Journal of Ecology and the Natural Environment Vol. 3(11), pp. 360-364, 12 October, 2011
Available online at http://www.academicjournals.org/JENE
ISSN 2006- 9847©2010 Academic Journals

Full Length Research Paper

Assessment of spatial distribution of pod borer, *Cydia ptychora* (Meyrick) on pigeonpea

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Accepted 30 December, 2010

Spatial distribution of *Cydia ptychora* infested flower and pods of pigeonpea was studied in the experimental field of Department of Life Sciences, Manipur University. Various indices of dispersion, such as variance, variance to mean ratio, Lloyd's index of patchiness, mean crowding, Iwao's regression and Taylor's power law were evaluated to study the distribution pattern. Distribution pattern of *C. ptychora* followed contagious behaviour of distribution on pigeonpea crops during both the years.

Keywords: Spatial distribution*, Cydia ptychora,* contagious, pigeonpea.

INTRODUCTION

Pigeonpea (*Cajanus cajan*) is an important crop in semi-arid, tropical and subtropical farming systems, providing high quality vegetable protein, animal feed, and firewood. Insect pests feeding on flowers, pods, and seeds are the most important biotic constraint affecting pigeonpea yields. Among the various borers attacking pigeonpea, the pod borer *Cydia ptychora* (Meyrick) (Lepidoptera: Tortricidae) often assumes significance and has been identified as a major constraint to pigeonpea production in Manipur (Devi, 2005). This pest causes damage by boring through the reproductive parts of the plant. To enhance pigeonpea yields, timely control of this pod borer is therefore important.

Studies on the distribution pattern of insect pests allows a better understanding of insect plant interactions under natural conditions. It provides the basic information for spatial pest dynamics, which is necessary for designing efficient sampling techniques as well as the development of effective population models (Taylor, 1984). It also allows for the formulation of suitable target oriented pest management strategies. In order to ascertain spatial distribution pattern of *C. ptychora* on pigeonpea, field trials were laid out for two consecutive seasons during 2003-2004 and 2004-2005 at the experimental field, Department of Life Sciences, Manipur University, India.

This study is being conducted for the first time in Manipur, a state in India. This pests is one of the major pod borer species infesting pigeonpea in Manipur.

MATERIALS AND METHODS

The spatial distribution pattern of *C. ptychora* was studied on pigeonpea (T-21) for two consecutive cropping seasons. The crop was grown in five plots measuring 27 sq.m. Each plot area was 27sq.m.Length of the plot was 9m and breadth 3m,each with inter and intra row spacing of 75 and 45 cm respectively during 22nd May and 27th May in the 1st and 2nd year respectively . A 1 m gap each was maintained between adjacent plots. In order to allow the pest population to build up freely, the crop was raised following recommended agronomic practices, without any insecticidal treatment. The distribution pattern of *C. ptychora* was assessed based on data collected on the number of infested buds, flower and pods on six randomly selected plants from each plot. (Plant inspection method (PIM) was adopted to study the distribution pattern of the individual pod borers. In this sampling method, the number of infested flowers and pods per plant were counted in situ, starting from flowering to pod maturity stage of the crop. Counting of the buds, flowers and pods was done *in situ* at weekly intervals. Altogether 50 samples were drawn from five plots. The data from original counts were arranged in frequency tables for fitting the different statistical parameters. Variance to mean ratio (Southwood, 1978), exponent – K (Lloyd, 1967), patchiness index (Lloyd, 1967), clumping index (David and Moore, 1954), mean colony size (Tanigoshi et al., 1975), mean clump size (Arbous and Kerrich, 1951), Iwao's patchiness regression (Iwao's, 1968) and Taylor's

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Table 1. Distribution pattern of *Cydia ptychora* on pigeonpea during (2003 – 2004).

