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INTEGRATED FIELD MANAGEMENT OF JASSID (*AMRASCA BIGUTTULA BIGUTTULA* ISHIDA.) INFESTING LADYSFINGER (*ABELMOSCHUS ESCULENTUS* L.) USING BIO-PESTICIDES

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Abstract: Ladysfinger (*Abelmoschus esculentus* L.) (Moench) is an annual crop belonging to the family Malvaceae and one of the most important vegetable crops grown in tropical and sub-tropical areas of the globe. Studies were made to evaluate efficacy of extracts from plants such as *Polygonum hydropiper* L. and *Pongamia pinnata* L., microbial insecticides like spinosad 45 SC (*Saccharopolyspora spinosa* Mertz & Yao) and B*eauveria bassiana* Vuillemin against jassid infesting ladysfinger under field conditions of the sub-Himalayan region of north-east India during the post-kharif season. Methanol was used as solvent for extracting from the plant parts of *Polygonum* and leaves of *Pongamia*. Imidacloprid 17.8% SL was used as check. Significant differences were found in the relative efficacy of different treatments in reducing the jassid population and their persistence at different days after treatment (DAT). Imidacloprid was found the most effective treatment for controlling jassids, followed by the microbial insecticide spinosad. It was observed that extracts of *Polygonum* plant and *Pongamia* leaves at a concentration of 5% and the microbial insecticide spinosad gave higher Jassid control, recording more than 50% mortality. The extract of *Polygonum* at 5% concentration was found very effective against jassids, achieving more than 60% mortality at 3 and 7 DAT. Plant extracts and microbial insecticides are biopesticides having less or no hazardous effects on human health and environment. Thus they can be incorporated in IPM programmes and organic farming in vegetable cultivation.

Keywords: Botanical extract, microbial toxin, vegetables IPM, organic farming.

Introduction

Ladysfinger (*Abelmoschus esculentus* L.) (moench) is an annual crop in the family Malvaceae and one of the most important vegetable crops in tropical and sub-tropical areas of the globe. This crop is cultivated at a commercial scale in the sub-himalayan region of north east India where insect pest damage limits production (Ghosh *et al*., 1999). The crop is susceptible to various insect pests of which jassid (also known as cotton leaf hopper) (*Amrasca biguttula biguttula* Ishida.) is most predominant. As high as 72 species of insects have been recorded on okra (Srinivas Rao and Rajendran, 2003). *Amrasca biguttula biguttula*

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is considered the most destructive sucking pest of this crop (Singh *et al.,* 1993; Dhandapani *et al*., 2003). Jassid caused up to 63.41 % yield loss on okra (Sharma and Sharma, 2001). Krishnaiah (1980) reported about 40-56 per cent losses in okra due to leafhopper. There is a reduction of 49.8 and 45.1 per cent in height and number of leaves, respectively due to attack of leafhopper (Rawat and Sadu, 1973). Its infestation begins at very early stages of crop growth (Faleiro and Rai, 1985) and continues up to harvest depending upon agro-climatic conditions. The nymphs and adults suck the sap from leaves and cause phytotoxic symptoms known as hopper burn which results in complete desiccation of plants. Senapathi and Khan (1978), who reported that leafhopper population was low during early part of March to third week of June. Mahamood *et al.* (1990) observed the appearance of pest, *A. biguttula biguttula* on okra in Pakistan and reported the activity of leafhopper until the end of crop season. Sharma and Sharma (1997) reported that pest population was positively correlated with the minimum temperature and average relative humidity.

Different groups of insecticides have been recommended to control this jassid by various workers like Satpathy *et al*., (2004); Kaur, (2002); Suryawanshi, *et al*., (2000) from time to time. However, the use of synthetic insecticides during the fruit bearing stage is problematic because the fruits are picked at frequent intervals; creating the possibility that toxic residues in the fruits could pose a health hazard. Previous research has evaluated less toxic and more environmentally safe insecticides to control jassid. For example, Faqir Gul (1998) reported that imidacloprid 200SL was effective in controlling jassid over a longer time period. Kaur (2002) reported that seed treatment with imidacloprid and foliar spray resulted in the lowest mean population of cotton jassid. Additionally, the oil of *Pongamia* repelled brown plant hopper (*Nilaparvata lugens* Stall.) in rice and significantly reduced its ingestion and assimilation of food. Both brown plant hopper and white backed plant hopper suffered heavy mortality (Lim and Bottrell, 1994). *Polygonum* is a well known weed in the terai agro-climatic region of West Bengal, India locally known as “Biskanthali” (Sarkar and Mukharjee, 2005). Badshah *et al*., (2005) reported from Pakistan that crude leaf and flower extracts of *Polygonum hydropiper* were responsible for mortality rates 10 days after feeding of 28% and 52% for *Heterotermes indicola* and 28% and 74.7% for *Coptotermes heimi* respectively. *Beauveria bassiana* caused 100% mortality of the larvae of the mango pest *Orthaga euadrusalis* (Walk) (Noctuidae: Lepidoptera after they crawled over the fungus for four days (Srivastava and Tandon, 1980). Acharya *et al*., (2002) studied the efficacy of the insecticides imidacloprid and abamectin and reported they were safer to use in the presence of coccinellid

