

Impact of the Various Abiotic Weather Parameters on Population of Sugarcane Leaf Hopper, *Pyrilla perpusilla* (Walk.)

RAVINDRA SINGH PATRE* V.K. SONI AND BHUPESH JOSHI

Department of Entomology, College of Agriculture,
Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh
*email: ravindra.patremd@gmail.com

ABSTRACT

Impact of the various abiotic weather parameters on population of sugarcane leaf hopper, *Pyrilla perpusilla* (Walk.) was studied during 2015-16 at farmer's field of Kawardha (Kabirdham), Chhattisgarh. The population of sugarcane leaf hopper, *P. perpusilla* was first occurred during the second fortnight of July with 0.49 eggs, 2.76 nymphs and 2.14 adults per leaf and reached maximum during first fortnight of August with 4.01 eggs, 13.51 nymphs and 13.82 adults per leaf and gradually decreased during second fortnight of September with 0.72 eggs, 0.25 nymphs and 0.07 adults per leaf, respectively. In various abiotic weather parameters, the relative humidity play significantly important role in the fluctuation the population of *P. perpusilla*.

Key words Abiotic weather parameters, sugarcane leaf hopper, *Pyrilla perpusilla* (Walk.)

Sugarcane, *Saccharum officinarum* L. is an important agro-industrial crop in India. India is the second largest producer of sugar in the world after Brazil. Sugarcane is cultivated under diverse agro climatic conditions in about 84 countries of the world. In India it is cultivated 50.32 lakh ha producing 3593.30 lakh tonnes with productivity of 70.86 tonnes/ ha (Anonymous, 2015a). Isaac in 1937 listed 79 species of insects infesting Sugarcane and Gupta and Avasthy (1957) categorized 18 as major pests and 21 as minor pests which are important limiting factors for obtaining high yield of sugarcane. Sugarcane leaf hopper, *Pyrilla perpusilla* (Walk) (Hemiptera: Lophopidae) is one of the most serious pest widely distributed on wheat, barley, oats, maize, sorghum and numbers of grasses near sugarcane fields during out break situations. It is the most destructive in subtropical India and appears periodically. The *Pyrilla* outbreak have been reported by Rajak *et al.* (1987) and Pawar, (1989) in Uttar Pradesh during 1934-36, 1937-38, 1947-48, 1951-53, 1968-70, 1973-74, 1976-77, 1978-79 and 1985-86. Nymphs and adults both suck sap from underside of the leaves but most of the damage is caused by the nymphs (Gupta and Avasthi 1957; Gupa and Ahmad, 1983; Chaudhary and Sharma 1990; Kumarasinghe, 1996; Rajak, 2007; Pandey *et al.*, 2008). The damage caused by *P. perpusilla* has been reported up to 28% in the potential cane yield and 2-34% in sucrose content of sugarcane. *P. perpusilla* feeding results in poor growth which also causes difficulty in milling of affected canes (Kumarasinghe and Wratten, 1996). Zubair *et al.* (2006) also estimated the *Pyrilla* cause a reduction in the yield about 30-35 percent, respectively. In some time the loss was 80-85 per cent. The pest remains active throughout the year with 3-4 numbers

of generations with optimum activity from July to September (Shah and Saleem, 2002). *P. perpusilla* causes direct and indirect losses. Adult and nymph suck phloem sap from underside of leaves. The nymphs and adults cause heavy damage to the plant and excrete thick transparent liquid known as honey dew which is good medium for the growth of black mould. The mould reduces the photosynthetic activity of the leaves and reduces about 25% of the sugar yield. The cane juice becomes high in glucose and if it is used for making gur gives a soggy mass which does not solidify properly (Chaudhry and Ansari, 1988). An early infestation during the grand growth period of cane adversely affects the yield while the late-infestation from September onwards mostly affects the sucrose contents of cane (Puri and Siddharth, 2001). for the batter adaptation of eco-friendly management technique in sugarcane, the first step is to know the ecosystem, pest status and their natural enemies by monitoring and identification. Different weather factors are quite important in regulating the insect populations. Gupta and Ahmed (1983) found that temperature 29.4 °C and RH 75.84% are most suitable for proper growth and development of *Pyrilla*. Pest growth retards above 43 °C and below 9.4 °C. Rajak *et al.* (1987) concluded that high humidity leads to low *Pyrilla* population but Patil and Hapase (1992) came to opposite conclusion. According to Ganehiarachchi and Fernando (2000) *Pyrilla* abundance is negatively correlated with rainfall and humidity but positively with minimum temperature. They further concluded that egg parasitoid, predators and rainfall are the main factors responsible for fluctuating *P. perpusilla* population.

