

Research Article

Population Survey of Natural Enemies of *Bactrocera* Flies from Mango and Guava Septic Fruits of Sindh Region

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Abstract | *Bactrocera* flies are noxious pests of fruits mainly infecting guava and mango in Sindh. *Bactrocera zonata* and *Bactrocera dorsalis* are the deleterious pests of several plant species. *Trybliographa daci* (Weld.) and *Diachasmimorpha longicaudata* (Ashmead) are natural enemies of fruit flies widely used as bio-agents in biological control programs against *Bactrocera* species. In current investigations we inspected the infected guava and mango fruits from lower (Hyderabad) and upper (Larkana) Sindh regions for population surveillance of parasitoids during 2019. The results shown ($P < 0.05$) maximum number of *Trybliographa daci* were (55.60 ± 4.52 , 46.40 ± 5.47) obtained from guava infested fruits of both regions. Moreover, Maximum number of *Bactrocera zonata* were emerged from infected guava (381.00 ± 10.85 , 259.40 ± 16.95) collected from lower and upper regions of Sindh. The current studies recognised that larval cum pupal parasitoid *Trybliographa daci* could be effective in controlling population of *Bactrocera* spp. in orchard agro-ecosystem of Sindh region.

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Keywords | *Bactrocera* flies, Natural enemies, Infected fruits, Agro-ecosystem, Sindh region



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1. Introduction

Fruit flies of genus *Bactrocera* are unquestionably the most notorious pests of fruits and vegetables all over Asia and World. *Bactrocera* species are known as constant destructive pests of various fruit varieties (Wang, 1996). The peach fruit fly, *Bactrocera zonata* (Saunders) and oriental fruit fly, *Bactrocera dorsalis* (Hendel) are polyphagous pests and predominantly infesting peach, guava and mango (CABI/EPPO, 2001). Both *Bactrocera* species are major pests in India and Pakistan (Qureshi et al., 1996). According to

available literature *B. zonata* is more significant pest species in Pakistan compared to *B. dorsalis* (Siddiqui et al., 2003; Sarwar et al., 2014; Abro et al., 2020). Fruit flies inflict 210 million US dollars and an estimated 190 million Euro damages of fruits in a year (USDA, 2016). Pakistan exported mango to 52 countries and second country in exporting mangoes worldwide. The guava of Pakistan is also famous for their particular taste and aroma (SU Magazine, 2018). Bio-control technology is an eco-friendly pest control technique to manage insect pests by using natural enemies (Cancino et al., 2008). Several species of fruit fly

parasitoids such as egg parasitoids, larval/pre-pupal parasitoids, pupal parasitoids have been extensively used against fruit fly species as bio-agents (Segura *et al.*, 2006). *Diachasmimorpha longicaudata* (Ashmead) and *Trybliographa daci* (Weld.) along with other species of parasitoids of dipteran flies successively mass reared and released in Argentina for suppression of *Bactrocera* species in various orchards (Senasa-Procem, 2000). The rearing of these parasitoids on *Bactrocera* spp. had been effectively implemented for execution of area-wide management strategy to control *Bactrocera* flies in expansion of national fruit fly control programme (Guillen and Sanchez, 2007).

The mass rearing of fruit flies along with rearing of their parasitoids especially *Trybliographa daci* and *D. longicaudata* is an ongoing process at Fruit Flies and their parasitoids laboratories, Plant Protection Division, Nuclear Institute of Agriculture (NIA), Tando Jam, Sindh. Our main focus of this study was to evaluate the population of natural enemies parasitizing *Bactrocera* flies in Sindh region in order to check their prevalence and persistence along with sustenance in various orchard agro-ecosystems as bio-control components.

2. Materials and Methods

The infested fruits from guava and mango orchards of Lower (Hyderabad) and Upper (Larkana) regions of Sindh Province were collected for population status of *Bactrocera* flies parasitoids.

The infested guava and mango were collected during 2019 and brought to Fruit Flies and their parasitoid laboratory, under controlled conditions at 28 ± 2 °C and relative humidity 60 ± 2 %. NIA, Tando Jam.

