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Incidence and management of *Empoasca kerri* Pruthi and *Aphis craccivora* Koch on cowpea

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ABSTRACT

A field trail was conducted to study incidence and management of *Aphis craccivora* Koch and *Empoasca kerri* Pruthi. The peak incidence of *E. kerri* was recorded during 1st standard week where as *A. craccivora* during 7th standard week. The incidence of *E. kerri* was negatively significant with minimum temperature where as all other factors were non significant. The incidence of *A. craccivora* had positive and highly significant association with coccinellids and spiders where as all the other abiotic factors had non significant association. The results of management trail indicated that thiamethoxam 0.005% and acetamiprid 0.002% were highly effective in reducing the population of *A. craccivora* and *E. kerri* on cowpea.

Key words : *A. craccivora, E. kerri,* Incidence and management

Cowpea [*Vigna unguiculata* (L.) Walp.] is the most important grain legume in the third world. It is commonly known as black-eyed pea, chinapea and marblepea. It is an important source of dietary protein in developing countries of Asia and Africa. It is used as fodder, vegetable, pulse and green manure crop.

Cowpea is infested by 21 insect pests of which aphids, *Aphis craccivora* Koch., leafhoppers, *Empoasca kerri* Pruthi, tobacco caterpillar, *Spodoptera litura* (Fab.) and spotted pod borer, *Maruca vitrata* Geyer cause about 65-100% yield losses (Pai, 1990). At present, synthetic pyrethroids are regularly used for control of *M. vitrata a*nd their indiscriminate use is leading to sucking complex resurgence. The present emphasis is not only the use of different groups of chemicals that are eco-friendly and give satisfactory control but also knowledge on population dynamics as influenced by biotic and abiotic factors. Study on the seasonal incidence of insect pests through out the crop period in relation to biotic and abiotic factors provides basic information on population dynamics of insect pests of *rabi* cowpea.

MATERIAL AND METHODS

The study was conducted at Agricultural College Farm, Bapatla during *rabi* 2006 – 2007. Swathi 71 variety of cowpea was sown in a bulk plot of 200 m^2 by adopting 30 x 15 cm spacing. The incidence of the leafhoppers, *E. kerri* was recorded weekly intervals from 50 randomly selected and tagged plants at five different locations recorded at total number of population in five leaves *i.e.,* top two, middle one and bottom two in the plants. Where as the total population of aphids, *A. craccivora* was recorded on top 1/3rd portion of the tagged plants. The pest incidence was correlated with meteorological data for establishing the effect of biotic and abiotic factors with meteorological data for establishing the effect of biotic and abiotic factors on the activity of the pests. The influence of biotic and abiotic factors on the incidence of *E. kerri and A. craccivora* was established through simple correlation and multiple linear regression studies.

Regarding management of *E. kerri and A. craccivora* of cowpea, the experiment was laid in a randomized block design with 10 treatments including the untreated control and replicated thrice. Plots of net size 4 x 3 m were prepared and enclosed by bunds all round and with irrigation channels in between the replications.

The crop received three round of foliar spray. Out of three sprays, the first spray was to control leafhoppers as their population was above threshold and subsequent build up was not significant to carry out any further sprays.However, *A. craccivora* population appeared in the crop and hence, second and third sprayings were aimed against this pest. The population data was recorded on day before spraying as pre-treatment count and on 1, 5 and10 days after spraying as post-treatment counts. The observations were recorded from 10 randomly selected plants which were tagged in each plot, leaving the border rows. Percent population reduction of *E. kerri and A. craccivora* over un treated control in different treatments was calculated using modified Abbot's formula and these values were further transformed to the corresponding angular values and the data were subjected to statistical analysis.

Table 1a. Effect of abiotic and biotic factors on the incidence of *E. kerri* on cowpea during *rabi*, 2006 - 07

Abiotic & Biotic Factors (Weather parameters and natural enemies)	Correlation coefficient (r)
X_1 – Maximum temperature (^{0}C)	-0.5151
X_2 – Minimum temperature (^{0}C)	-0.5418*
X_3 – Morning relative humidity (%)	0.2289
X_4 – Evening relative humidity (%)	-0.3142
X_5 – Rain fall (mm)	-0.1537
X_6 – Coccinellids	-0.1720
X_7 – Spiders	-0.2145

* Significant at 5% level

Table 1b. Multiple linear regression between abiotic and biotic factors and E. kerri on cowpea during rabi, 2006-07.