MATERIALS AND METHODS

Studies on Impact of the various abiotic weather parameters on population of sugarcane leaf hopper, *Pyrilla perpusilla* (Walk.) was studied during 2015-16 at farmer's field of Kawardha (Kabirdham), Chhattisgarh at 21°32' to 22°28' north latitude and 80°48' to 81°48' east longitude with altitude of 289 meter above the mean sea level. In the experiment fixed plot survey was conducted. Fortnightly observations were recorded on variety Rasgulla (Co 8036) of sugarcane at two different locations Village-Ramhepur and Nawadih, Kabirdham, Chhattisgarh were selected. Each location was considered as a replication. Number of egg mass, nymph and adult of *P. perpusilla* (Walk.) was recorded on each leaf of plant. The population data was recorded on three leaves *i.e.* top, middle and lower leaves on 20 randomly selected plants from each location. No pesticide was applied during the crop period. For the ease of analysis and findings, various abiotic weather parameters was obtained from meteorological observatory of S.K. College of Agriculture and Research Station, Kabirdham from the occurrence of

Table 1. Population dynamics of *Pyrilla perpusilla* (Walk.) on sugarcane at fifteen days interval during 2015-16

Date	Egg of <i>Pyrilla perpusilla</i>			Nymph of <i>Pyrilla perpusilla</i>			Adult of <i>Pyrilla perpusilla</i>		
	Ramhepur	Nawadih	Mean	Ramhepur	Nawadih	Mean	Ramhepur	Nawadih	Mean
July 30	0.38	0.59	0.49	3.25	2.26	2.76	0.93	3.35	2.14
August 15	1.85	6.16	4.01	0.02	27	13.51	14.25	13.39	13.82
August 30	0.30	4.36	2.33	4.77	17.9	11.34	0.75	2.11	1.43
September 15	0	1.06	0.53	0	6.02	3.01	0.04	0.52	0.28
September 30	0.2	1.24	0.72	0.5	0	0.25	0.10	0.04	0.07
October 15	0	0	0.00	0	0	0.00	0	0	0.00

leaf hopper till the disappearance of pest and pooled out at fifteen days interval. The data on population dynamics of *P. perpusilla* was correlated with prevailing temperature, rainfall, relative humidity, sunshine hours and wind velocity.

RESULTS AND DISCUSSION

Usually, egg, nymph and adults population of *P. perpusilla* was appeared in July on sugarcane crop and its population goes on increasing till August and then falls down in September. In the course of study, it was first observed during second fortnight of July; population continued to grow and reached peak at first fortnight of August and decreased second fortnight of September. Variation in results regarding appearance of *Pyrilla* may be attributed to difference in area. Chaudhary *et al.* (1987) noticed *Pyrilla* outbreak on sugarcane in Haryana. In most parts of the state the *Pyrilla* from July onwards with average populations 137.1 nymphs and adults per leaf. Chaudhary and Sharma (1990) reported that the *Pyrilla* population was maximum 12.1 adults per plant during 2nd fortnight of August, falling to 1.8 adults per plant in the 2nd week of September.

