Pakistan J. Zool., vol. 53(5), pp 1969-1972, 2021 DOI: https://dx.doi.org/10.17582/journal.pjz/20191012081034

Short Communication

Population Fluctuation of *Bactrocera zonata* and *Bactrocera dorsalis* in Guava Orchard Agro-Ecosystem in Sindh Region

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Article Information
Received 12 October 2019
Revised 17 May 2020
Accepted 07 July 2020
Available online 19 August 2021

Authors' Contribution
ZUAA performed the experiments, analyzed the data and wrote the article. NB supervised the study. RMM conceived the study. NHK designed the experiments.

Key words
***Bactrocera zonata*, Oriental fruit fly, Population dynamics, Guava orchards, Sindh**

ABSTRACT

The population dynamics of the peach fruit fly, *Bactrocera zonata* (Saunders) and oriental fruit fly *Bactrocera dorsalis* (Hendel) were monitored from January to December 2018 in guava orchards of the Sindh Pakistan. The investigations were done at different localities of Hyderabad and Larkana using Steiner type traps incorporated with methyl eugenol. The trap catches of *B. zonata* and *B. dorsalis* in both climatic zones shown a similar pattern during the study with a major peak in August in off seasoned guava. Whereas decreased population of *Bactrocera* flies were obtained in the month of January in Larkana (16.5±1.18, 12.9±1.47) and Hyderabad (19.3±1.28,13.4±1.39) regions, respectively. The abundance of fruit flies showed a significant correlation with temperature and slight negative relativity with humidity. The result suggests that high temperature enhances the fruit flies activity in connection with the availability of fruiting parts. The present investigations would be helpful to attain effective integrated pest management campaign in guava orchards.

Studies on the population fluctuations of peach fruit fly, *Bactrocera zonata* and oriental fruit fly *Bactrocera dorsalis* the severe pests of guava (*Psidium guajava* L.) mango (*Mangifera indica* L.) and carambola (*Averrhoa carambola* L.) were undertaken in India (Leblanc *et al*., 2013). The fruit flies are injurious and multiparous pests that attacks over 185 cultivated and wild plants in many parts of the world (Pena *et al*., 1998). These fruit flies occur in Southeast Asian countries such as India, Bangladesh, Mauritius, the Maluku Islands, SriLanka and Thailand. In Pakistan, it has been documented in coastal and sub-coastal areas of Baluchistan and Sindh, as well as semi desert areas and northern plains of Punjab.

Considering the economic and quarantine importance control of this pests is normally stating most of the countries of the world (Heather and Hallman, 2008). Eight species of genus *Bactrocera* have been recognized among quarantine pests related to mango, guava, peach etc in Pakistan (Mohamed, 2002). The fruit flies attack may reach up to 89.50% of guava fruits in India (Grewal and Kapoor, 1987) and losses incurred from 10 to 20% in the north-western Himalayan region (Gupta and Verma, 1990). In India, the pest status of *B. zonata* and *B. dorsalis* may correspond in the same crop (Kapoor, 1993).

For sustainable pest management strategy to control fruit flies population monitoring of pest population round the year is one of the most important and key tool for enunciating IPM package (Laskar and Chatterjee, 2010). No published data is available so far regarding the population dynamics of *B. zonata* and *B. dorsalis* in the guava growing areas of Pakistan especially in Sindh. Hence this study was undertaken to workout the population dynamics of male fruit flies in guava orchards of two different climatic zones. Keeping in view the disadvantages and residual effects of chemical insecticides pesticide free and environment free tactics be applied to overcome this obnoxious pest.

We recorded population fluctuations of *B. zonata* and *B. dorsalis* using Steiner type traps locally known as "Tando Jam Traps" lured with methyl eugenol in guava orchard ecosystem of different climatic regions of Sindh. We documented data in connection with meteorological factors to find sustainable pest management strategy against *Bactrocera* spp. in guava orchard ecosystem.

Materials and methods

The experiment was conducted in the guava orchards of Nuclear Institute of Agriculture (NIA), Tando

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0030-9923/2021/0005-1969 $ 9.00/0

Jam, 25º25'60N 68º31'60E Hyderabad and Bakrani, 27º26'46.66"N 68º11'07.11"E Larkana using commercial formulation of methyl eugenol (steiner type traps/ Tandojam traps) during 2018.

Traps were prepared from transparent plastic jars (20 cm in length and 8 cm in diameter) for fruit flies capturing. Meanwhile, a small cotton wick dipped in male lure (4 ml methyl eugenol) having 5% (pyramid 10% AS) were suspended inside each trap, near the center. These traps had two holes on each side to allow the flies to enter inside. Male flies were attracted to lure, and slain by the insecticide on the cotton wick. The traps were deployed at three meter height in all selected locations from 01.01.2018 to 31.12.2018. The captures were collected on weekly basis and cue lure was replenished at fortnightly interval. The trappings were brought to the laboratory in Tando Jam where flies from each trap were identified and counted.