Variable	Partial regression coefficient	Stan-dard error	t - value
X_1 – Maximum temperature (^{0}C)	-5.678	14.430	0.394
X_2 – Minimum temperature (^{0}C)	-4.535	5.018	0.904
X_3 – Morning relative humidity (%)	0.425	1.579	0.269
X_4 – Evening relative humidity (%)	0.333	1.193	0.279
X_5 – Rain fall (mm)	2.549	3.155	0.808
X_6 – Coccinellids	-0.648	1.313	0.494
X_7 – Spiders	0.017	1.272	0.013

Intercept: 205.28 R^2 value: 0.4517

RESULTS AND DISCUSSION

The incidence of aphids and leafhoppers on cowpea was recorded and correlated with corresponding meteorological data to understand relationship during the season.

Empoasca kerri

The incidence of leafhopper population commenced during 50th standard week *i.e.,* 12 days after sowing and the pest population reached its peak during last standard week *i.e.*, at 32 DAS and thereafter exhibited declining. These results are in close agreement with Sankar *et al.* (2004) who recorded leafhopper incidence from early vegetative phase to pod initiation stage. In the present study also the same trend was observed. The variation in the seasonal incidence of leafhoppers in the present study and earlier repots on other crops was probably due to variation in the time of planting, different nature of crop and geographical location.

During the present study the leafhopper population showed negative and non-significant association with maximum temperature, evening relative humidity and rainfall, while the association with minimum temperature was negative but significant and the morning relative humidity was positive and non – significant (Table 1). The leafhopper population showed negative and non-significant association with the population of coccinellids and spiders. However, the multiple linear regression analysis could not reveal any individual significant factor but there was interaction among different factors.

Earlier studies conducted by Muthukumar and Kalyansundaram (2003a), revealed negative relationship of leafhoppers with minimum temperature and rainfall on brinjal at Killikulam, Tamilnadu. The results obtained in the present study are in agreement with the above workers. Contrary to this, Srinivasan *et al.* (1988) reported positive

Table 2a. Effect of abiotic and biotic factors on the incidence of *A. craccivora* on cowpea during *rabi*, 2006 - 07

Abiotic & biotic factors (Weather parameters and natural enemies)	Correlation coefficient (*r*)
X_1 – Maximum temperature (^{0}C)	0.1764
X_2 – Minimum temperature (^{0}C)	0.1051
X_3 – Morning relative humidity (%)	-0.0676
X_4 – Evening relative humidity (%)	-0.1092
X_5 – Rain fall (mm)	0.4325
X_6 – Coccinellids	0.8735**
X_7 – Spiders	0.9314**

** Significant at 1% level

Table 2b. Multiple linear regression between abiotic and biotic factors and A. craccivora on cowpea during rabi, 2006-07.

Variable	Partial regression coefficient	Stan-dard error	t - value
X_1 – Maximum temperature (^{0}C)	-19.140	30.075	0.636
X_2 – Minimum temperature (^{0}C)	-0.188	10.459	0.018
X_3 – Morning relative humidity (%)	-4.211	3.291	1.280
X_4 – Evening relative humidity (%)	2.937	2.488	1.181
X_5 – Rain fall (mm)	-5.792	6.576	0.881
X_6 – Coccinellids	2.999	2.738	1.095
X_7 – Spiders	8.344	2.651	3.148*

Intercept: 743.468 R^2 value: 0.9420 *Significant at 5% level

impact of minimum temperature. Similar results were reported by Narendra Reddy *et al.* (2001) and Chinna Babu Naik (2006). This may be attributed to changes in cropping pattern, geographical location and seasonal variation.

Aphis craccivora

The incidence of aphid population commenced during 50th standard week *i.e*., 12 DAS and the pest population reached its peak level during 7th standard week *i.e.,* at 75 DAS and there after exhibited declining trend and reached a minimum population by 10th standard week *i.e*., at 96 DAS.

During the present study the aphid population showed non-significant association with weather parameters. But, the correlation studies clearly revealed significant positive impact of natural enemies *i.e.*, coccinellids and spiders on aphid population. Even, the multiple regression has revealed that spider population was positively significant and their numbers increased with increase in aphid population(Table 2a&b).

Earlier studies of Mehto *et al.* (1985) revealed that aphid population was noticed during the active vegetative stage of chickpea from January first week to February. Mehto *et al.* (1985), Kavita *et al*. (2003) reported positive correlation with maximum temperature and the results obtained in the present study are in conformity with that of above workers.