predators. The objective of this study was to determine the efficacy of the microbial pesticide *Beauveria bassiana,* the microbial toxin *Saccharopolyspora spinosa*, and plant extracts of *Polygonum hydropiper* and *Pongamia pinnata* against jassid.

Materials and methods

Study period and location

Study was conducted for the two years 2010 and 2011 during the post kharif season at the instructional farm of Uttar Banga Krishi Viswavidyalaya (State Agricultural University) at Pundibari, Coochbehar, West Bengal, India. The experimental area is situated in the sub-Himalayan region of north-east India. This so called terai zone is situated between $25^0$57' and 27^0 N latitude and $88^0$25' and $89^0$54' E longitude. The soil of the experimental field was sandy loam with pH value 6.9. The climate of this zone is subtropical humid with a short winter spell during December to February.

Cultivation practices

The ladysfinger variety 'Nirmal-101' was grown during the post-kharif (early September) season in both years under recommended fertilizer levels (120:60:60 kg NPK/ha) and cultural practices in 4 m x 5m plots at a spacing of 75 cm x 35 cm. The treatments were replicated three times in a Randomized Block Design.

Treatments

Two microbial insecticides, *Saccharopolyspora spinosa* (Spinosad 45 SC) @ 1.0 ml/ 3 L and *Beauveria bassiana* (Bals.) Vuillemin (Biorin 10^7 conidia /ml) @ 1.0 ml/L, and two botanical extracts, *Pongamia pinnata* leaf extract @ 2.0% and 7.0% and *Polygonum hydropiper* plant extract(stem, leaves and floral parts together) @ 2.0% and 7.0 %, were evaluated and compared with the ability of imidacloprid (Confidor 17.8 SL) @ 1ml/5 L) to control jassid. This insecticide is recommended for use against this jassid pest.

Preparation of extract of Polygonum etc.

The *Pongamia* leaves and *Polygonum* plants (stem, leaves and floral parts together) were extracted in methanol as follows. After washing with water, the plant parts were dried and powdered in a grinder. The powder (50 g) samples of each tested plant were transferred separately to a conical flask (500 ml) and dipped in 250 ml methanol. The material was allowed to stand for 72 hours at room temperature with occasional stirring. After 72 hours the extract was filtered through Whatman 42 filter paper and residues were washed twice with methanol.

Data recording

Three sprays at 12 day intervals were made, starting with the initiation of infestation. Jassid population densities were recorded 3, 7, and 11 days after each spraying by counting jassid on each leaf of five apical leaves from five randomly selected plants per replication. The results were expressed as jassid population suppression (%) compared to densities recorded on the control treatment. Percent reduction of jassid population over control was calculated by the following formula (Abbott, 1925):

$$Pt = \frac{Po - Pc}{100 - Pc} \times 100$$

Where, Pt = Corrected mortality, Po = Observed mortality and Pc = Control mortality.

Percent reduction over control =

$$\frac{\text{Percent reduction in treatment} - \text{Percent reduction in control}}{100 - \text{Percent reduction in control}} \times 100$$

Data were analyzed by using INDO-STAT- software for analysis of variance following randomized block design (RBD) treatment means were separated by applying CD Test (critical difference) at 5 % level of significance.

Harvesting of fruits

The fruits were harvested at frequent intervals when they reached marketable size. The yield of marketable produce was calculated in different years separately on the basis of fruit yield per plot and converted to quintals per hectare.