The infested fruits were put on cleaned saw dust (pupation substrate) in plastic trays sheltered with fine wire mesh to avoid infestation of other organisms. The observations were made on number of adult fruit flies emerged from unparasitized pupae and number of larval cum pupal parasitoids emerged from parasitized larvae.

The emerged *Bactrocera* flies were transferred in steel framed cages (80 × 72 × 80 cm) and parasitoids were placed in separate cages (45 × 40 × 40 cm) provided with artificial diet.

2.1 Ingredients of artificial diets

Sugar: Casein Protein: Water at 1:2:4 ratio (For adult fruit flies)

Casein protein: Yeast extract: Sugar at 2:1:2 ratio. (For adult fruit flies)

Water soaked cotton in Petri dishes (For adult fruit flies)

Honey + Water soaked cotton in Petri dishes (For Parasitoids).

2.2 Statistical analysis

Statistix® Version 8.1, Analytical Software, Inc., and Tallahassee, FL, USA was used for statistical analyses. Two-ways ANOVA for different parameters were performed followed by Fisher's (LSD) Test to check the significance.

3. Results and Discussion

The surveillance results for prevalence and abundance of natural enemies of *Bactrocera* species has shown ($P < 0.05$) higher number of pre-pupal parasitoid *Trybliographa daci* ($55.60 \pm 4.52, 46.40 \pm 5.47$) were observed in infested guava collected from lower (Hyderabad) followed by upper (Larkana) regions of Sindh Province. Similarly, significantly ($P < 0.05$) maximum number of *B. zonata* ($381.00 \pm 10.85, 259.40 \pm 16.95$) were obtained from infested guava collection of (Hyderabad) followed by upper (Larkana) regions. Whereas, minimum number of ($30.80 \pm 3.38, 18.20 \pm 1.07$) *Diachasmimorpha longicaudata* were recorded from septic mangoes of both regions. Likewise, reduced number of ($198.80 \pm 8.10, 166.60 \pm 14.75$) *B. dorsalis* was also observed from infested mangoes collected during field visits from both regions Table 1.

Overall maximum infestation of *Bactrocera zonata* found in guava fruits of both regions. However, higher abundance of larval/pupal parasitoid *Trybliographa daci* were emerged from infested guava of upper and lower region of Sindh (Figure 1 and 2).

The fruit flies and their parasitoids emergence varied significantly from infested guava of Larkana and Hyderabad ($F = 105$; $DF = 3, 16, 19$; $P = 0.0000$), ($F = 571$; $DF = 3, 16, 19$; $P = 0.0000$) while from infested Mango of Larkana ($F = 102$; $DF = 3, 16, 19$; $P = 0.0000$) and Hyderabad ($F = 125$; $DF = 3, 16, 19$; $P = 0.0000$) slight variance were observed in emergence of insects according to statistical values given above.

Table 1: Number (Mean±SE) of *Bactrocera* species and their bio-control agents recorded from infected guava and mango fruits of lower and upper regions of Sindh.

Location and fruit		Fruit fly species		Parasitoid species	
		<i>B. zonata</i>	<i>B. dorsalis</i>	<i>T. daci</i>	<i>D. longicaudata</i>
Hyderabad	Guava	381.00±10.85 a	300.60±8.38 b	55.60±4.52 c	35.80±1.71 c
	Mango	291.60±20.56 a	198.80±8.10 b	43.00±2.81 c	30.80±3.38 c
Larkana	Guava	259.40±16.95 a	179.00±12.20 b	46.40±5.47 c	25.40±1.94 c
	Mango	230.00±14.14 a	166.60±14.75 b	31.40±1.78 c	18.20±1.07 c

Values with the same letters are not significantly different according to Fisher's Least Significant Difference (LSD) test at (P < 0.05).

