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Seasonal incidence and control of black fly (*Aleurocanthus rugosa* Singh) infesting betelvine (*Piper betle* L)

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ABSTRACT

Black fly (Aleurocanthus rugosa Singh) is an important pest in betel vine particularly under Tarai region of West Bengal. Experiments were conducted to find out the population build up of black fly in betel vine as influenced by climatic factors and efficacy of some insecticides under the boroj of the instructional farm, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during the period from Nov.,2005 to Apr.,2007. Population of black fly was found active throughout the year but the maximum (20 nos./ leaf) and minimum (1.2 nos./ leaf) population (nymphs & adults) was recorded at 44th standard week of 2006 and at 16th standard week of 2007 respectively. Simple correlation analysis revealed no significant correlation between abiotic factors with black fly population; though population was positively correlated with maximum and minimum temperature, maximum relative humidity but negatively with minimum relative humidity and rainfall in the present study. Multiple regression analysis showed significant variation and the R^2 value suggested that the biotic factors contribute 20% variation in blackfly population. Among ten (10) different insecticides, the highest mortality (74.53%) of black fly was found in the Imidachlorprid treated plots though it was at par with acetamiprid and quinolphos + cypermethrin combined product.

Key wodrs: Betel vine, black fly, chemical control and population dynamics.

Betelvine (*Piper betle* L.) or *Pan* is a highly remunerative crop for the farmers of West Bengal. It has high domestic demand and about 15 to 20 million people consume betel leaves in our country on a regular basis (Jana,1996).. The crop has been cultivated traditionally over the years without any improvement in package of practices and has led to diminishing returns. The crop is raised under the covered structure which not only creates favourable condition for crop growth but also influence pest incidence. The crop is attacked by large number of insect- pests causing huge loss in leaf yield (Nikam *et al*., 1958).The white and black fly have been identified as major constraints in increasing the leaf yield of betelvine (Giri, 1995; Jana, 2006). Literature revealed meager information on population build up and efficacy of insecticides against the pest particularly in *Terai* Region of West Bengal. The present investigation was, therefore, carried out to study the incidence of black fly and their control on betel vine in *Terai* Region of West Bengal.

MATERIALS AND METHODS

The experiments were conducted in two years old standing betel vine *boroj* (cv. Kali Bangla) under closed conservatory system of cultivation at the instructional farm, Uttar Banga Krishi Vidyalaya, Pundibari, Cooch Behar, West Bengal during the period from Nov.,2005 to Apr.,2007. Planting was done with a spacing of 50 cm x 10cm in between the rows and the plants respectively. The crop was raised with recommended (Guha, 2006) package of practices (150 : 100 : 100 kg NPK / ha/ yr). Half of the nitrogen was applied as organic in the form of mustard cake and rest amount in the form of urea in six equal splits at a monthly interval starting from May to October. Phosphatic and potassic fertilizers were applied at a time during onset of monsoon in May .

In order to study the seasonal incidence of black fly population in relation to prevailing climatic conditions, observations on both nymphs and adult population were made at weekly interval. Five rows each having 20 creepers were considered as replication. One plant from each of five rows was taken into consideration for each replication. Five replications were used for RBD design . Daily records of abiotic factors such as maximun and minimum tempurature, maximun and minimum relative humidity and rainfall were collected. The data thus obtained were computed and subjected to correlation analysis.

Ten (10) synthetic and botanical insecticides *viz.,* NSKE 5%, Tobacco leaf extracts 2.5%, Azadirachtin 0.0002%, Imidachlorprid 0.0023%, Endosulfan 0.07%, Chlorpyriphos + Cypermethrin 0.05%, Cartap hydrochloride 0.05%, Carbaryl 0.13%, Acetamiprid 0.0027% and Quinolphos + Cypermethrin 0.07% were taken into consideration. Spraying was made during winter (Oct. - Nov.) and spring (Feb.- Mar.) season when moderate to high level of insect pests was observed. Eleven (11) plots

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each having three rows were selected. Ten (10) insecticides were sprayed on ten plots randomly while the remaining plots (mention method of recording population) were considered as control where no insecticide was applied. The number of adults and nymphs was counted (Eye estimation) from top 5 leaves where flies were found to occur. The black fly population was recorded from 3 randomly selected plants in each plot at 3, 8 and 14 days after spraying from all plots. General formula used for the calculation of per cent mortality of black fly is given below-

Percent mortality= (X-Y) / X x 100

X = Pre treatment count

Y = Post treatment count

Data thus obtained were transformed (ARC-SIN) accordingly and subjected to statistical analysis.