Sampling period	* Mean density (0)	Variance (S^2)	Variance to mean ratio ($S^2/0$)	Dispersion parameter (K)	Co-efficient of variation (CV)	Index of clumping (IDM)	Mean crowding Index (X*)	Lloyd's patchiness Index (X*/0)	Mean colony size (C*)	Pattern of distribution	Mean clump size (λ)
4WN0V 03	3.8	10.2	2.68	2.26	0.84	1.68	5.48	1.44	6.48	C	3.25
1WDEC 03	6.8	54.6	8.03	0.97	1.09	7.03	13.83	2.03	14.83	C	4.66
2WDEC 03	7.4	26.8	3.62	2.82	0.70	2.62	10.02	1.35	11.02	C	6.54
3WDEC 03	11.4	116.3	10.20	1.24	0.95	9.20	20.60	1.81	21.60	C	8.53
4WDEC 03	10.6	56.3	5.31	2.46	0.71	4.31	14.91	1.41	15.91	C	9.20
5WDEC 03	18.8	224.7	11.95	1.72	0.80	10.95	29.75	1.58	30.75	C	15.31
1WJAN 04	15.2	315.2	20.74	0.77	1.17	19.74	34.94	2.30	35.94	C	9.45
2WJAN 04	9.8	48.7	4.97	2.47	0.71	3.97	13.77	1.41	14.77	C	8.51
3WJAN 04	12.4	77.3	6.23	2.37	0.71	61.34	73.74	5.95	74.74	C	10.70
4WJAN 04	7.8	34.7	4.45	2.26	0.76	3.45	11.25	1.44	12.25	C	6.69
1WFEB 04	9.6	48.3	5.03	2.38	0.72	4.03	13.63	1.42	14.63	C	8.29
2WFEB 04	6.8	36.7	5.40	1.55	0.89	4.40	11.20	1.65	12.20	C	5.40
3WFEB 04	6.4	15.8	2.47	4.36	0.62	1.47	7.87	1.23	8.87	C	5.91

C= Clumped, 1-5W = number of week. * Mean of 30 samples.

power law (Taylor, 1961) were analyzed to test the dispersion behaviour of this pest. α and B which were obtained from the regression of the mean crowding against mean density refers to the basic component of dispersion and the pattern of distribution respectively (Iwao, 1968). The regression constants 'a' and 'b' of Taylor's power law also indicated the sampling parameter and the aggregation index respectively (Taylor, 1961).

RESULTS AND DISCUSSION

The statistical parameters for testing distribution pattern of *C. ptychora* infested flowers and pods for two consecutive cropping seasons are shown in Tables 1 and 2 respectively. The symptoms of infestation were first observed on 2^{5th} November and 27th November with the infestation level of 3.8 and 6.2 in the 1st and 2nd cropping season, respectively. Planting date is mentioned in the Materials and Methods. The values of variance to mean ratio exceeded unity in all the sampling occasions indicating a contagious type of distribution. Further, the numerical value of 'k' was less than eight in all the sampling dates, which signified that the distribution pattern was contagious in nature. The trend was confirmed by the positive values of David and Moore's index of clumping in different sampling occasions. Further, the indices of mean crowding and patchiness as well as the mean colony size also confirmed these observations. The results that the distribution pattern of *C. ptychora* was contagious corroborated the findings of Yu et al. (1997). They observed that the distribution of cotton bollworm (*Helicoverpa armigera*) followed an aggregate pattern in a typical field in China. Similar observations were also made by Patnaik and Senapati (2000) who studied the distribution pattern of *H. armigera* larvae in Orissa. Although *H. armigera* is a different species, a discussion was made with this pest since it is also a pod borer and moreover literatures on the studies of *C. ptychora* is not availble specially with regard to distribution pattern in other areas.

Mean clump size computed showed that the values were greater than two for most of the cases, which signified that the clumping was due to environmental heterogeneity as well as inherent behaviour of the insect.

Iwao's patchiness regression, were computed as X* = - 5.93 + 2.67 X in 2003 and X* = 5.48 + 0.83 X in 2004 and these were graphically represented in Figures 1 and 2 respectively. The index of basic contagion (α) was negative in the

Table 2. Distribution pattern of *Cydia ptychora* on pigeonpea during (2004 – 2005).