Contrary to the present findings Sankar *et al*. (2004) reported that aphid population was confined only to the first three weeks after germination of cowpea during *kharif* at Hissar. This may be due to seasonal variation and different set of abiotic factors influence. Thus, these results clearly showed that aphid population favored build up of natural enemies and the population fluctuation of aphids was governed by coccinellids and spiders as it was clearly evident by strong significant positive correlation.

Regarding the efficacy of insecticides thiamethoxam 0.005% and acetamiprid 0.002% were found to be the most effective being on par

Table 3. Efficacy of insecticides against *E. kerri* on cowpea during *rabi,* 2006-07 (First spray).

Treatments	PTC population per ten plants (5 leaves each)	Mean reduction of population over control			Overall efficacy
		1 DAS	5 DAS	10 DAS	
T_1 : Azadirachtin 0.3%	37.67	13.16 (21.27)^{f}	58.71 (50.01)^{g}	42.89 (40.91)^{g}	38.26 (38.20)^{f}
T_2 : Thiamethoxam 0.005%	37.00	41.82 (40.29)^{b}	85.73 (67.81)^{b}	87.30 (69.12)^{ab}	71.62 (57.81)^{a}
T_3 : Fipronil 0.01%	37.67	37.51 (37.77)^{c}	77.58 (61.74)^{e}	75.06 (60.04)^{d}	63.38 (52.76)^{c}
T_4 : Thiodicarb 0.075%	36.67	18.73 (25.64)^{e}	58.96 (50.16)^{g}	45.71 (42.54)^{f}	41.13 (39.89)^{e}
T_5 : Acetamiprid 0.002%	36.67	42.78 (40.85)^{b}	84.78 (67.04)^{c}	86.44 (68.40)^{b}	71.33 (57.63)^{a}
T_6 : Acephate 0.075%	35.67	44.38 (41.77)^{a}	79.29 (62.93)^{d}	80.23 (63.61)^{c}	67.97 (55.53)^{b}
T_7 : Novaluron 0.01%	37.67	10.72 (19.11)^{g}	38.41 (38.30)^{h}	35.64 (36.65)^{h}	28.26 (32.11)^{g}
T_8 : Buprofezin 0.025%	36.67	28.18 (32.06)^{d}	86.58 (68.51)^{a}	88.06 (69.79)^{a}	67.60 (55.31)^{b}
T_9 : Chlorpyriphos 0.02% + dichlorvos 0.038%	37.67	44.16 (41.64)^{a}	72.70 (58.50)^{f}	60.26 (50.92)^{e}	59.04 (50.20)^{d}
T_{10} : Control	37.33	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
F-test	NS	Sig.	Sig.	Sig.	Sig.
SEm±		0.21	0.20	0.40	0.16
CD (p=0.05)		0.64	0.61	1.20	0.48

Values in parentheses are angular transformed values.
Numbers followed by same alphabet in each column are not significantly different.
Sig.: Significant NS : Non Significant
DAS: Days after spraying PTC : Pre treatment count

with each other, followed by acephate 0.075% and buprofezin 0.025% which were being on par against both *E. kerri* and *A. craccivora.* The treatment novaluron 0.01% recorded the lowest percent reduction of *E. kerri* population over control, while treatments azadirachtin 0.3% and novaluron 0.01% were being on par and recorded the lowest per cent reduction of *A. craccivora* population over control (Table 3).

The results of the present investigation showed that the treatments thiamethoxam and acetamiprid were the best being on par with each other and significantly superior to all other treatments in bringing down the leafhopper and aphid population. This was probably due to high insecticidal activity of thiamethoxam against sucking pests (Harrewijn *et al.,* 1998), and activity of acetamiprid which diffuses rapidly in treated plants from base to top and brings about the destruction of hidden pests and assures the protection of young rapidly growing shoots (Tomlin, 1995). The results of thiamethoxam are in conformity with the result of Krishna Kumar *et al.* (2001) against leafhopper on mango and Mhaske and Mote (2005) against both leafhoppers and whiteflies. The results of acetamiprid are in conformity with the results of Bellettini *et al.* (1999) against cotton aphid and Kumawat and Ashok Kumar (2007) against leafhopper.