RESULTS AND DISCUSSION

Population build up of blackfly

It is revealed from the present study that black fly population prevailed throughout the period of study and population build up showed the significant variation over weeks throughout the period of investigation. High level of population was recorded during 35th to 44th standard week of 2006 while low population was existed during the end of April to the month of July. Maximum (20 nos./ leaf) was recorded at 44th standard week of 2006 (i.e, the end of October to the first few days of November) while the minimum (1.20 nos./ leaf) population was registered at 16th standard week of 2007 (i.e, 3rd week of April). Jana (2006) reported two peak population of black fly on betel vine once during June to August and other during September to November at B. C. K. V., Nadia, West Bengal which confirms the findings of the present study but slight deviation of the result may be due to climatic variation in two distant places.

Simple correlation and multiple regression analysis were worked out between means of various abiotic factors and mean population of black fly and no significant variation was observed among abiotic factors. The black fly population was positively correlated with maximum and minimum temperature, maximum RH but negatively with Minimum RH and rainfall in the present investigation (Table 2). The impact of climatic parameters was also collectively measured by multiple regression analysis and the R^2 value suggested 20.60% variation in the pest incidence due to various climatic factors studied (Table 2).

Efficacy of insecticides

The results from mean of two seasons indicate that all the insecticidal treatments were significantly superior over control in reducing the black fly population and also had significant variation among themselves at different date of observations. It was evedent from the result (Table 3) that three days after spraying both acetamiprid and quinolphos + cypermethrin gave the highest mortality (100%) against blackfly though it was at par with endosulfan (98.54%). After 8 days of spraying, acetamiprid occupied the first position (76.36%) in relation to mortality percentage followed by cartap hydrochloride (75.62%), imidachlorpid (73.45%), a combination of quinolphos and cypermethrin (71.35%) and endosulfan (71.36%) but they did not differ significantly from each other. At 14 days of spraying, mortality percentage of blackfly was found to be maximum (60.31%) in imidachlorpid treated plots and it differs significantly from rest of the insecticides.

The overall mortality of black fly by different insecticides showed significant variations among them. The relative order of efficacy of insecticides to black fly was found to be imidachlorpid (73.53%) > acetamiprid (74.35%) > quinolphos + cypermethrin (74.16%) > endosulfan (73.84%) > cartap hydrochloride (71.53%) and these insecticides had no difference among themselves. Though Neem based insecticides like azadirachtin produced little lower mortality (63.90%) over synthetic insecticides against black fly but had significant importance whenever the residual toxicity in leaf will be taken into account. The reduction of the black fly population on betel vine by the use of chemical and botanical insecticides was also reported by various workers Das (1988) recorded 77.50% reduction of black fly over control in neem oil treated plots after 4 days of spraying which supports the findings of the present investigation by observing 80.42% mortality in azadirachtin treated plots.

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Table 1.:Variations in black fly population as influenced by weather factors.

