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Yellow Pan Trap : A Monitoring Tool for Aphid Population (*Aphid craccivora* Koch.)

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Abstract

An experiment was conducted to study the seasonal activities of pulse aphid (*Aphis craccivora* Koch.) along with other homopteran insects by using yellow pan water trap as a monitoring tool in greengram and groundnut. Four species of aphid viz. *A.craccivora*, *A.gossypii*, *M. persicae* and *L. erysimi* along with white fly and jassid were recorded inside trap. The combined effect of abiotic factors on trap catch of *A. craccivora* varied from 24 to 37%. In the secomd year of the study the estimated coefficient revealed a significant negative association with maximum relative humidity and a significant positive association with bright sunshine hour, while in pooled result significant negative contribution of relative humidity difference was observed. The influence of independent variables were 45 to 52%, 31 to 65% and 32 to 41% in *Myzus*, *Lipaphis* and *A. gossypii*, respectively while it was less varying from 9 to16% and from 4 to 22% on the trap catch of white fly and jassids, respectively. The effect of trapped population of *A. craccivora* on its incidence on different varieties of greengram and on groundnut varied widely from 0.7% (in groundnut) to 31% (in variety T-44 of greengram). However, in three varieties of greengram viz. Pusa Bold 2, Pusa Bold 1 and T-44 significant positive association with the trapped aphid population was revealed.

Key words : *Aphis craccivora,* Yellow pan water trap, Abiotic factors, Greengram, Groundnut.

There are several reasons behind the lower productivity of food legumes and one of the major constraints to increasing pulse and oilseed production is the loss of seed yield due to infestation of insect pests. A number of insect species have been recorded on food legumes. Only a few are important considering the severity of damage and one among them is *Aphis craccivora* Koch.It is known as pulse aphid or groundnut aphid and had so far been recorded on many leguminous crops including mungbean, urdbean, chickpea, lentil, dolichos bean, cowpea, pigeonpea, grasspea, fababean, *Sesbania* and groundnut.The knowledge on the nature of incidence pattern of crop pests in a locality is the primary requisitement for developing pest management system. An accurate forecast of pests especially aphids for its proper management warrants efficient monitoring technique. Sampling of aerial aphid population gives an indication of the intensity of the dispersal. Yellow pan water trap, one of the commonest methods for monitoring, samples of aerial population of aphids and other homopteran insects positively responds to the yellow color (Taylor and Palmer 1973). Therefore, an experiment was carried out to study the seasonal activities of aphid along with other homopteran insects by using yellow pan water trap as a monitoring tool.

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Methods

The experiment was conducted at Bidhan Chandra Krishi Viswavidyalaya situated at Kalyani, Nadia, West Bengal during *pre-kharif* and *kharif* seasons in 2003 and 2004. With a view to collect the aphid species in the locality one yellow pan water trap was set in the middle of the experimental field covering dense crop canopy of greengram and groundnut. In greengram, five varieties viz. Pusa Bold 1, Pusa Bold 2, T-44, K-851 and B-1 and in groundnut only one variety i.e. TAG-24 were sown following normal agronomic practices. The metal trap (54 cm × 35 cm × 8 cm) painted yellow inside, was placed on

Table 1. Full model multiple regression results for explaining insect population caught inside yellow water pan trap on the basis of different weather parameters.Y= Insect population, X_1 = Average of maximum temperature of previous seven days, X_2 = Average of differences between maximum and minimum temperature of previous seven days, X_3 = Average of maximum relative humidity of previous seven days, X_4 = Average of differences between maximum and minimum relative humidity of previous seven days, X_5 = Total rainfall of previous seven days, X_6 = Average of wind speed of previous seven days, X_7 = Average of bright sunshine hour of previous seven days, * = Significant.