A total area of 5 acres was selected at each guava orchard of discrete zones for observing the *B. zonata* and *B. dorsalis* population fluctuations and effect of weather parameters on it. Experiment was designed in randomized complete block design (RCBD) having ten replications, Where each trap was considered as one replicate.

Meteorological data used in this study were obtained from Regional AGRO-MET Centre Tando Jam and Larkana, Sindh, Pakistan.

All statistical analyses were done with the help of Statistix® Version 8.1, Analytical Software, Inc., and Tallahassee, FL, USA. Statistical analysis was calculated using two-ways analysis of variance ANOVA for different parameters followed by Tukey's Post Hoc HSD test for the significance of data.

Results and discussion

The population dynamics of male *B. zonata* and *B. dorsalis* has shown similar pattern in two climatic zones of Sindh with a major peak in off seasoned guava in August (Table I). Highest monthly population of *B. zonata* was recorded at Hyderabad (1020.7±96.86) followed by *B. dorsalis* (776.4±39.07). Similarly, in Larkana region significantly ($P<0.05$) higher *B. zonata* population was recorded in the month of August (1009.3±100.63) followed by *B. dorsalis* (416.8±19.83) and the lowest population of both species were recorded in the month of January in both the climatic zones. The results show that population of *B. zonata* starts increasing from May onwards and the maximum population is recorded in August whereas, *B. dorsalis* population started increasing from June with major peak in August in Hyderabad region (Fig. 1A). The population declines slowly from October to December after which it is to some extent static until up to March (Fig. 1A). In Larkana where conditions are hot and dry *B. zonata* population started increasing in May onwards till September with peak population in off seasoned guava in August and *B. dorsalis* population started increasing from July to September peak population in the August. Temperature had positive and highly significant correlation with *Bactrocera* flies caught per trap in both climatic zones. While RH % has negative effect on the fruit flies catches in Hyderabad region and slightly negative effect on fly trappings in Larkana (Table II).

Table I. Month wise population fluctuation of *B. zonata* and *B. dorsalis* during January to December, 2018 (Mean±SE) in guava orchards of Sindh region.

Months of 2018	Hyderabad		Larkana	
	B. zonata	***B. dorsalis***	***B. zonata***	***B. dorsalis***
January	19.3±1.28 e	13.4±1.39 f	16.5±1.18 e	12.9±1.47 h
February	24.5±2.29 e	20.6±1.44 f	19.1±0.97 e	16.4±1.49 h
March	97.6±12.43 de	81.1±4.32 def	83.2±3.21 de	75.9±13.04 fg
April	162.7±12.11 cde	125.9±6.22 cde	155.4±10.75 cde	96.5±5.47 ef
May	242.7±12.52 c	198.3±14.98 c	233.7±18.81 cd	100.5±11.60 ef
June	270.6±9.46 c	201.4±15.47 c	264.7±21.99 c	136.3±12.38 de
July	586.8±22.52 b	516.9±30.26 b	580.2±28.86 b	203.2±14.15 c
August	1020.7±96.86 a	776.4±39.07 a	1009.3±100.63a	416.8±19.83 a
September	561.3±22.55 b	428.8±43.72 b	532.7±29.27 b	355.9±22.76 b
October	178.7±12.40 cd	166.7±16.39 cd	167.1±15.27 cde	162.1±12.97 cd
November	39.9±4.77 de	27.3±3.17 ef	30.8±3.99 e	22.3±2.04 gh
December	26.7±2.04 e	15.4±1.49 f	20.5±2.60 e	14.3±1.15 h

Values followed by different letters are significantly differ at 5% according to Tukey's honest significant difference (HSD) test.

Table II. Pearson's correlation between weather parameters and population fluctuations of *B. zonata* and *B. dorsalis* in guava orchards of Sindh region.

Meteorological factors	Hyderabad		Larkana	
	B. zonata	*B. dorsalis*	*B. zonata*	*B. dorsalis*
Temp (°C)				
Minimum	0.7120 *	0.4218*	0.6950*	0.6852*
Maximum	0.4056 *	0.5865 *	0.5372*	0.5295*
Relative humidity (%)	-0.5899	-0.6413	0.3016	0.3332

*Positively significant at ($p < 0.001$) according to Pearson's correlation significance test.