Sampling period	* Mean population density (0)	Variance (S^2)	Variance to mean ratio ($S^2/0$)	Dispersion parameter (K)	Co-efficient of variation (CV)	Index of clumping (I_{DM})	Mean crowding (X*)	Lloyd's patchiness Index (X*/0)	Mean colony size (C*)	Pattern of distribution	Mean clump size (λ)
4WN0V 04	6.2	35.7	5.76	1.30	0.96	4.76	10.96	1.77	11.96	c	4.71
1WDEC 04	7.6	39.8	5.24	1.79	0.83	4.24	11.84	1.56	12.84	c	6.24
2WDEC 04	17.4	60.3	3.47	7.06	0.45	2.47	19.87	1.14	20.87	c	16.59
3WDEC 04	15.2	49.2	3.24	6.80	0.46	2.24	17.44	1.15	18.44	c	14.46
4WDEC 04	11.8	74.7	6.33	2.21	0.73	5.33	17.13	1.45	18.13	c	10.08
1WJAN 05	15.4	87.3	5.67	3.30	0.61	4.67	20.07	1.30	21.07	c	13.88
2WJAN 05	14.8	43.7	2.95	7.58	0.45	1.95	16.75	1.13	17.75	c	14.15
3WJAN 05	12.0	52.0	4.33	3.60	0.60	3.33	15.33	1.28	16.39	c	10.91
4WJAN 05	16.0	61.0	3.81	5.69	0.49	2.81	18.81	1.18	19.18	c	15.07
5WJAN 05	13.6	58.8	4.32	4.09	0.56	3.32	16.92	1.24	17.92	c	12.51
1WFEB 05	12.0	40.0	3.33	5.14	0.53	2.33	14.33	1.19	15.33	c	11.23
2WFEB 05	10.6	38.3	3.61	4.06	0.58	2.61	13.21	1.25	14.21	c	9.74

C= Clumped; 1-5W = number of week. * Mean of 30 samples.

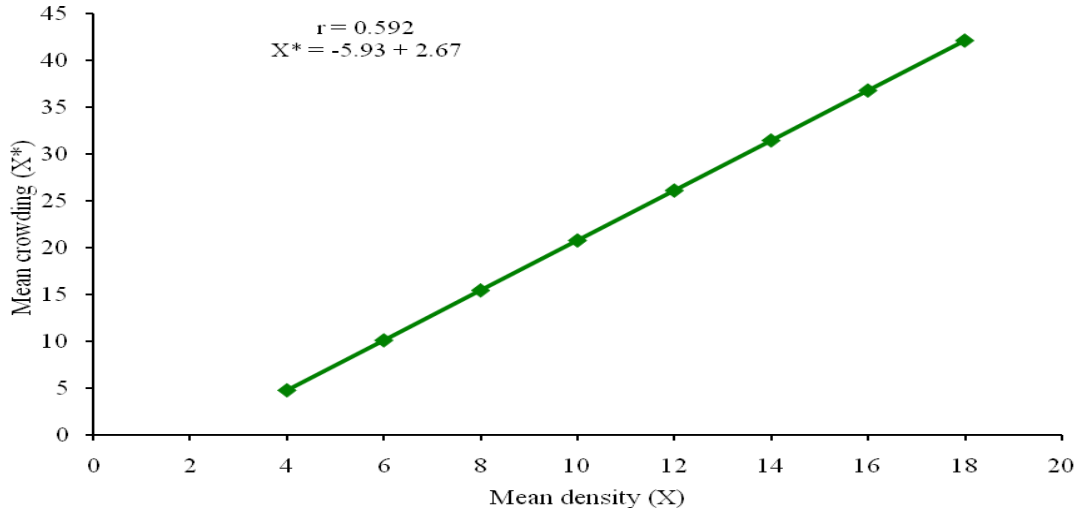

Figure 1. Iwao's regression of mean crowding (X*) on mean density (X) of *C. ptychora* larvae on pigeonpea.

