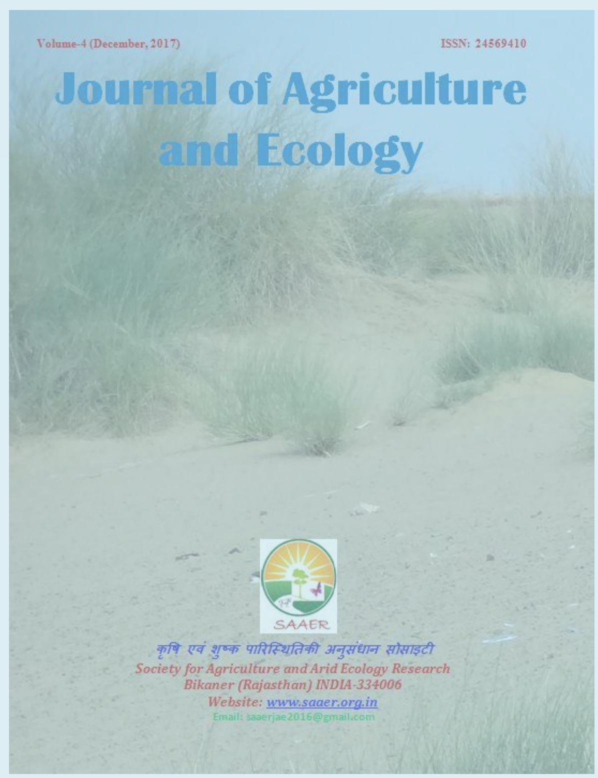
Study the influence of climate change on *Clavigralla gibbosa* (Spinola) in pigeonpea

BL Jakhar, Narendra Singh, PV Tapre,Y Ravindrababu & S Venilla

Journal of Agriculture and Ecology

ISSN: 2456-9410
Volume: 4

Journal of Agriculture and Ecology (2017) 4: 37-43



Journal of Agriculture and Ecology, 2017, Vol.4, 37-43
http://saaer.org.in

Research Article **Open Access**

Study the influence of climate change on *Clavigralla gibbosa* (Spinola) in pigeonpea

BL Jakhar, N Singh, PV Tapre, Y Ravindrababu & S Venilla

[1]*Asstt. Research Scientist (Entomology), Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar - 385 506*

[2]*Associate, Research Scientist (Soil Science), Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar - 385 506*

[3]*Asstt. Research Scientist (Nematology), Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar - 385 506*

[4]*Research Scientist (Pulses), Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar - 385 506*

[5]*Principal Scientist (Entomology) ICAR-NCIPM, New Delhi*

Corresponding author: BL Jakhar, E-mail: bjakhar@rediffmail.com

Article Info

Article history
Received: 25 September, 2017
Accepted: 18 October, 2017
Available online: 30 November 2017

Key Words: Population dynamics, *Clavigralla gibbosa*, weather parameters

Abstract

Monitoring and population dynamics of tur pod bug, *Clavigralla gibbosa* in unprotected pigeonpea crop during kharif seasons from 2011 to 2014 at the Farmers field of Jurdcial area of S.D. Agricultural University, S.K. Nagar, North Gujarat, India. Temperature, rainfall and host-plant species were analyzed with respect to population fluctuation of the tur pod bug. The observations revealed that, the average number of larval population per plant in the season (from 27th to 3rd standard weeks) was 0.97, 0.32, 0.30 and 0.38 larvae per plant during 2011, 2012, 2013 and 2014 respectively. Population of *C. gibbosa* had significant and negative correlation with maximum temperature (r= -0.73), rainfall (r= -0.29) and relative humidity (r= -0.79, r= -0.58 morning and evening, respectively).

Preferred citation: Jakhar BL, Singh N, Tapre PV, Ravindrababu Y & Venilla S. 2017. Study the influence of climate change on *Clavigralla gibbosa* (Spinola) in pigeonpea. *Journal of Agriculture and Ecology*, 4: 37-43.