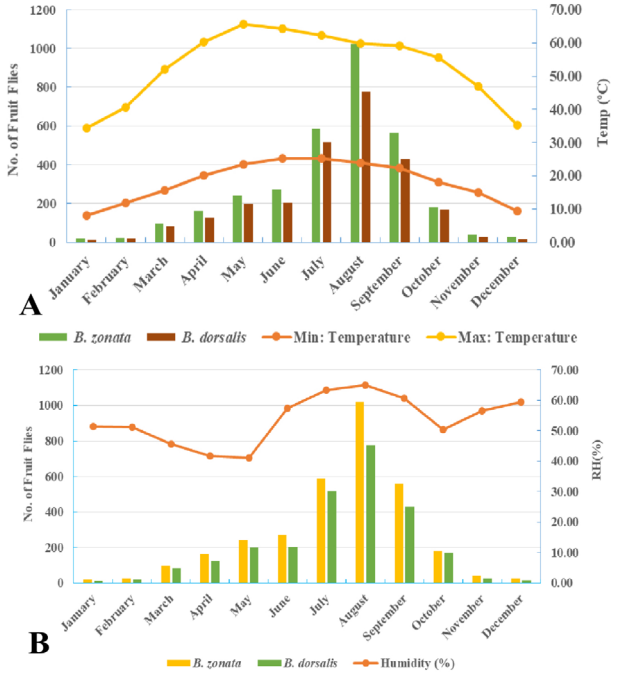

Fig. 1. Influence of temperature (°C) (**A**) and relative humidity (%) (**B**) on population fluctuation of *B. zonata* and *B. dorsalis* in guava orchard agro-ecosystem in district Hyderabad.

In northern Bihar, India the maximum fly populations were detected during the third week of June (357.0 flies/trap), whereas the lowest numbers were recorded during the last week of August (14.3 flies/trap) (Agarwal *et al.*, 1999).Our results are in contradiction to their's because in our studies *B. zonata* population started increasing in June with peak population in August. Our findings are in line with Siddiqui *et al.* (2003) who recorded the higher number of adult flies of *B. zonata* in the first week of June and the lowest in January. Ali *et al.* (2011) reported similar results in Egypt as in our study that during warm months April to May the flies *B. zonata* were more active in as compared to that of cold weather period (December-February) months. Draz *et al.* (2016) reported that the peach fruit fly was very active fruits orchards in Kafer El-Shikh Governorate, Egypt in warm months (June-August) and it caused severe damage to a wide range of fruits such as guava, peach, mango, and apricot. Sarwar *et al.* (2014) observed that population increase of *B. dorsalis* in Pakistan starts from April onwards and the maximum population is recorded during June-August with a peak in July. In Bangladesh, Uddin *et al.* (2016) reported the highest population of *B. dorsalis* male in the month of July and the lowest in the month of January. The results of the present findings are almost similar to that of the aforementioned authors.

The positive correlation was observed between fruit flies population and temperature in both districts (Figs. 1 and 2) where as relative humidity had negatively effect on fruit flies captured from Hyderabad and Larkana (Figs. 1 and 2). Our results are in agreement with these previous researchers (Ranjitha *et al.*, 2006; Abro *et al.*, 2017; Merrill *et al.*, 2008).

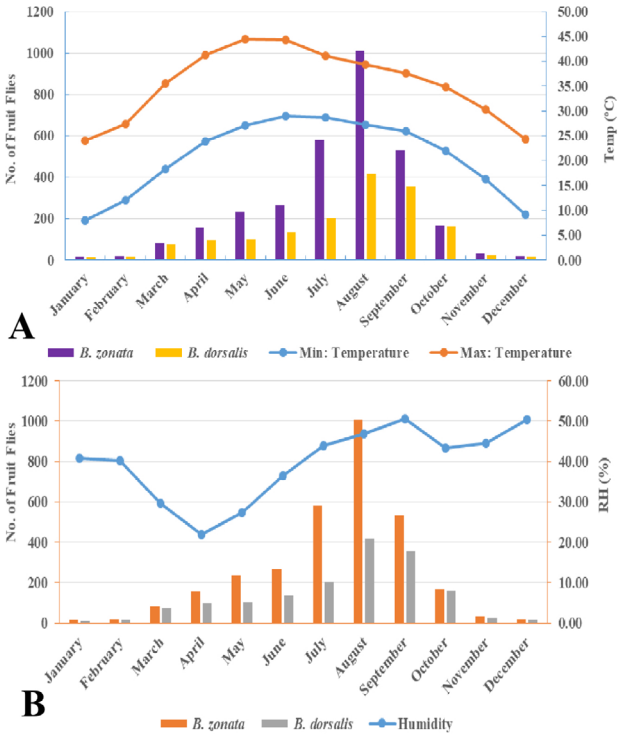

Fig. 2. Influence of temperature (°C) (**A**) and relative humidity (%) (**B**) on population fluctuation of *B. zonata* and *B. dorsalis* in guava orchard agro-ecosystem in district Larkana.

Conclusion

In present studies it was observed that population of *Bactrocera zonata* and *Bactrocera dorsalis* in different climatic zones of Sindh start increasing in the first week of March with highest peak in August. High temperature enhances the activity of *Bactrocera* species due to the accessibility to full-grown fruit.

Acknowledgments

The authors wish to thank all the staff of Fruit Flies Laboratories, NIA, Tando Jam who helped in sample collection and transportation during field visit.

Statement of conflict of interest

The authors have declared no conflict of interest.

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