Insect	Year	Regression equation	R^2	SE of estimate
Aphis	2003	$Y = 34.94X_1 + 26.63X_2 - 4.89X_3 - 10.3X_4 - 9.47X_5 - 46.0X_6 - 30.33X_7 - 50.49$	0.30	248.68
craccivora	2004	$Y = -0.46X_1 - 2.29X_2 - 37.8*X_3 - 9.03X_4 + 0.69X_5 - 81.85X_6 + 70.67*X_7 + 3727.59$	0.37	193.02
	Pooled	$Y = 12.58X_1 + 5.57X_2 - 15.43X_3 - 11.09*X_4 - 1.10X_5 - 51.54X_6 + 33.78X_7 + 1435.65$	0.24	228.05
Myzus	2003	$Y = -30.03*X_1 + 44.47*X_2 + 2.24X_3 - 9.29*X_4 - 2.09X_5 + 38.26X_6 + 6.24X_7 + 509.45$	0.49	137.07
persicae	2004	$Y = -37.3*X_1 + 54.96X_2 + 7.57X_3 - 7.72X_4 - 1.46X_5 + 40.78X_6 - 27.81X_7 + 404.41$	0.52	185.19
	Pooled	$Y = -34.15*X_1 + 40.09*X_2 - 5.51X_3 - 5.26X_4 - 0.55X_5 + 18.52X_6 - 11.57X_7 + 1499.05$	0.45	167.06
Lipaphis	2003	$Y = -16.15X_1 - 22.9X_2 - 24.33X_3 + 7.56*X_4 - 1.5X_5 - 25.84X_6 - 27.71X_7 + 3166.07$	0.31	112.36
erysimi	2004	$Y = -64.94*X_1 + 8.69X_2 - 1.04X_3 - 1.51X_4 - 1.41X_5 + 98.41*X_6 - 8.85X_7 + 2238.04$	0.65	192.35
	Pooled	$Y = -43.99*X_1 - 32.23X_2 - 21.94*X_3 + 7.25X_4 - 0.64X_5 + 9.83X_6 - 11.68X_7 + 3805.84$	0.43	182.90
Aphis	2003	$Y = 53.66X_1 - 50.92X_2 + 69.17X_3 + 21.54X_4 + 2.53X_5 + 110.44X_6 + 54.83X_7 - 8786.42$	0.32	386.11
gossypii	2004	$Y = 23.47X_1 + 34.38X_2 - 12.27X_3 - 4.81X_4 + 0.78X_5 + 76.26X_6 + 85.0X_7 - 177.89$	0.41	374.49
	Pooled	$Y = 34.04*X_1 - 24.54X_2 + 10.33X_3 + 8.8X_4 + 0.33X_5 + 56.07X_6 + 68.5*X_7 - 2338.96$	0.32	376.18
White fly	2003	$Y = -0.69X_1 + 0.55X_2 + 0.83X_3 - 0.58*X_4 - 0.28X_5 + 2.63X_6 + 1.72X_7 - 55.32$	0.16	8.06
	2004	$Y = 0.22X_1 + 2.22X_2 - 1.07X_3 - 0.64X_4 + 0.04X_5 - 5.43X_6 + 0.96X_7 + 100.47$	0.16	12.56
	Pooled	$Y = -0.16X_1 + 1.16X_2 - 0.57X_3 - 0.49*X_4 + 0.04X_5 - 2.09X_6 + 1.34X_7 + 63.54$	0.09	10.60
Jassid	2003	$Y = 0.27X_1 + 0.23X_2 - 0.42X_3 + 0.09X_4 + 0.05X_5 - 2.38X_6 + 0.52X_7 + 38.89$	0.04	14.36
	2004	$Y = -2.01*X_1 - 5.19X_2 - 2.12X_3 + 1.0X_4 + 0.09X_5 + 1.55X_6 + 2.95X_7 + 283.34$	0.22	18.66
	Pooled	$Y = -1.18X_1 - 2.38X_2 - 1.63X_3 + 0.44X_4 + 0.05X_5 - 1.39X_6 + 1.74X_7 + 209.88$	0.10	16.60

bamboo stand 80 cm above the ground level and filled with water in 1/2 to 2/3 of its capacity. The insects caught inside were collected and subsequently identified in weekly intervals. Weekly observations of seven weather parameters viz. maximum temperature, difference between maximum and minimum temperature, maximum relative humidity, difference between maximum and minimum relative humidity, rainfall, wind speed and bright sunshine hour were taken and used as predictor variables to see the effect of abiotic factors on the trapping of those species recorded. Full model multiple regression analysis was followed displaying regression equation, R^2 and standard error of estimated values for two different years separately and also for both years together as pooled. As the next step, the aphid population recorded inside trap was used as predictor variable to predict its incidence on both greengram and groundnut following full model linear regression analysis.

Results and Discussion

This study revealed four species of aphid catch viz. *Aphis craccivora* Koch., *Aphis gossypii* Glover *Myzus persicae* (Sulz.) and *Lipaphis erysim*i Kalt. along with white fly and jassid inside yellow pan water trap. However, the study by Pal (1992) revealed trapping of seven aphid species viz. *A.gossypii*, *A. craccivora, L. erysimi, M.persicae, Myzocallis* sp., *Ceratovacuna* sp. and *Prociphilus* sp. in West Bengal which may be due to the presence of other field crops in vicinity.

Effect of Abiotic Factors on A. craccivora Recorded Inside Yellow Pan Water Trap

On regression analysis, the trap count of *A. craccivora* in two years of study and in its pooled result showed differential responses to the combined effects of seven weather variables (Table 1). The combined effect of these abiotic factors on trap catch of *A. craccivora* varied from 24% (in pooled result) to 37% (in 2004) while in 2003 the effect was 30%. The estimated coefficient revealed a significant negative association with maximum relative humidity and a significant positive association with bright sunshine hour

Table 2. *A. craccivora* Koch. recorded on different host plants on the basis of their population recorded inside yellow water pan trap. Y = Aphid population on host plant. * Significant.