Introduction

Developing improved techniques for management of pests requires a better understanding of climate-pest relationships and hence data on climate and insect pests is a prerequisite. Climate plays a major role in the growth, development and distribution of insects. The short term change in weather conditions at a location is termed as climate variability and the long term change in average climate of the location is referred to as climate change and both influence the growth and development of insects. Climate change projections made for India indicate an overall increase in temperature by 2–4◦C and precipitation by 9–16% towards 2050s (Krishna Kumar et al. 2011). Most of the predictive models indicates that average temperature increases by 1.7–5.3◦C within next 60–100 years (Haldhar et al. 2012; Jaworski & Hilszczanski 2013). However, the extent of increase is expected to be non-uniform across geographical locations. Increases in temperature have significant implications on temperature-dependent development of insects.

Pigeonpea (*Cajanus cajans* L.) is a tropical grain legume mainly grown in India and ranks second in area and production (3.81 M ha area with production 3.02 MT, Anonymous 2014). It is attacked by more than 300 species of insect pests. Among these, the maximum yield losses is caused by pod borer's complex and pod fly. Among pod borer complex the major are *Helicoverpa armigera* and *Maruca vitrata* and pod fly, *Melanagromyza obtusa* (Sreekanth et al. 2015). The productivity levels range from 360 to 1145 kg/ha owing to the cultivation of the crop on a wide range of soils in different cropping systems across varied agro climatic regions. A number of factors are responsible for the lower productivity, which mainly includes biotic as well as abiotic factors.

Among biotic stresses diseases *viz.*, wilt, sterility mosaic and foliar diseases and insect pests feeding on pods lead to significant yield losses. Climate change is expected to trigger changes in diversity and abundance of arthropods, geographical and temporal distribution of insect pests, insect biotypes, herbivore plant interactions, activity and abundance of natural enemies, and efficacy of crop protection technologies. We expect both the crop in terms of phenology and physiology and the pests in their occurrence and abundance likely to change. Hence, study of impact of climate change on pigeonpea crop-pest interactions requires carefully collected data on long term basis. While already available historical data could form an approach for partial study of climate change impacts, formulation and implementation of a robust research strategy combining the present scenario of cropping patterns, cultivars, and production and protection practices across heterogeneous locations over time would yield improved and holistic understanding. Considering the importance of the pigeonpea grown across Indian cropping systems as a pulse crop and assessment of the changing pest dynamics in relation to climate, and through development of forewarning models. A plan to study of dynamics of pigeonpea pod bug in multiple locations over seasons along with other system components including weather was formulated to be implemented through surveillance integrating geographical, field, crop, agronomical and pest management practices.

Materials and methods

Surveillance plan and procedures

Two pigeonpea fields each at the pulse research station and in ten selected villages of North Gujarat region are to be fixed for pest surveillance. Fixed fields are those fields grown with pigeonpea, that once selected should be continuously monitored year round on weekly basis for pests and diseases using the specified data sheet formats. Observations in all the designated fixed fields should be made on weekly basis.

Selection of fixed fields

Fixed fields of farmers in villages

Ten villages of pigeonpea growing from the three nearby districts of North Gujarat were selected. In each village, two farmer fields were selected with a area near to one acre for surveillance during the season. Assigning fields of farmers as Fixed 1 and Fixed 2 should be made during the first observation of surveillance and the same were maintained till the end of season.

Observations

The recording of observations on insect pests and diseases in the selected fixed fields was initiated with the sowing of the crop and continued till the end of the crop season. In each selected field, select five spots randomly such that four are from four corners and one from the centre of the field. Five feet distance alongside of boundary in all directions of the field should be left out as buffer space to avoid border effects during pest observations. The spot selection for pest observations during each weekly visit was random and it is not the fixed spots in a pigeopea field. All insect and disease recordings at each spot should be completed before moving on to next spot. Further weather parameters *viz*., rainfall, maximum and minimum temperature, maximum and minimum relative humidity were gathered from metrological department and averaged for every metrological standard week. Also the population data were correlated with weather parameters.

