Journal of Agrometeorology 20 (3) : 234-237 (September 2018)

Population dynamics of insect pests on short duration pigeon pea in relation to weather parameters

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ABSTRACT

Population dynamics of insect pests on short duration pigeon pea was studied in relation with weather parameters during *kharif* 2016 and 2017. Spotted pod borer, *Maruca vitrata* (F.) and blister beetle, *Mylabris pustulata* Thunberg were observed to be major pests in Delhi environment during both the years while, low incidence of other pests *viz*., gram pod borer, *Helicoverpa armigera* (Hubner) and pod bug, *Clavigralla gibbosa* Spinola were also recorded. Spotted pod borer population peaked during 41st standard meteorological week. Blister beetle incidence commenced during 36th standard meteorological week and peaked during 37th standard meteorological week. Maximum temperature of 1-lag week was found to have non-significant positive correlation with gram pod borer (r= 0.64) and spotted pod borer (r = 0.52) larval population. The built-up of pod bug population had highest significant negative correlation with minimum temperature (r=-0.82) of current week and also with relative humidity (r = -0.93) of current week.

Key words: *Pigeon pea, Maruca vitrata, blister beetle,* weather factors, correlation

Pigeon pea or red gram (*Cajanus cajan* (L.) Millspaugh) is a most important pulse crop especially in rainfed agriculture. Among several constraints in adoption of this crop which insect pests are of major concern (Lal *et al*., 1981). Borer complex comprising of American bollworm, *Helicoverpa armigera* (Hubner); spotted pod borer, *Maruca vitrata* (F.); blue butterfly, *Lampides boeticus* (L.) and plume moth, *Exelastis atomosa* (Walsingham) inflicts serious damage to this crop. Besides other pests *viz*., pod fly, *Melanogromyza obtusa* (Malloch); different species of pod bugs, *Clavigralla gibbosa* Spinola and other species; Blister beetle, *Mylabris pustulata* Thunberg; Eriyophid mite, *Aceria cajani* (Acarina : Eriophyidae) have also been found to be important. Prevailing and preceding weather conditions along with varietal characteristics are important factors responsible for incidence and build up of pest population. Hence, studies on pest incidence and dynamics are important for better understanding of pest situation in different agro-climatic conditions. Moreover, climate change impact on insect pests (Meena & Bhatia, 2014; Jakhar *et al*., 2016) and regional variation in agronomic practices have been reported to influence pest scenario of crops in a given locality. In this context, we studied the dynamics of different pests on pigeon pea and its relation to weather parameters at ICAR-Indian Agricultural Research Institute (IARI), New Delhi during 2016 and 2017.

MATERIALS AND METHODS

The experiments were conducted during *kharif* 2016 and 2017 to study the incidence and population dynamics of insect pests on short duration variety of pigeon pea at ICAR-IARI, New Delhi (28.08° N, 77.12 ° E, 228.61 m). All the recommended agronomic practices were followed in raising the crop excluding the plant protection measures. Pest populations were recorded at seven-day intervals during morning hours from 20 randomly selected and tagged plants. Larvae of spotted pod borer were observed on buds, flowers and pods; larvae of gram pod borer and nymphs and adults of pod bugs on pods whereas blister beetle adults were counted on whole plants and mean population per plant was computed. Adult trap catches of gram pod borer, *H. armigera* were recorded using Fero-T traps @ 5traps/ha with Helilure, procured from Pest Control India (PCI) Pvt. Ltd. and lures were replaced with new ones after every 20 days. *H. armigera* adult trap catches were recorded on weekly basis and expressed as mean number of male moths/trap/week.

The data on pest population and adult trap catches of *H. armigera* were square root transformed before subjecting to correlation analysis. Weather data were obtained from the Agricultural Physics Division, ICAR-IARI, New Delhi. Pest population counts as well as trap catches of *H. armigera* and weather parameters were pooled for 2016

Table 1: Incidence and dynamics of different insect pests in short duration pigeon pea (Mean data of two years, 2016 and 2017)

Standard Meteorological Week	Gram pod borer (Larvae/ plant)	Spotted pod borer (Larvae/ plant)	Pod bug (Nymph and adults/ plant)	Blister beetle (Adults/ plant)	Gram pod borer adult trap catches (Male moths/ trap/ week)
34	0.00	0.00	0.00	0.00	3.58
35	0.00	0.00	0.00	0.00	0.59
36	0.00	0.10	0.00	0.21	0.77
37	0.03	0.85	0.15	1.07	0.31
38	0.23	1.84	0.05	0.83	1.00
39	0.29	2.21	0.34	0.49	0.77
40	0.19	2.66	0.29	0.46	0.38
41	0.38	4.14	0.33	0.78	2.81
42	0.30	0.87	0.55	0.20	0.13
43	0.08	0.55	0.40	0.10	0.04

and 2017. Simple correlation co-efficient of pooled pest population with weather parameters *viz*., maximum temperature (Tmax), minimum temperature (Tmin), morning relative humidity (RH_1), evening relative humidity (RH_2), rainfall (RF), sunshine hours (SSH) and wind speed (WS) of current, 1-lag and 2-lag weeks were computed.

RESULTS AND DISCUSSION

Continuous monitoring of insect pests in short duration pigeon pea revealed the incidence of different pests at various crop growth stages. Among different pests spotted pod borer (*M. vitrata*) and blister beetle (*M. pustulata*) were major during *kharif* 2016 and 2017 whereas population of other pests such as gram pod borer (*H. armigera*) and pod bug (*C. gibbosa*) remained very low.