Eggs of *Pyrilla*

At Ramhepur periodical observations on the egg population of sugarcane leaf hopper, *P. perpusilla* revealed that the eggs of sugarcane leaf hopper appeared in second fortnight of July. Initially the eggs of *P. perpusilla* were 0.38 per leaf. The peak population (1.85 eggs per leaf) was noticed during first fortnight of August. Thereafter, the egg population gradually decreased reaching 0.2 eggs per leaf during second fortnight of September. The population ranged from 0.2 to 1.85 eggs per leaf during second fortnight of July to second fortnight of September. However, the egg

population of sugarcane leaf hopper, *P. perpusilla* first appeared in second fortnight of July 0.59 eggs per leaf at Nawadih. The maximum population (6.16 eggs per leaf) was noticed during first fortnight of August. The egg population gradually decreased 1.06 eggs per leaf during first fortnight of September. The population ranged from 1.06 to 6.16 eggs per leaf during second fortnight of July to second fortnight of September. The average number of maximum *P. perpusilla* 4.01 eggs per leaf were noticed during first fortnight of August and decreased 0.53 eggs per leaf during first fortnight of September (Table 1) The egg population of sugarcane leaf hopper, *P. perpusilla* (Walk.) was correlated with prevailing rainfall, temperature, relative humidity, sunshine hours and wind velocity. There was a positive trend between the egg population and relative humidity with 'r' value of 0.77 at 5 per cent level of significance. Whereas, the egg population were showed non significant positively correlation with rainfall ($r = 0.54$), maximum ($r = 0.45$) and minimum ($r = 0.65$) temperature. There were sunshine hours ($r = -0.76$) and wind velocity ($r = -0.48$) showed non significant negative correlation with egg population (Table 2).

Nymphal of *Pyrilla*

First appearance of nymph of sugarcane leaf hopper, *P. perpusilla* were observed on second fortnight of July with mean population of 3.25 nymphs per leaf at Ramhepur. The peak population 4.77 nymphs per leaf were noticed during second fortnight of August. Thereafter, the nymphal population gradually decreased reaching 0.5 nymphs per leaf during second fortnight of September. The population ranged from 0.02 to 3.25 nymphs per leaf during second fortnight of July to second fortnight of September. At Nawadih the nymphal population of sugarcane leaf hopper,

Table 2. Correlation coefficient of *Pyrilla perpusilla* (Walk.) with various abiotic weather parameters on sugarcane at fifteen days interval during 2015-16.

Weather parameter	<i>Pyrilla perpusilla</i> (Walk.)		
	Egg	Nymph	Adult
Rain fall (mm)	0.54	0.44	0.12
Maximum Temperature (°C)	0.45	0.42	0.08
Minimum Temperature (°C)	0.65	0.68	0.92**
Relative humidity (%)	0.77*	0.67	0.84*
Wind velocity (Km hr ⁻¹)	-0.48	-0.32	-0.07
Sunshine hours (hr day ⁻¹)	-0.76	-0.60	-0.63

*: Significant (5%) **: Highly significant (1%)

P. perpusilla first appeared in second fortnight of July 2.26 nymphs per leaf. The peak 27.00 nymphs per leaf were noticed during first fortnight of August. The nymphal population gradually decreased 6.02 nymphs per leaf during first fortnight of September. The population ranged from 2.26 to 27.00 nymphs per leaf during second fortnight of July to first fortnight of September. The average peaks of *P. perpusilla* 13.51 nymphs per leaf were noticed during first fortnight of August and decreased 0.25 nymphs per leaf during first fortnight of September. There were non significant positive correlation found with rainfall ($r = 0.44$), maximum ($r = 0.42$) and minimum ($r = 0.68$) temperature and relative humidity ($r = 0.67$). Whereas, the sunshine hours ($r = -0.60$) and wind velocity ($r = -0.32$) were showed non significant negative correlation with nymphal population. The results revealed that abiotic weather parameters were showed non significant role in the fluctuation of nymphal population of sugarcane leaf hopper, *P. perpusilla*.

Adult population of *P. perpusilla* (Walk.)