Statistical analysis: Correlation analysis of data obtained from pod borers population, rainfall, maximum and minimum temperature, maximum and minimum relative humidity at every metrological standard week from 2011 to 2014 were analyzed.

Results and Discussion

The population dynamics of tur pod bug, *Clavigralla gibbosa* was recorded from cropping season of pigeonpea during 28th standard metrological weeks (SMW) to 2nd SMW from 2011, 2012, 2013 and 2014 years. During 2011, the pest incidence started in 40th SMW with 0.35 bug/ plant and peak incidence of 1.20 bug/ plant in 47th SMW (Table 1) there after its population started declining. Over all that season mean incidence of *C. gibbosa* was 0.86 bugs/ plant. The pest incidence during 2012 was initiated on 39th SMW (0.37 bug/plant) and peaks population recorded in 1st SMW with 2.31 bugs/plant and there was drastic decline in the pest population (Table 1). During 2013, the incidence started from 39th SMW and continued upto 2nd SMW. Maximum incidence of pest was noticed during 1st SMW was recorded 2.93 bugs/ plant. During 2014 the pest incidence was started somewhat later than other years. The incidence started from 42nd SMW and continued upto 51st SMW. Maximum incidence of pest was noticed during 50th

SMW 3.98 bugs/plant and onwards drastically declined.

Table 1. Population fluctuation of *C. gibbosa* on pigeonpea at farmer's field

MSW	2011-12	2012-13	2013-14	2014-15
30	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0
39	0.0	0.37	0.4	0.0
40	0.35	0.49	0.44	0.0
41	0.38	0.72	0.66	0.0
42	0.75	0.78	0.28	0.12
43	1.11	0.91	0.87	0.51
44	0.71	1.02	0.5	0.66
45	0.86	0.59	1.02	1.4
46	1.13	0.64	1.23	1.43
47	1.20	1.12	2.27	1.53
48	1.08	0.93	2.58	2.45
49	1.06	1.44	1.61	3.28
50	0.78	1.79	1.79	3.98
51	0.88	2.04	1.51	3.73
52	0.0	2.11	2.58	0.0
1	0.0	2.31	2.93	0.0
2	0.0	1.1	2.11	0.0
3	0.0	0.0	0.0	0.0

MSW- Meteorological Standard Week

The *C. gibbosa* population was increasing trend over the years. Pest population was range from 0.35- 1.20 bugs/plant and mean of 0.86 bugs/plant during 2011 in short period of 40th to 51st SMW (Fig. 1). Average *C. gibbosa* population 1.17 bugs/plant with range between 0.37-2.31 bugs/plant on 39th to 2nd SMW during 2012. During 2013, it was 1.42 bugs/plant with range of 0.40 to 2.93 bugs/ plant on 39th to 2nd SMW. *C. gibbosa* population was range between 0.12 -3.98 bugs/ plant with average of 1.91 bugs/ plant during 2014. During first years, the pest population was higher and thereafter during 2012, 2013 and 2014 pest population was started declining every year. In all four years observations, peak population was observed between 50th SMW to 1st SMW and the *C. gibbosa* population was started rising every year. It shows that over the years the incidence builds up to maximum level (Table 1). *C. gibbosa* population influenced by abiotic factors such as temperature and humidity. Hence, pest population was

Journal of Agriculture and Ecology, 2017, Vol.4, 37-43
http://saaer.org.in

correlated with abiotic factors and presented here.

Population of *C. gibbosa* had significant and negative correlation with maximum temperature (r = 0.728) and non-significant and negatively correlated with minimum temperature (r = 0.415) shown in table 2.