Year	Standard week	Black Fly (Nos. /Leaf)	Temperature (^{0}c)			Relative Humidity (%)			Rainfall (mm)
			Max.	Min.	Gradient	Max.	Min.	Gradient	
2005	48th	5.46	26.70	14.70	12.00	95.00	82.00	13.00	0.00
	49th	4.98	26.40	14.40	12.00	92.00	81.00	11.00	0.00
	50th	3.00	26.30	13.50	12.80	88.00	75.00	13.00	0.00
	51th	2.84	25.90	13.40	12.50	87.00	75.00	12.00	0.00
	52th	3.15	25.30	10.90	14.40	89.00	78.00	11.00	0.00
2006	1st	4.02	21.40	9.40	12.00	86.00	62.00	24.00	0.00
	2nd	4.27	21.30	9.30	12.00	87.00	63.00	24.00	0.00
	3rd	2.27	22.10	10.10	12.00	83.00	58.00	25.00	0.00
	4th	2.00	21.90	10.20	11.70	82.00	57.00	25.00	0.00
	5th	6.56	21.80	10.10	11.70	81.00	62.00	19.00	0.00
	6th	5.21	27.20	12.90	14.30	79.00	53.00	26.00	0.00
	7th	4.67	29.10	16.80	12.30	78.00	52.00	26.00	0.00
	8th	4.40	32.50	17.00	15.50	79.00	51.00	28.00	0.00
	9th	4.88	30.20	16.90	13.30	78.00	51.00	27.00	0.00
	10th	6.32	29.40	16.30	13.10	88.00	65.00	23.00	0.30
	11th	5.00	32.20	18.40	13.80	79.00	53.00	26.00	0.00
	12th	5.08	33.50	17.90	15.60	79.00	55.00	24.00	0.00
	13th	4.30	34.10	18.50	15.60	75.00	62.00	13.00	0.60
	14th	4.08	34.70	18.10	16.60	94.00	84.00	10.00	2.10
	15th	2.93	34.30	18.20	16.10	94.00	82.00	12.00	21.30
	16th	2.64	30.10	21.00	9.10	89.00	85.00	4.00	36.00
	17th	3.95	29.60	21.00	9.10	86.00	64.00	22.00	7.10
	18th	1.90	33.00	21.00	11.70	87.00	65.00	22.00	99.70
	19th	2.20	29.50	22.00	7.20	91.00	75.00	16.00	33.00
	20th	2.80	31.60	22.00	9.80	81.00	68.00	13.00	27.80
	21st	2.90	33.50	25.00	8.90	84.00	76.00	8.00	17.00

Table contd.

Year	Standard week	Black Fly (Nos. /Leaf)	Temperature (^{0}c)			Relative humidity (%)			Rainfall (mm)
			Max.	Min.	Gradient	Max.	Min.	Gradient	
	22nd	1.24	29.00	24.00	5.20	95.00	85.00	10.00	243.00
	23rd	1.78	31.50	25.00	6.10	91.00	81.00	10.00	123.00
	24th	2.82	30.90	24.00	7.20	94.00	83.00	11.00	49.40
	25th	2.00	32.10	25.00	7.50	94.00	82.00	12.00	85.20
	26th	1.64	30.40	25.00	5.70	94.00	82.00	12.00	237.30
	27th	3.90	33.00	26.00	7.20	93.00	79.00	14.00	106.10
	28th	3.06	31.40	26.00	5.70	95.00	79.00	16.00	109.30
	29th	7.81	32.60	26.00	6.40	93.00	80.00	13.00	0.20
	30th	2.79	31.20	25.00	6.30	92.00	79.00	13.00	113.60
	31st	3.48	33.20	26.00	7.60	90.00	70.00	20.00	33.60
	32nd	5.56	33.10	26.00	7.20	92.00	73.00	19.00	11.60
	33rd	4.88	33.30	26.00	7.40	88.00	72.00	16.00	25.20
	34th	2.96	32.10	25.00	6.90	96.00	72.00	24.00	68.40
	35th	12.13	32.40	25.00	7.10	94.00	71.00	23.00	13.90
	36th	5.00	33.00	25.00	8.20	93.00	76.00	17.00	142.70
2006	37th	4.58	28.90	24.00	5.10	98.00	76.00	22.00	166.30
	38th	11.37	31.00	24.00	7.10	96.00	77.00	19.00	61.80
	39th	10.77	30.10	24.00	5.80	96.00	77.00	19.00	90.90
	40th	12.00	31.20	23.00	7.80	98.00	78.00	20.00	89.40
	41st	14.09	32.00	23.00	8.80	94.00	69.00	25.00	83.20
	42nd	16.56	30.90	22.00	9.40	96.00	72.00	24.00	39.40
	43rd	18.65	30.00	18.00	11.60	84.00	65.00	19.00	0.00
	44th	20.00	29.70	18.00	11.40	93.00	67.00	26.00	0.00
	45th	4.36	27.80	19.00	8.90	94.00	72.00	22.00	0.00
	46th	4.00	27.90	17.00	10.90	97.00	59.00	38.00	1.00
	47th	6.28	24.90	16.00	9.00	97.00	74.00	23.00	1.00
	48th	8.04	24.30	11.40	12.90	97.00	77.00	20.00	0.00
	49th	3.80	25.30	13.00	12.80	95.00	78.00	17.00	0.00
	50th	4.12	23.90	13.00	10.80	98.00	85.00	13.00	0.00
	51th	3.34	25.50	13.00	12.20	95.00	70.00	25.00	0.00
	52nd	4.26	13.50	11.00	13.00	100.00	82.00	18.00	0.00
	1st	3.72	19.10	9.90	9.20	95.00	79.00	16.00	0.00
	2nd	3.12	23.00	8.00	15.00	99.00	58.00	41.00	0.00
2007	3rd	3.30	21.20	7.10	14.10	99.00	55.00	44.00	0.00
	4th	3.30	23.10	9.50	13.60	100.00	57.00	43.00	0.00

Table contd.