Host plant	Variety	Regression equation	R^2	SE of estimate
Greengram	Pusa Bold 2	0.0026*X + 1.357	0.18	1.54
	Pusa Bold 1	0.0034*X + 1.310	0.27	1.50
	1—44	0.0046*X + 1.490	0.31	1.87
	K-851	0.0034X + 2.632	0.12	2.55
	B-1	0.0029X + 2.155	0.11	2.25
Groundnut	TAG-21	0.0005X +1.451	0.007	1.57

in 2004, while in pooled result significant negative contribution of relative humidity difference was observed. In first year of the present study both maximum temperature and difference between maximum and minimum temperature had positive impact on aphid population while in second year the impact was reverse. In both the years and in pooled analysis, the negative association of both maximum relative humidity and difference between maximum and minimum relative humidity with aphid catch was revealed. The deterrent effects of both the temperature and rainfall and its occurrence were earlier recorded by Pal (1992).

Effect of Abiotic Factors on Other Aphid Species Recorded Inside Yellow Pan Water Trap

In *M.persicae*, the regression equation, revealed significant negative impact of maximum temperature in both the years and in pooled result, while temperature differences had a significant positive influence on its population in 2003 and in pooled result (Table 1). Difference in relative humidity had significant negative association in first year. The negative impact of maximum temperature, rainfall and sunshine hour on *Myzus* catch had earlier been recorded by Lakhanpal and Raj (2002), though their observation regarding effect of relative humidity and wind velocity contradicts with the present study which may be due to the less availability of susceptible crops in vicinity. This model revealed that the influence of independent variables (i.e., meteorological parameters) for the variation of *Myzus* catch were 49, 52 and 45% in 2003, 2004 and in pooled result ,respectively. A significant negative association between maximum temperature and *L. erysimi* population was established in second year and in pooled result. The equation also tells about the significant positive influence of relative humidity difference in 2003, positive influence of wind speed in 2004, and negative influence of maximum relative humidity on its trap catch in the pooled result. Similar relationship among temperature and sunshine hour on aphid population was established by Lakhanpal and Raj (2002) in *L. erysimi*. The regression analysis showed a wide variation in terms of predicting *Lipaphis* catch e.g. 31% in 2003, 65% in 2004 and 43% in pooled result. On the other hand, in *A.gossypii* the responses to the combined effect of meteorological parameters varied from 32% (in 2003 and in pooled result) to 41% (in 2004). However, the study by Lakhanpal and Raj (2002) revealed negative impact of temperature and rainfall on *A. gossypii* population which contradicts with the present experiment as the present study showed positive impact of these factors on aphid population. The regression equation of pooled result revealed significant positive association with maximum temperature and bright sunshine hour on its population trapped.

Effect of Abiotic Factors on Other Homopteran Insect Pests

The combined effects of seven weather parameters were quite low on the trap catch varying from 9 to 16% and from 4 to 22% for white fly and jassids, respectively (Table 1). However, a significant negative association with relative humidity difference on *Bemisia* population in 2003 and in pooled result, and a significant negative influence of maximum temperature on jassid catch in second year were established. Though the combined effects of meteorological parameters was low on the trap catch of whitefly, this method can easily be suggested for monitoring of this pest as this is cost effective method and required less manpower (Lloyd 1921, Nath 1993).

Effect of Trapped Population of A. craccivora on Their Incidence Pattern on Greengram and Groundnut in Field Condition

Linear regression models showed that the number of *A. craccivora* recorded on host plants (greengram and groundnut) differed significantly with their population trapped inside yellow pan water trap (Table 2). The effect of trapped population of aphid species on its incidence on different varieties of greengram and on groundnut varied widely from 0.7% (in groundnut) to 31% (in T-44 of greengram). However, in three varieties of greengram viz. Pusa Bold 2, Pusa Bold 1 and T-44 showed significant positive association with the trapped aphid population, though in others the influence was positive but non-significant.

References

Lakhanpal G. C. and D. Raj. 2002. Monitoring of aphid populations by Moericke yellow pan water trap in rapeseed aphid complex at Palampur in Himachal Pradesh. *J. Ent. Res.* 26 : 77—81.

Lloyd L. 1921. Notes on color tropism of *Asterochiton* (*Aleurodes*) *vaporariorum* Westwood. *Bull. Entomol. Res.* 12 : 355—359.

Nath P. D. 1993. Monitoring of whitefly population in mungbean yellow mosaic infected greengram field. *Ann. Agric. Res.* 14 : 360—362.

Pal D. 1992. *Aerial activity of aphids (Aphididae : Homoptera) infesting crops*. M. Sc. (Ag.) thesis., BCKV, Mohanpur, India.

Taylor L. R. and J. M. P. Palmer. 1973. Aerial sampling. Pp.189–234. *In* H. F. van Emden (ed.) *Aphid technology*. Academic Press, London, UK.