Helicoverpa armigera

The population of *H. armigera* larvae was found to be below economic threshold level (ETL). Incidence of *H. armigera* started in 37th standard meteorological week (SMW) and peaked (0.38 larvae/ plant) in 41st SMW (Table 1). In present study, non-significant positive association was observed between maximum temperature and *H. armigera* larval population (Table 2). Earlier, positive correlation with maximum temperature has also been reported by Jat *et al*. (2017). Morning and evening relative humidity of all three weeks except morning relative humidity of current week had negative correlation with larval population. Significant positive and negative correlation was observed with sunshine hours of 2-lag week and wind speed of current week, respectively.

Maruca vitrata

Incidence of *M. vitrata* was recorded in 36th SMW and peak population was observed in 41st SMW (4.14 larvae/ plant) (Table 1). Analysis of *M. vitrata* larval population and its correlation with weather factors revealed highest positive correlation with maximum temperature of 1-lag week whereas relationship with minimum temperature was found to be very weak (Table 2). The population was also found to be negatively correlated with morning relative humidity of 1-lag and 2-lag week, while it had positive correlation with current week. Similarly positive correlation was observed with sunshine hours of 2-lag week and it was negative with wind speed of current week. Jat *et al*. (2017) observed incidence of *M. vitrata* in 36th and 39th SMW, respectively, in early and late sown pigeon pea wherein they found negative correlation with wind speed, evening humidity, rainfall and minimum temperature.

Pod bugs

C. gibbosa was observed on the crop however it never crossed ETL (2 bugs/ plant). Its incidence started during 37th SMW and peaked (0.55 bugs/plant) during 42nd SMW (Table 1). Similar trend of low population (peak population of 0.40 bugs/ plant) in short duration pigeon pea has also been reported by Pandey *et al*. (2016). In the present study, maximum temperature of 2-lag week showed highest positive correlation with bug population, whereas minimum temperature had significantly negative correlation (Table 2). Significant negative correlation of bug population

Table 2: Correlation co-efficient between insect pests of pigeon pea and different weather parameters (pooled values of 2016 and 2017)

Weather parameter	*Helicoverpa armigera* larvae			*Maruca vitrata* larvae			Pod bugs (Nymphs and Adults)			Blister beetle (Adults)			*Helicoverpa armigera* adult trap catches		
	Current	1 lag	2 lag	Current	1 lag	2 lag	Current	1 lag	2 lag	Current	1 lag	2 lag	Current	1 lag	2 lag
Tmax	0.02	0.64	0.58	0.22	0.52	0.19	-0.10	0.34	0.67	0.61	0.33	-0.52	-0.13	-0.04	-0.44
Tmin	-0.35	-0.11	0.15	0.00	0.16	0.02	-0.82*	-0.76*	-0.70	0.58	0.64	0.50	0.38	0.47	0.42
RH_1	0.46	-0.25	-0.42	0.60	-0.34	-0.46	0.35	-0.21	-0.05	0.18	-0.40	0.13	0.57	-0.08	-0.15
RH_2	-0.47	-0.47	-0.55	-0.23	-0.24	-0.28	-0.93*	-0.79*	-0.83*	0.30	0.29	0.49	0.34	0.36	0.26
Rainfall	0.13	-0.36	-0.60	0.20	-0.39	-0.27	-0.47	-0.50	-0.33	0.35	-0.32	0.45	0.04	0.27	0.11
Sunshine hours	-0.26	0.12	0.76*	-0.49	0.19	0.58	0.06	0.26	0.41	0.03	0.31	-0.05	-0.41	-0.40	-0.14
Wind speed	-0.76*	-0.53	0.05	-0.67	-0.25	0.15	-0.78*	-0.60	-0.64	-0.09	0.68	0.54	-0.13	0.33	0.14

n=8 for *Helicoverpa armigera and Maruca vitrata* larvae, pod bugs and blister beetle (r=0.707); n=10 for *Helicoverpa armigera* adult trap catches (r=0.632); * Correlation is significant at the 0.05 level of significance (Two-tailed)

Tmax =Maximum temperature (°C); Tmin =Minimum temperature (°C); RH_1 = Morning Relative humidity (%); RH_2 = Evening Relative humidity (%)

with evening relative humidity was also observed with evening relative humidity of all three weeks.

Blister beetle

Blister beetle, *M. pustulata* was found feeding voraciously on unopened flower buds and flowers of the crop. Its incidence was observed during 36th SMW and the peak population (1.07 beetles / plant) was observed during 37th SMW (Table 1). Maximum and minimum temperature of current and 1-lag week, respectively, was found to be positively correlated with beetle's population, whereas its relationship with morning relative humidity of 1-lag week was found to be negative (Table 2). Wind speed of 1-lag week had highest positive association with beetle population.

Activity of Helicoverpa armigera male moths

Pheromone trap catches of *H. armigera* male adults commenced during 34th SMW with maximum catch (3.58 adults/ trap) during same SMW, which declined later (Table 1). The correlation analysis revealed that maximum temperature had negative non-significant association with *H. armigera* trap catches, while minimum temperature and morning relative humidity of current week had non-significant positive correlation (Table 2). Earlier, Sagar *et al.* (2017) reported that male moth population of *H. armigera* had highest significant positive correlation with maximum and minimum temperature of 2-lag week in chickpea.

CONCLUSION

The study concluded that spotted pod borer, *M. vitrata* and blister beetle, *M. pustulata* were the major pests of short duration pigeon pea in Delhi environment and populations of all the four pests were greatly influenced by weather parameters of current and preceding weeks.

ACKNOWLEDGEMENT

We thank Dr. R. S. Raje, Principal Scientist, Division of Genetics, ICAR-IARI, New Delhi for his help during the study and we are also thankful to Head, Division of Entomology, ICAR-IARI, New Delhi for providing required support during these studies.

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Received : May 2018 ; Accepted : July 2018