Table 2. Correlation matrix of *C. gibbosa* population with environmental factors at farmer's field

Year	Rainfall	Weather factors			
		Temperature		Relative humidity	
		Maximum	Minimum	Morning	Evening
2011-12	-0.234^{NS}	-0.051^{NS}	-0.120^{NS}	-0.456^{*}	-0.365^{NS}
2012-13	-0.433^{*}	-0.817^{**}	-0.214^{NS}	-0.701^{**}	-0.351^{NS}
2013-14	-0.602^{**}	-0.835^{**}	-0.063^{NS}	-0.561^{**}	-0.210^{NS}
2014-15	-0.348^{NS}	-0.591^{**}	-0.062^{NS}	-0.551^{**}	-0.277^{NS}
Mean	-0.404	-0.573	-0.114	-0.567	-0.300
Cumulative	-0.293	-0.728	-0.415	-0.789	-0.577

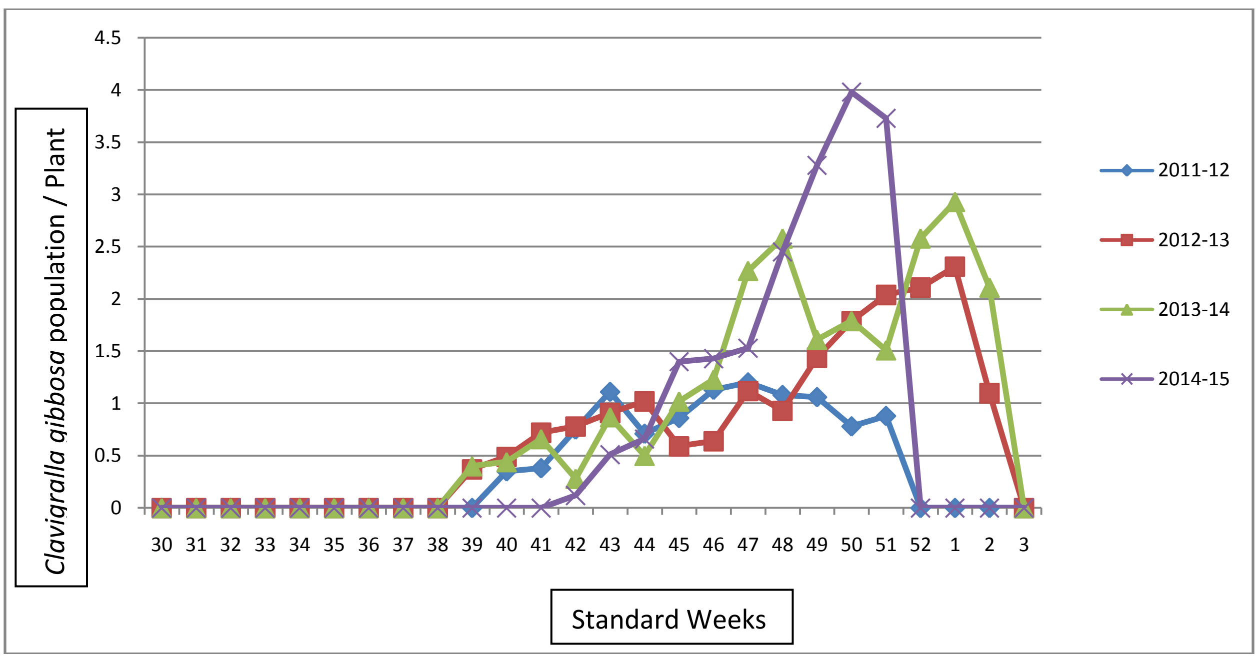


Fig. 1 Temporal variation of *C. gibbosa* population on pigeonpea

However, significant and negatively correlated with rainfall (r = -0.29). Similarly, Relative humidity (morning) had significant and negative correlation to *Clavigralla gibbosa* population (r= -0.79) and non-significant and negatively correlated during evening (r= -0.58). Present studies were in partially in line with the Singh et al. (1990) reported that *E. kerri* had a negative association with the rainfall, minimum daily temperature, relative humidity. Jayasimha et al. (2012) reported that leafhopper population had a significant negative correlation with rainfall. However, RH was non significant and negative with population. Similarly Sutaria et al. (2010) who observed rainy days were negatively correlated. Singh et al. (2013) who reported negative correlation between cotton leaf hopper population and relative humidity. Yadav et al. (2015) who showed that leafhopper population was negatively correlated with minimum temperature. Present studies were in partially in line with the Jakhar et al. (2016)that the population of *Helicoverpa* had significant and negative correlation with maximum temperature (r = -0.52) and non-significant and negatively correlated with minimum temperature (r = -0.71). However, significant and positively correlated with rainfall (r = 0.08). Similarly, Relative humidity (morning and evening) had significant and negative correlation to *Helicoverpa* population (r= -0.83, r= -0.59, respectively).