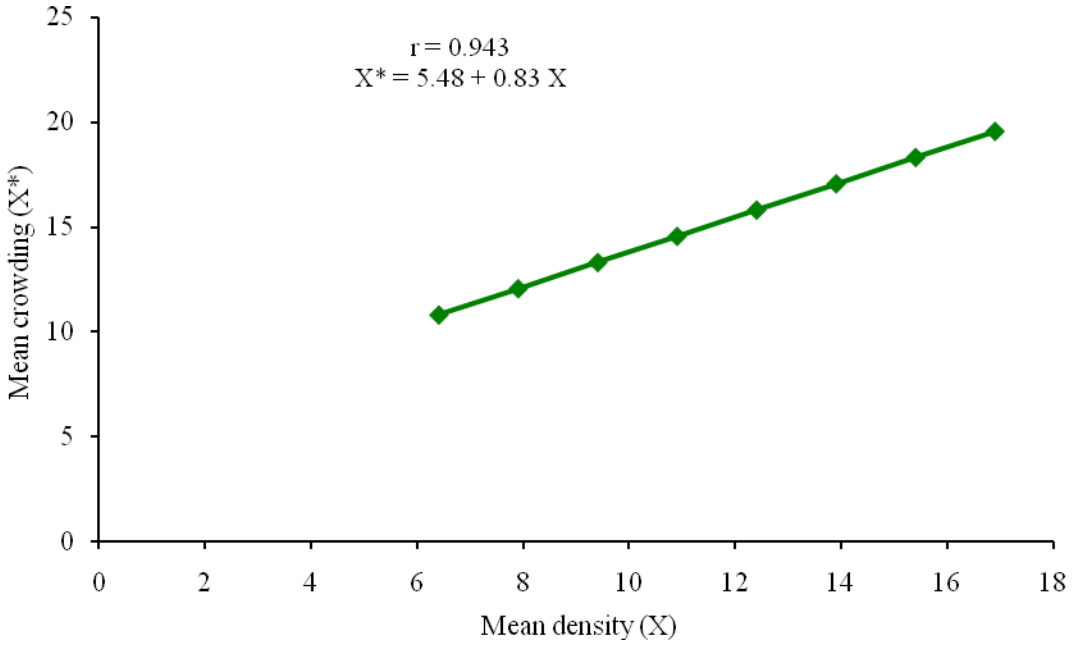

Figure 2. Iwao's regression of mean crowding (X*) on mean density (X) of *C. ptychora* larvae on pigeonpea.

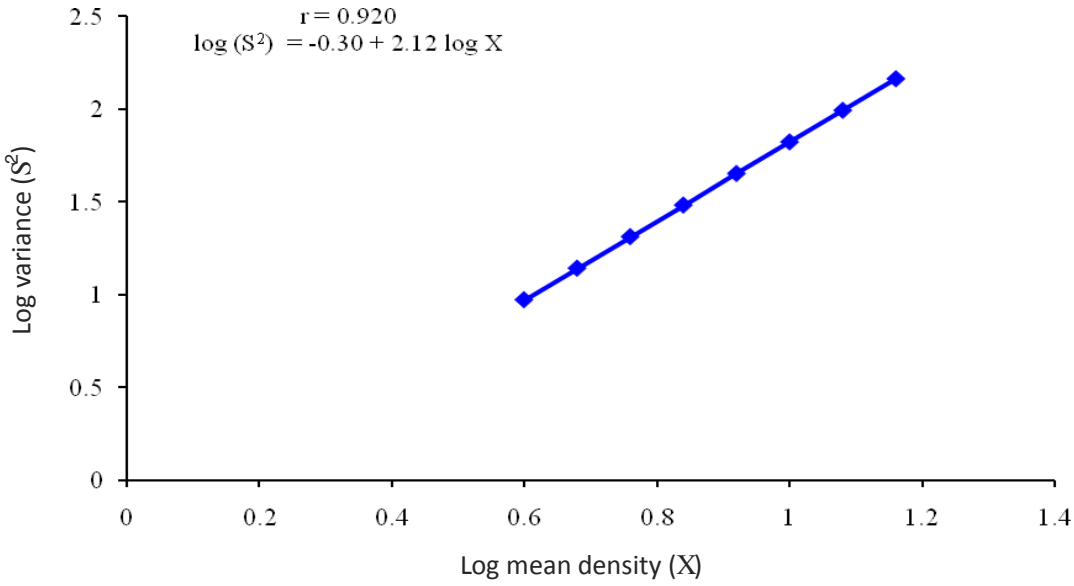

Figure 3. Regression of log variance (S2) on log mean density (X) of *C. ptychora* larvae on pigeonpea.

first year whereas it was positive in the second year. The negative values indicated that aggregation was of individuals rather than colonies whereas the positive values revealed positive association. Further, the density contagiousness coefficient were $\beta = 2.67$ and $\beta = 0.83$ in 1st and 2nd year respectively, being greater than unity in the first year suggested that the colonies were over dispersed whereas in the second year the values was recorded less than unity indicated that the colonies were not dispersed in an aggregated manner. The regression equation based on Taylor's Power law were computed as $\log S^2 = -0.30 + 2.12 \log X$ and $\log S^2 = 1.09 + 0.57 \log X$ in 2003-2004 and 2004-2005 respectively (Figures 3 and 4). The value of the index of aggregation (b) were more than unity in 1st year, thus confirmed the aggregate nature of distribution whereas the values of aggregation