The adult population of *P. perpusilla* was observed second fortnight of July 0.93 adults per leaf at Ramhepur. The maximum 14.25 adults per leaf were noticed during first fortnight of August. Thereafter, the adult population gradually decreased 0.10 adult per leaf during second fortnight of September. The population ranged from 0.04 to 14.25 adults per leaf during second fortnight of July to second fortnight of September. However, the adult population of sugarcane leaf hopper, *P. perpusilla* first appeared in second fortnight of July 3.35 adults per leaf at Nawadih. The maximum 13.39 adult per leaf were noticed during first fortnight of August. The adult population gradually decreased 0.04 adults per leaf during second fortnight of September. The population ranged from 0.04 to 13.39 adults per leaf during second fortnight of July to second fortnight of September. The average numbers of maximum *P. perpusilla* 13.82 adults per leaf were noticed during first fortnight of August and decreased 0.07 adults per leaf during first fortnight of September. There were a positive trend between the adult population and minimum temperature and relative humidity with 'r' value of 0.92 and 0.84 at 1 and 5 per cent level of significance, respectively. Whereas, the adult population were showed non significant positively correlation with rainfall ($r = 0.12$), maximum temperature ($r = 0.08$). There were sunshine hours ($r = -0.63$) and wind velocity ($r = -0.07$) showed non significant negative correlation with adult population.

On the basis of overall impact of present study revealed that the average egg, nymph and adult population of sugarcane leaf hopper, *P. perpusilla* was first occurred during the second fortnight of July with 0.49, 2.76 and 2.14 per leaf and reached their peak during first fortnight of August with 4.01, 13.51 and 13.82 per leaf and gradually decreased during second fortnight of September with 0.72, 0.25 and 0.07 per leaf, respectively. In various abiotic weather parameters *viz.* rainfall, minimum and maximum temperature and relative humidity were influence positively egg, nymph and adult population of sugarcane leaf hopper, *P. perpusilla*; while sunshine hours and wind velocity negatively correlated the pest incidence. In case of egg and adult population correlation with relative humidity

showed high positive correlation. It's evident that when the relative humidity was increased the population was also gradually increased *i.e.* relative humidity play significantly important role in the fluctuation of *P. perpusilla* population. The present findings are in agreement with Hugar *et al.* (2002) who noticed the egg and nymphal incidence of the leaf hopper from June to December; while the adult activity was observed throughout the year. Rana *et al.* (2002) observed *Pyrilla* first appeared in March, April and May. Peak population of *Pyrilla* was recorded during August. Mishra (2005) reported that *Pyrilla* is more active in the humid area and during summer bring down the population. More or less similar findings were obtained by Akhtar *et al.* (2014) reported that maximum population of *P. perpusilla* during the second fortnight of September and more variation in *P. perpusilla* population by temperature rather than relative humidity. Choudhary *et al.* (2015) reported the *Pyrilla* infestation initiated in last week of June. The peak activity (14-20 individuals/leaf) was observed from second last week of August to 1st week of September. The relative humidity of morning and evening, total rain fall were positive influence on *Pyrilla* field population.

ACKNOWLEDGEMENT

The first author expresses his heartfelt gratitude to Dr. V.K. Soni, Assistant Professor, S. K. College of Agriculture and Research station Kawardha (Kabirdham), IGKV, (C.G.) for his full support, constant enthusiasm and motivation. A special thanks to Bhupesh joshi, Ph.D. scholar, Department of Entomology for giving me help during field observation and thesis writing.

LITERATURE CITED

- Akhtar, M. F., Gogi, M. D., Abbas, Q., Shamraiz, R. M., Ahmed, R. and Niaz, T. 2014. Impact of abiotic factors on population build up of *Pyrilla perpusilla* and *Epiricania melanoleuca* on Sorghum. *Journal of Entomology and Zoology Studies*. 2 (6): 77-81.
- Anonymous, 2015a. Forth Advance Estimates of production of Food grains for 2014-15. Agricultural statistics Division, Directorate of Economics & Statistics, Department of Agriculture & Cooperation, Government of India, New Delhi. p.12
- Chaudhary, J. P., S. K. Kaushik, R. Singh and K. K. Mrig, 1987. Role of natural enemies in the suppression of sugarcane leafhopper, *Pyrilla perpusilla* (Walker) *FAO Plant Protection Bulletin*, 35(1): 15-19.
- Chaudhary, M. A. and Ansari, N. A. 1988. Insect pests of sugarcane in Pakistan. *Prog. Farm*. 8(4): 10-18.
- Chaudhary, R. N. and Sharma, V. K. 1990. A note on *Pyrilla perpusilla* Walker on maize. *Indian Journal of Plant Protection*. 18 (1) :113-114.
- Chaudhary, R.N. and Sharma, V.K. 1990. A note on *Pyrilla perpusilla* Walker on maize. *Indian J. of Pl. Pro.* 18:113-114.
- Choudhary, A. K., Amrate, P. K. and Chatterjee, A. 2015. Role of biotic and abiotic factors in population dynamics of sugarcane leaf hopper, *Pyrilla perpusilla* Walker in Madhya Pradesh, India. *Environment and Ecology*. 33(3): 1038-1043.
- Ganehiarachchi, G. A. S. M. and Fernando, I. V. S. 2000. Population dynamics of the sugarcane planthopper *Pyrilla perpusilla* in the wet zone of Sri Lanka. *Tropical Science*. 40 (3): 144-153.
- Gupta, B. D. and Avasthi, P. N. 1957. Observations on a new beetle pest of sugarcane crop in Bihar. *Indian Sug*. 7:587-594.