Table 3a. Efficacy of insecticides against *A.craccivora* on cowpea during rabi, 2006-07 (Second spray)

Treatments	PTC population per ten plants (top $^1/_3{}^{rd}$ portion each)	Mean reduction of population over control			Overall efficacy
		1 DAS	5 DAS	10 DAS	
T_1 : Azadirachtin 0.3%	170.27	11.26 (19.61)^g	47.89 (43.79)^h	42.03 (40.41)^h	33.73 (35.50)^i
T_2 : Thiamethoxam 0.005%	169.33	42.49 (40.68)^a	89.13 (70.75)^a	85.05 (67.26)^a	72.23 (58.20)^a
T_3 : Fipronil 0.01%	171.33	38.49 (38.34)^c	76.73 (61.16)^e	70.18 (56.90)^e	61.80 (51.83)^e
T_4 : Thiodicarb 0.075%	169.67	19.91 (26.50)^e	58.47 (49.88)^g	44.16 (41.65)^g	40.85 (39.73)^g
T_5 : Acetamiprid 0.002%	173.33	42.35 (40.60)^a	88.54 (70.21)^b	83.88 (66.33)^b	71.59 (57.79)^b
T_6 : Acephate 0.075%	172.67	40.71 (39.65)^b	81.56 (64.57)^d	77.56 (61.73)^d	66.61 (54.70)^d
T_7 : Novaluron 0.01%	171.67	19.40 (26.13)^f	46.87 (43.21)^i	40.54 (39.55)^i	35.61 (36.64)^h
T_8 : Buprofezin 0.025%	169.33	34.41 (35.92)^d	86.72 (68.64)^c	82.57 (65.33)^c	67.90 (55.49)^c
T_9 : Chlorpyriphos 0.02% + dichlorvos 0.038%	173.00	42.58 (40.73)^a	70.26 (56.95)^f	65.30 (53.91)^f	59.38 (50.41)^f
T_{10} : Control	170.67	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
F-test	NS	Sig.	Sig.	Sig.	Sig.
SEm±		0.11	0.18	0.16	0.09
CD (p=0.05)		0.33	0.52	0.49	0.27

Values in parentheses are angular transformed values.
Numbers followed by same alphabet in each column are not significantly different.

Sig.: Significant NS : Non Significant
DAS: Days after spraying PTC : Pre treatment count

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Table 3b. Efficacy of insecticides against *A.craccivora* on cowpea during rabi, 2006-07 (Third spray)

Treatments	Mean reduction of population over control			Overall efficacy	Overall mean efficacy of two sprays
	1 DAS	5 DAS	10 DAS		
T_1 : Azadirachtin 0.3%	12.79 (20.92)^{f}	51.36 (45.78)^{h}	40.14 (39.32)^{h}	34.39 (35.91)^{h}	34.06 (35.71)^{e}
T_2 : Thiamethoxam 0.005%	43.72 (41.39)^{a}	93.36 (75.07)^{b}	86.27 (68.25)^{b}	74.71 (59.81)^{a}	73.47 (59.00)^{a}
T_3 : Fipronil 0.01%	37.82 (37.95)^{c}	76.63 (61.09)^{e}	68.58 (55.91)^{d}	60.78 (51.23)^{e}	61.29 (51.53)^{c}
T_4 : Thiodicarb 0.075%	20.08 (26.62)^{e}	59.51 (50.48)^{f}	57.58 (49.36)^{f}	45.66 (42.51)^{f}	43.26 (41.12)^{d}
T_5 : Acetamiprid 0.002%	40.48 (39.51)^{b}	94.15 (76.01)^{a}	87.57 (69.36)^{b}	74.52 (59.68)^{a}	73.06 (58.74)^{a}
T_6 : Acephate 0.075%	43.41 (41.21)^{a}	85.28 (67.45)^{d}	77.07 (61.39)^{c}	68.54 (55.88)^{c}	67.58 (55.29)^{b}
T_7 : Novaluron 0.01%	9.81 (18.25)^{g}	55.05 (47.90)^{g}	48.78 (44.30)^{g}	37.29 (37.63)^{g}	36.45 (37.14)^{e}
T_8 : Buprofezin 0.025%	31.68 (34.25)^{d}	89.92 (71.50)^{c}	89.29 (70.90)^{a}	70.13 (56.87)^{b}	69.02 (56.18)^{b}
T_9 : Chlorpyriphos 0.02% + dichlorvos 0.038%	40.66 (39.62)^{b}	76.77 (61.19)^{e}	67.40 (55.18)^{e}	61.30 (51.53)^{d}	60.34 (50.97)^{c}
T_{10} : Control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
F-test	Sig.	Sig.	Sig.	Sig.	Sig.
SEm±	0.45	0.15	0.16	0.11	0.48
CD (p=0.05)	1.33	0.45	0.48	0.32	1.55

Values in parentheses are angular transformed values.
Numbers followed by same alphabet in each column are not significantly different.

Sig.: Significant NS : Non Significant
DAS: Days after spraying PTC : Pre treatment count

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