Results and discussion

The different treatments and their persistence at different days after application varied significantly in their suppression of jassid populations (Tables 1 and 2). Among the seven treatments (table -2), imidacloprid provided the best suppression of jassid population (83.24 %), closely followed by microbial toxin *Saccharopolyspora spinosa* (74.76% suppression). Kaur (2002) reported that seed treatment with imidacloprid and foliar spray resulted in the lowest mean population of cotton jassid. Ghosh *el al*., reported in 2009 that *Saccharopolyspora spinosa* (Spinosad 45 SC) @ 1.0 ml/ 3 L was very effective against another sucking pest, aphid on ladysfinger achieving 71.76 % suppression. Among the bio-pesticides, *Saccharopolyspora spinosa* was the most effective followed by the *Polygonum* plant extract at the higher concentration *i.e.,* 7.0% (59.00% suppression). From overall observation it was revealed that extracts of *Polygonum* plant and *Pongamia* leaf at higher concentration gave better result, recording more than 50% jassid suppression. The least

effective treatments were the *Pongamia* leaf extract at the lower concentration (44.57 % suppression) and *Polygonum* plant extract at lower concentration (49.75 % suppression).

Three days after spraying, imidacloprid was the most effective (83.27% suppression) against the jassid, closely followed by *Saccharopolyspora spinosa* (79.77% suppression). There was no significant difference in efficacy among these two insecticides. *Polygonum* plant extract at higher concentration provide better results against jassid (60.56% suppression). Likewise, the ability of imidacloprid to suppress jassid populations extended to seven and 11 days after spraying. Persistency of imidacloprid is very high and even 11 days after spraying it provided high suppression of the pest (81.40 % suppression of jassid population) which is supported by Faqir Gul (1998). At seven and eleven days after spraying, among the bio-pesticides, *Saccharopolyspora spinosa* was found very effective against jassid (75.34% suppression and 69.17% suppression respectively) followed by the *Polygonum* plant extract at the higher concentration (61.69% suppression and 54.71% suppression respectively).

Yield was directly related to the efficacy of insecticides. The highest yield was obtained from plots treated with imidacloprid (42.22 q/ha) followed by *Saccharopolyspora spinosa* (41.20q/ha) (table -2). There was no significant difference in yield between these two treatments. In general, the plant extract of *Polygonum* and leaf extract of *Pongamia* at (the higher concentration) and the microbial toxin *Saccharopolyspora spinosa* gave satisfactory jassid suppression. Additionally, Lim and Bottrell, 1994 reported that the oil of *Pongamia* repelled brown plant hopper (*Nilaparvata lugens* Stall.) in rice and both brown plant hopper and white backed plant hopper suffered heavy mortality. The *Polygonum* plant extract at the higher concentration was very effective against jassid achieving more than 60% mortality at 3 and 7 days after treatment. Ghosh *el al*., reported in 2009 that *Polygonum hydropiper plant* extract at 5% concentration was very effective against another sucking pest, aphid on ladysfinger achieving 65 % and 67.64 % suppression at 3 and 7 days after treatment respectively. Based on their moderate to high efficacy levels, as well as low toxicity to natural enemies and minimum impact on human health, we conclude that microbial insecticides and plant extracts can be incorporated in future IPM programme and organic farming in vegetable cultivation.

Table 1: Effect of different treatment schedules of plant extracts and microbial insecticides against jassid on ladysfinger