Year	Standard week	Black Fly (Nos. /Leaf)	Temperature (^{0}c)			Relative Humidity (%)			Rainfall (mm)
			Max.	Min.	Gradient	Max.	Min.	Gradient	
2007	5th	6.32	25.50	13.30	12.20	98.00	64.00	34.00	0.00
	6th	3.25	21.90	14.30	7.60	98.00	73.00	25.00	43.70
	7th	3.76	21.30	12.30	9.00	96.00	74.00	22.00	28.30
	8th	5.79	25.70	12.10	13.60	96.00	52.00	44.00	0.00
	9th	4.43	24.60	14.30	10.30	95.00	66.00	29.00	10.30
	10th	6.07	27.10	12.60	14.50	97.00	41.00	56.00	0.00
	11th	4.92	28.10	14.90	13.20	87.00	46.00	41.00	0.00
	12th	4.82	29.30	16.90	12.40	87.00	53.00	87.00	3.30
	13th	2.78	32.20	17.80	14.40	85.00	44.00	41.00	0.00
	14th	2.51	30.50	20.30	10.20	88.00	66.00	22.00	18.70
	15th	1.99	26.70	18.90	7.80	84.00	66.00	18.00	23.20
	16th	1.20	31.90	20.50	11.40	97.00	62.00	35.00	98.80
S Em (±)		**2.61**							
LSD (0.05%)		**7.29**							

Table 2 : Correlation co-efficient and multiple regression between black fly and environmental parameters.

Environmental parameters		Correlation co-efficient (r)	Co-efficient of determination (R^2)	Regression Equation
Temperature	Maximum	0.135	0.2060*	$Y=-9.783+ 5.225X_1- 4.954X_2- 5.233X_3 + 0.165X_4 - 0.051X_5 - 0.016X_6 - 0.025X_7$
	Minimum	0.112		
	Gradient	-0.046		
Relative Humidity	Maximum	0.107		
	Minimum	-0.022		
	Gradient	0.070		
Rainfall		-0.128		

** Significant at 1% level of significance * Significant at 5% level of significance

Table 3 : Efficacy of insecticides against Black fly

Treatment	Concentration	Mean percent mortality			Overall mortality
		3 D.A.S.	8 D.A.S.	14 D.A.S.	
N.S.K.E.	5%	73.03 (58.88)	64.85 (53.67)	44.08 (41.60)	60.66 (51.15)
Tobacco leaf extract	2.5%	71.49 (57.97)	61.23 (51.51)	41.01 (39.77)	57.91 (49.57)
Imidachlorprid	0.0023%	89.87 (71.64)	73.43 (58.98)	60.31 (50.95)	74.53 (59.70)
Azadirachtin	0.00015%	80.42 (63.47)	62.40 (52.27)	48.87 (44.32)	63.90 (53.10)
Endosulfan	0.07%	98.54 (83.12)	71.36 (57.70)	51.63 (45.94)	73.84 (59.27)
Chlorpyriphos + Cypermethrin	0.05%	87.57 (69.52)	64.93 (53.71)	47.51 (43.56)	66.67 (54.75)
Cartap Hydrochloride	0.05%	91.98 (73.68)	75.62 (60.45)	46.98 (43.26)	71.53 (57.75)
Carbaryl	0.13%	93.37 (75.52)	65.31 (54.00)	46.46 (42.97)	68.38 (55.78)
Acetamiprid	0.0027%	100.00 (85.95)	76.35 (61.04)	46.64 (43.06)	74.33 (59.62)
Quinolphos + Cypermethrin	0.07%	100.00 (85.95)	71.53 (57.70)	51.11 (45.64)	74.16 (59.48)
Control	-	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)
S. Em (±)		**2.00**	**1.72**	**1.69**	**0.92**
LSD (0.05%)		**5.89**	**5.08**	**4.98**	**2.70**

Figures in the parentheses are angular (ARC SIN) transformed values.