years indicated that, Buprofezin 15% + Acephate 35% WP and Imidacloprid 17.8 % SL, had higher effects on aphid population without significant differences among them. The effect of different treatments on *Aphis craccivora* Koch incidence showed that Imidacloprid 17.8 % SL significantly superior. The neonicotinoid insecticides were highly effective against various aphid species and reduced the aphid population under field conditions (G Abdu-Allah, 2012). The mean data revealed that maximum numbers of aphid was recorded on T_3 (24.3) aphids/plant and lowest numbers of aphid population/plant was observed in T_2 (11.5) followed by T_1 (15.6) against the T_0 untreated control (107.4) Table 2. Besides, average numbers of aphids were trapped on yellow sticky trap was 48.33 aphids/trap were recorded during the experimental period. The present findings were in accordance with those of Tam and Webb (1993) who reported that *A.*

Table 2. Relative effect of conventional insecticides on the population of *Aphis craccivora* Koch and yield of broadbean during *rabi* 2020-21 and 2021-22.

Treatment	[1]Mean population (no)/plant	[2]Yield (q/ha)	B:C ratio
T_1 = Buprofezin 15% + Acephate 35% WP	15.6 (4.00)	6.4 (2.60)	2.8
T_2 = Imidachloprid @ 0.4ml/l	11.5 (3.45)	7.2 (2.75)	3.3
T_3 = Yellow sticky trap	24.30 (4.29)	6.0 (2.54)	2.5
T_0=Farmer Practice	107.4 (10.38)	5.1 (2.34)	2.0
SEm (±)	0.10	0.15	-
CD (0.05)	0.33	0.46	-

Figures in parentheses are √X + 0.5 transformed values. [1]Mean aphid population of three time intervals under observation based on three application data. [2]Mean broadbean yield (t/ha) based on three replication.

craccivora was caught more often in yellow traps as compared to green traps in watermelon plants. Similarly, Khatake *et al* (2023) reported that white and yellow sticky traps are effective tools against aphid. Roth *et al* (2016) also reported similar result indicating yellow sticky color traps were more effective for aphid. Similar results were observed by Khade *et al* (2014) reported highest percent reduction in population of sucking pests in cowpea by imidacloprid 17.8 SL @ 0.005%. Preetha *et al* (2012) opined that imidacloprid 17.8 SL was quite promising in reducing the population of aphids and leafhoppers on cotton crop. Muhammad Afzal (2014) showed that imidacloprid and diafenthiuron gave maximum mortality against sucking pests of cotton during first spray (92.42 and 88.56%) and second spray (90.87 and 85.67%) after 72 h of application. Another study found that neonicotinoid insecticides were highly effective against cowpea aphid (*Aphis craccivora* Koch) compared to the other groups of insecticides (Patil *et al,* 2017). The results were in agreement with those obtained by Jansen and Warnier (2011).

Effects of insecticides on the yield of broadbean

The pod yield of broadbean under different insecticidal treatments was significantly higher over untreated control. Imidacloprid 17.8 % SL produced the highest pod yield of 7.2 q/ha which was significantly higher than the other all treatments (Table 2). The yellow sticky trap installed treatment significantly produced a yield of 6.0 q/ha. Similarly, the highest B:C ratio was also recorded from Imidacloprid 17.8 % SL (3.3) closely followed by Buprofezin 15% + Acephate 35% WP (2.8) against the untreated plot (2.0), respectively. The finding showed a close resemblance with the research carried out by Mohammad and Semaskiene (2021) reported that applications according to local threshold with contact and systemic insecticides increased grain yield at the same level, and it was in line with the full control treatment. Hodgson *et al* (2012) reported that suitable insecticide timing is decisive for the control of soybean aphid (*Aphis glycines*), and the aphids can recover from insecticide applications in the absence of natural enemies.

The percent avoidable loss due to *Aphis craccivora* Koch infestation varied from nil in Imidacloprid 17.8 % SL sprayed plots to 35.13 % in untreated check. Among the insecticidal treatments maximum avoidable yield loss (18.91%) was observed in yellow sticky installed plot (Table 3). Similarly, the highest marketable yield in terms of increased production over control was recorded from combined application of Imidacloprid 17.8 % SL (29.16%) followed by Buprofezin 15% + Acephate 35% WP (20.31%) respectively.

Table 3. Avoidable loss of broadbean due to *Aphis craccivora* Koch and increase yield of different insecticidal treatments over control during *rabi* 2020-21 and 2021-22.

Treatments	Broadbean yield (q/ha)	Avoidable loss (%)	Increase yield over control	
			(q/ha)	Percentage (%)
T_1 = Buprofezin 15% + Acephate 35% WP	6.4	10.8	1.3	20.31
T_2 = Imidachloprid @ 0.4ml/l	7.2	-	2.1	29.16
T_3 = Yellow sticky trap	6.0	18.9	0.9	15.0
T_0 = Farmer Practice	5.1	35.13	-	-

CONCLUSION

Results of the present findings showed that using of Neonicotinoid and organo phosphorus groups of insecticides gave highest control of aphid and increased the yield broadbean. Thus, both the groups could be included as useful tactic in aphid management however, ensure safe application. Based on the current study it is also indicated that yellow sticky traps are effective tools against aphid. Therefore, they could be used in the integrated pest management program of this insect pest particularly in *Aphis craccivora*.