Treatments	Dose ml./Liter (%)	Pre-Treat. Obs. Jassid /Leaf	% Reduction on different days after treatment (DAT)								
			1st Spraying			2nd Spraying			3rd Spraying		
			DAT			DAT			DAT		
			3	7	11	3	7	11	3	7	11
T1= *Saccharopolyspora sponisa* (Spinosad 45 SC)	1 ml/3L	4.99	83.39 (65.03)	78.30 (62.32)	72.71 (58.30)	78.84 (61.56)	75.19 (60.14)	67.60 (55.32)	77.09 (61.42)	72.52 (58.39)	67.19 (55.06)
T2=Imidacloprid (Confidor 17.8 S.L.)	1 ml/5 L	4.81	87.62 (68.89)	90.68 (72.28)	89.41 (71.02)	85.86 (67.07)	78.60 (62.07)	73.52 (59.03)	76.33 (60.90)	85.91 (67.98)	81.27 (67.98)
T3=*Pongamia pinnata* (2.0%)	20.00 (2.0%)	4.93	55.08 (48.05)	56.77 (48.89)	50.59 (45.34)	42.37 (40.42)	44.82 (42.02)	37.65 (37.85)	39.52 (38.77)	41.00 (39.81)	33.30 (35.24)
T4=*Pongamia pinnata* (7.0%)	70.00 (7.0%)	4.95	58.77 (50.03)	64.44 (53.40)	58.82 (50.09)	50.31 (45.18)	54.66 (47.68)	49.30 (44.60)	50.59 (45.34)	51.40 (45.81)	40.37 (39.44)
T5=*Polygonum hydropiper* (2.0%)	20.00 (2.0%)	4.89	51.88 (46.08)	55.03 (47.50)	53.86 (47.21)	55.03 (47.50)	49.42 (44.67)	44.82 (42.02)	47.99 (43.85)	51.32 (45.76)	38.39 (38.28)
T6=*Polygonum hydropiper* (7.0%)	70.00 (7.0%)	5.08	67.60 (55.32)	65.82 (54.23)	63.72 (53.01)	57.00 (49.03)	59.49 (50.47)	49.02 (44.44)	57.08 (49.07)	59.76 (50.64)	51.40 (45.81)
T7=*Beauveria bassiana* (Biorin 10^7 conidia/ml)	1 ml/L	4.85	55.19 (47.98)	50.94 (45.54)	44.82 (42.02)	49.82 (44.89)	59.27 (44.58)	38.05 (38.09)	51.32 (45.76)	48.26 (46.00)	41.70 (40.22)
T8=Untreated Control	-	4.82	120.25	135.00	195.25	175.22	225.25	300.55	320.25	320.00	257.25
SE m±	-	-	2.47	2.34	3.70	2.13	2.93	2.41	3.15	3.25	2.81
C.D at 5%	-	NS	7.36	6.97	10.99	6.34	8.71	7.18	9.37	9.66	8.36

Figure in the parenthesis are angular transformed values, DAT= days after treatment, NS = Not significant

Table 2: Overall efficacy of plant extracts and microbial insecticides against jassid, and the fruit yield of ladysfinger

treatments	Dose ml./Litre (%)	Pre-Treatment Observation jassid/Leaf	Overall efficacy (% reduction) Days after treatment				Fruit Yield (q/ha)
			3	7	11	Mean	
T1= *Saccharopolyspora sponisa* (Spinosad 45 SC)	1 ml/3 L	4.99	79.77 (62.67)	75.34 (60.28)	69.17 (56.23)	74.76 (59.73)	41.20
T2= Imidacloprid (Confidor 17.8 S.L.) (T2)	1 ml/5 L	4.81	83.27 (65.62)	85.06 (67.44)	81.40 (66.01)	83.24 (66.36)	42.22
T3= *Pongamia pinnata* (2.0%)	20.00 (2.0%)	4.93	45.66 (42.41)	47.53 (43.57)	40.51 (39.48)	44.57 (41.82)	33.90
T4=*Pongamia pinnata*(7.0%)	70.00 (7.0%)	4.95	53.22 (46.85)	56.83 (48.96)	49.50 (44.71)	53.18 (46.84)	36.98
T5= *Polygonum hydropiper* (2.0%)	20.00 (2.0%)	4.89	51.63 (45.81)	51.92 (45.98)	45.69 (42.51)	49.75 (44.77)	31.89
T6=*Polygonum hydropiper* (7.0%)	70.00 (7.0%)	5.08	60.56 (51.14)	61.69 (51.78)	54.71 (47.75)	59.00 (50.22)	37.23
T7= *Beauveria bassiana* (Biorin 10^7 conidia/ml) (T7)	1 ml/ L	4.85	52.11 (46.21)	52.82 (46.71)	41.52 (40.11)	48.82 (44.34)	33.51
T8= Untreated Control	-	4.82	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	27.38
SE m (±)	-	-	2.13	2.93	2.93	-	1.14
CD at 5%	-	NS	6.34	8.71	8.71	-	3.87

Figure in the parenthesis are angular transformed values, DAT= days after treatment, NS = Not significant

Conclusions

The plant extract of *Polygonum* and leaf extract of *Pongamia* at higher concentration (7.0%) and the microbial toxin *Saccharopolyspora spinosa* gave higher jassid suppression. The *Polygonum* plant extract at the higher concentration (7.0%) was very effective against *Amrasca biguttula biguttula* (60.56 % mortality at 3 days after application). Based on their moderate to high efficacy levels, as well as low toxicity to natural enemies and minimum impact on human health, we conclude that microbial insecticides and plant extracts can be incorporated in future IPM programme and organic farming in vegetable cultivation.

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