- Gupta, M. and Ahmad, I. 1983. Morphology of Indian Sugarcane leafhopper *Pyrilla perpusilla* Walker. *Folia Morph.* 31: 325-330.
- Hugar, P. S., Rachappa, V. and Rajendra, H. 2002. Population dynamics of sugarcane leafhopper, *Pyrilla perpusilla* (Walker) and its natural enemies in Northern Karnataka. Resources management in plant protection during twenty first century, Hyderabad, India, 14-15 November 2002. Vol. II pp. 26-29
- Isaac, P. V.(1937) Information on pests of sugarcane in India from published received from Provinces and state governments,.. Indian publications. pp 186.
- Kumarasinghe, N. C. 1996. The sugarcane lophopid planthopper *Pyrilla perpusilla* (Homoptera: Lophopidae): A review of its biology, pest status and control. *Bul Entomol Res.* 86:485-498.
- Mishra, S. R. 2005. Plant Protection and Pest Management. Discovery Publishing House, New Delhi, India., pp. 147.
- Pandey, K.P., Pandey, M.N., Mishra, V.K., Singh, S., Singh, D.N. and Singh, S.B. 2008. Studies on the effect of eco-friendly bio-agent *Epiricania melanoleuca* for the control of Sugarcane Pyrilla (*Pyrilla perpusilla*) in eastern U.P. *Indian Agricultural Research Article.* 23 (2): 91-95.
- Patil, A.S. and Hapase, D.G. 1992. Sugarcane pests management under drought conditions in Maharashtra. Cooperative Sugar. 23(8):531-533.
- Pawar, A. D. 1989, Role of egg parasite *Tetrastichus pyrillae* (Chrawford) and nymphal and adult parasite, *Epiricania melanoleuca* (Fletcher) in the integrated control of sugarcane pyrilla, *pyrilla purpusilla* (Walker) *Indian Sugar*; 38:961-968.
- Puri, K. D. and Sidhart, K. 2001. Effect of *Pyrilla epidemic* (1999-2000) on Sugarcane yield and sucrose. Proc. 63rd Ann. Conv. Sugar Tech. Assoc., Ind., 25th to 27th August, A60-A68.
- Rajak, D. C. 2007. Colonization & redistribution of *Epiricania melanoleuca* Fletcher against *P. perpusilla* Walker. *Ann. Pl. Protec. Sci.* 15: 83-86.
- Rajak, R. L., Pawar A. D., Mishra M.P., Prasad J., Verma A. and Singh G.P. 1987. Sugarcane pyrilla epidemic 1985- a case study, *plant protection bulletin.* 39:1-9.
- Rana, Z. A., Mahmood, M. M. and Hashmi, A. A. 2002. Population dynamics of *Pyrilla perpusilla* Walk. and its parasite *Epiricania melanoleuca* Fletcher at Faisalabad. *Pakistan Journal of Agricultural Research.* 17 (3):267-272.
- Shah, H. A and Saleem, M. A. 2002. Applied Entomology. 2nd ed. Izhar Sons Printers, Lahore. pp 92.
- Zubair, M., S. Ahmad, A. Rasool and Farooq. M. A. 2006. Sugar crop research programme report, PARC, Islamabad, Pakistan.

Received on 03-02-2017

Accepted on 09-02-2017