Figures in parentheses are $\sqrt{X}$ + 0.5 transformed values. [1]Mean aphid population of three time intervals under observation based on three application data. [2]Mean broadbean yield (t/ha) based on three replication.

REFERENCES

Aly AA (2014). Toxicity and persistence of selected neonicotinoid insecticides on cowpea aphid, *Aphis craccivora* Koch (Homoptera: Aphididae). *Arch Phytopathol and Pl Prot* **47**:366-376

Crepon K, Marget P, Peyronnet C, Carrouee B, Arese P, Duc G (2010). Nutritional value of faba bean (*Vicia faba* L.) seeds for feed and food. *Field Crops Res* 115:329–39.

Ebadah I M A, Mahmoud Y A and Moawad S S (2006). Susceptibility of some faba bean cultivars to field infestation with some insect pests. *Res J Agri and Biological Sci* **2**(6):537-540

El Defrawi, G M and El-Harty EF (2009). Injury levels and yield loss model for the cowpea Aphid, *Aphis craccivora* koch on *Vicia faba* L. *Egyptian J Agri Res* **87**(2):1-25

El-Sarand, E A Refaei, E A and El-Dewy M E H (2019). Population density of *Empoasca* Spp.; *Liriomyza trifolii* (Burgess) and the common natural enemies on faba bean plants in relation to sowing dates. *J Pl Prot and Pathol* **10**(2):147-153

G Abdu-Allah (2012). Aphicidal activity of imidacloprid and primicarb compared with certain plant extracts on *Brevicoryne brassicae L*. and *Aphis craccivor*a Koch. *Assiut J Agri Sci* **43**:104-114

Hodgson E W, Mc Cornack B P, Tilmon K and Knodel J J (2012). Management recommendations for soybean aphid (Hemiptera: Aphididae) in the United States. *J Integrated Pest Manage* **3**(1):E1–E10.

Jansen J P and D A M Warnier (2011). Side effect of flonicamide and pymetrozine on five aphid natural enemy species. *Int. Organization for Biol Control (IOBC)* **56**:759-770

Juliana S, Singh A and Roy S S (2012). Field screening of broad bean (*Vicia faba* L.) cultivars of Manipur for their resistance reaction to *Aphis craccivora* (Koch.). *J Crop and Weed* **8**(2):152-153

Khade K N, Undirwade D B, Tembhurne R D and Lande G K (2014). Biorational management of sucking pests of cowpea *Vigna sinensis* L. *Trends in Biosci* **7**(20):3212-3217.

Khatake D, More D, Magar S, Khedkar P and Randive D (2023). Trapping efficiency of different coloured sticky traps against sucking pests of pulse crops. *The Pharma Inno J* SP-**12**(12): 2286-2290

Khodeir I A, Khattab M A, Rakha, O M, Sharabash A S, Ueno T and Mousa K M (2020). Population densities of pest aphids and their associated natural enemies on faba bean in Kafr EL Sheikh, Egypt. *Faculty of Agriculture, Kyushu University, Fukuoka, Japan*, 65(1):97-102.

Mohammad Almogdad and Roma Semaskiene (2021). The occurrence and control of black bean aphid (*Aphis fabae* Scop.) in broad bean. *Zemdirbyste-Agriculture* **108**(2): 165–172.

Muhammad A, Muhamma HB, Ibrar-ul-Haq and Zafar I (2014). Relative efficacy of different insecticides against jassid, *Amrasca devastans* (Dist.) on Cotton, Bt-121. *Pakistan J Nutri* **13**(6):344-347

Ofuya ZM and Akhidue V (2005). The role of pulses in human nutrition: a review. *J Appl Sci Environ Manag* **9**: 99–104.

Patil S S, Sridevi D, Ramesh Babu T R and Pushpavathi B (2017). Relative efficacy of selected insecticides on cowpea aphid, *Aphis craccivora* (Koch). *J Entomol and Zool Stud* 5(5):1603–1607.

Preetha G, Stanley J and Manoharan T (2012) Bioefficacy of Imidacloprid 17.8 SL against cotton aphids and leafhoppers. *Indian J Entomol* **74**(4):336-342.

Rekha S and Mallapur C P (2007). Abundance and seasonability of sucking pests of dolichos bean. *Karnataka. J Agric Sci* **20**(2): 397-39.

Roth F, Galli Z, Toth M, Fail J and Jenser G (2016). The hypothesized visual system of *Thrips tabaci* (Lindeman) and *Frankliniella occidentalis* (Pergande) based on different coloured traps' catches. *NW J Zool* **12**(1):40-49.

Roy S K, Ali M S, Mony F T Z, Islam M S and Matin M A (2014). Chemical control of whitefly and aphid insect pest of French bean (*Phaseolus vulgaris* L.). *J Biosci and Agri Res* **2**(2): 69–75.

Saxena H, Bandi S and Devindrappa M (2018). Pests of pulses. *In: Pests and Their Management*; 99-136.

Srinivasan R (2014). Insect and mite pests on vegetable legumes: a field guide for identification and management. AVRDC - *The World Vegetable Center, Shanhua, Taiwan. AVRDC Publication*. 92:14-778..

Tam C K and Webb J C (1993). Dispersion-relation-preserving finite difference schemes for computational acoustics. *J computational Phys* 107(2):262-81.

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