Conclusion

Clavigralla gibbosa on pigeonpea is at increasing trend from year to year and causing severe damage to crop. During last four years (2011 to 2014) there was a lot of variation in prevalence of abiotic factors viz., rainfall, temperature and relative humidity in this region might have favoured the pest buildup from year to year at increasing trend and near future if the similar variation continued with aboitic factor particularly rainfall and relative humidity will lead to attainment of this to a major status.

Acknowledgement

This research was funded by ICAR New Delhi under National Initiative on Climate Resilience Agriculture Project. Authors are thankful to Dr OP Sharma and Dr S Vennila, Principal Scientists, NCIPM, New Delhi for their help in this research.

References

Anonymous, 2014. Project Co-coordinators report. All India Co-ordinate Research Project on Pigeonpea, Indian Institute of Pulses Research, Kanpur pp- 10.

Haldhar SM, Karuppaiah V, Sharma SK & Singh RS. 2010. Population Dynamics of Lemon Butterfly (*Papilio demoleus*) in *Bael* [*Aegle marmelos*] as Influenced by Abiotic Factors in Arid Region of Rajasthan. *Indian Journal of Arid Horticulture*, 5 (1-2): 50-52.

Jakhar BL, Singh N, Venilla S, Patel MH, Vekaria MV, Patel DB & Panickar B. 2016. Influence of climate change on *Helicoverpa armigera* (Hubner) in pigeonpea. *Journal of Agriculture and Ecology*, 2: 25-31**.**

Jaworski T & Hilszczanski J. 2013. The effect of temperature and humidity changeson insects development and their impact on forest ecosystems in the context of expected climate change. *Forest Research Papers*, 74 (4): 345-355.

Jayasimha GT, Rachana RR, Manjunatha M & Rajkumar VB. 2012. Biology and seasonal incidence of leafhopper, *Amrasca biguttula biguttula* (Ishida) (Hemiptera : Cicadellidae) on okra. *Pest*

Management in Horticulture Ecossystem, 18: 149-153.

Krishna Kumar K, Patwardhan SK, Kulkarni A, Kamala K & Koteswara Rao Jones R. 2011. Stimulated projections for summer monsoon climate over India by ahigh-resolution regional climatic model. *Current Science*, 3: 312-326.

Singh TVK, Singh KM & Singh RN. 1990. Groundnut pestcomplex: 4. Regression studies to determine the association ship between jassid and thrips and weather parameters. *Indian Journal of Entomology*, 52.

Singh Y, Jha A, Verma S, Mishra VK & Singh SS. 2013. Population dynamics of sucking insect pests and its natural enemies on okra agro- ecosystem in Chitrakoot region. *African Journal of Agriculture Research*, 8: 3814-3819.

Sreekanth M, Lakshmi MSM & Rao KY. 2015. Efficacy of different insecticides against legume pod borer, *Maruca vitrata* (Geyer) on Pigeonpea. *International Journal of Innovative Science, Engineering & Technology*, 2 (5): 452-459.

Sutaria VK, Motka MN, Jethva DM & Ramoliya DR. 2010. Seasonal abundance of jassid, *Empoasca kerri* infesting soybean and weather parameters. *Annals of Plant Protection Science*, 18: 232-233.

Yadav SK, Agnihotri M & Bisht RS. 2015. Seasonal incidence of insect-pests of blackgram, *Vigna mungo* (Linn.) and its correlation with abiotic factors. *Agriculture Science Digest*, 35(2): 146-148.