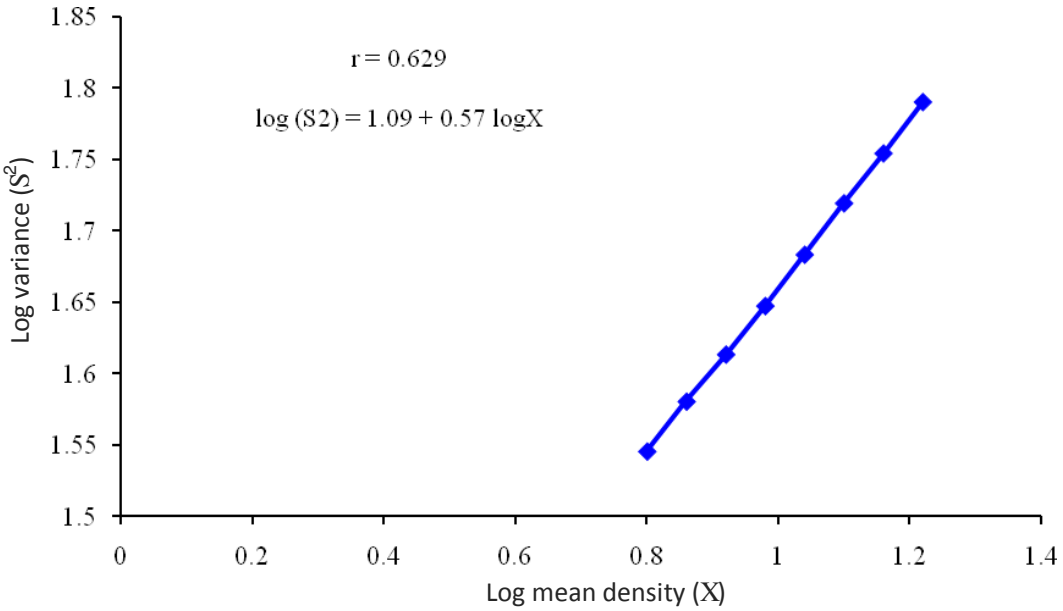

Figure 4. Regression of log variance (S2) on log mean density (X) on *C. ptychora* larvae on pigeonpea.

Was found to be less than unity during second year, suggesting regular distribution pattern.

ACKNOWLEDGEMENT

The authors thank Head, Department of Life Sciences, Manipur University for providing the necessary facilities to carry out this work.

REFERENCES

Arbous AG, Kerrich JE (1951). Accident statistics and the concept of accident proneness. Biometrics, 7: 340-342.

Devi SS (2005). Studies on the bio-ecology, economic injury level and management of the pod borer complex on pigeonpea agro-ecosystem in Manipur. Ph. D. Thesis submitted to Manipur University, Manipur, p. 132.

Iwao S (1968). A new regression method for analyzing the aggregation pattern of animal population. Res. Crop Eco., 10: 1-20.

Lloyd M (1967). Mean crowding. J. Anim. Ecol., 36: 1-30.

Southwood TRE (1978). Ecological methods with particular reference to the study of insect population. 1st. Ed., The English language Book Society and Chapman and Hall, London, p. 524.

Tanigoshi LK, Browne RW, Hoyt ST (1975). A study on the dispersion pattern of foliage injury by *Tetranychus medanieli* (Acarina: Tetranychidae) in sample apple ecosystem. Can.Ent. 107: 439 - 446.

Taylor TA (1984). Assessing and interpreting the spatial distribution of insect population. Ann. Rev. Ent., 29: 321- 357.

Yu YJ, Feng BC, Yang ZF, Zhou XS, Zhu SGYY, Feng BC, Yang ZF, Zhon XS, Zhu SG (1997). The spatial distribution pattern and sampling techniques of eggs of cotton bollworm on the cotton fields. Acta Agric. Zhejiangensis, 9 (3): 140-143.

Patnaik HP Senapati B (2000). Spatial distribution of *Helicoverpa armigera* Hubner larvae in chickpea, *Cicer arietinum* L. Indian J. Plant Prot., 28(1): 64 - 68.