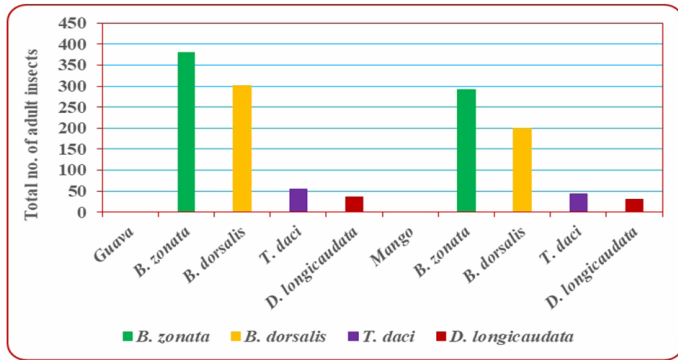


Figure 1: *Bactrocera* flies and their parasitoids obtained from infected guava and mango fruits of lower (Hyderabad) Sindh region.

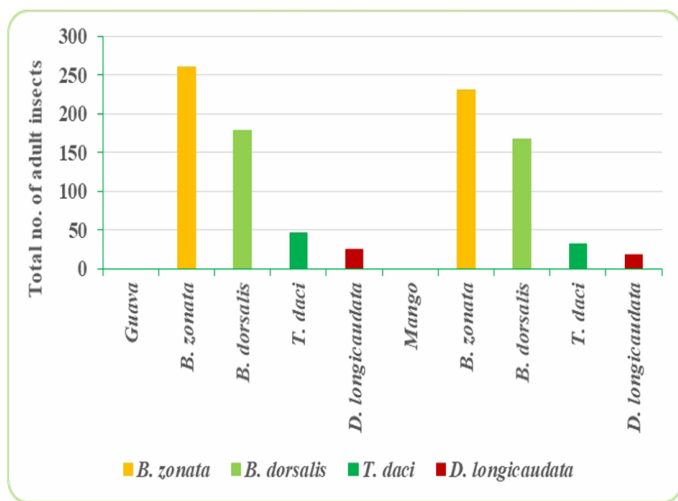


Figure 2: *Bactrocera* flies and their parasitoids obtained from infected guava and mango fruits of upper (Larkana) Sindh region.

Several surveys on population abundance of fruit flies have been done so far but no noticeable work on population monitoring of its parasitoids has been reported from Sindh. However, our results are in lined with that by (Abro *et al.*, 2019) who conducted surveillance studies for fruit flies parasitoids from said region. Yet other authors (Wong *et al.*, 1987, 1991) observed maximum parasitization of *Diachasmimorpha tryoni* along with maximum infestation of *B. dorsalis* and *C. capitata* from Kula

Maui area of Hawaii. Furthermore, (Sivinski *et al.*, 1996) suppressed *Anastrepha suspensa* population by augmentative releases of *Diachasmimorpha longicaudata* in contradiction we have found *T. daci* more effective in suppressing population of *Bactrocera* species. Our results are in agreement with those by (Vargas *et al.*, 2002) who conducted surveys on comparative demography of six parasitoids species. The maximum infestation of *B. zonata* were recorded in guava, likewise (Abro *et al.*, 2021) also investigated more population of *B. zonata* in guava orchards of Sindh.

We suggested the application of bio-control in orchards to eradicate fruit flies population. Similarly, it has been advocated Baeza *et al.* (2002) and Hendrichs *et al.* (2009) as the use of natural enemies for improving trade and safety. Still more investigations on survey of bio-control agents to assess their prevalence and perseverance in agro-ecological conditions of Sindh are the need of time for bio-control base IPM.

Conclusion and Recommendation

The pre-pupal parasitoid *Trybliographa daci* were discovered as dexterous bio-control agent in agro-ecological conditions of Sindh.

Guava were observed as most preferred host by *Bactrocera zonata* and *Bactrocera dorsalis* as compared to mango in Sindh region.

Surveillance studies for the assessment Fruit fly parasitoids from infested fruits should be extended to develop parasitoids culture in the laboratory for biological control in the sustainable pest management.

Novelty Statement

The purpose of this survey was to document availability of biological control agents from different climatic

conditions of Sindh. However, no prominent work on prevalence of *Diachasmimorpha longicaudata* and *Trybliographa daci* has been done or published so far from the region.

Author's Contribution

Zain-ul-Aabdin Abro: Performed the experiments, analyzed the data and wrote the article.

Naheed Baloch: Supervised the study.

Raza Muhammad Memon: Conceived the study.

Niaz Hussain Khuhro: Designed the experiment.

Waseem Akbar Qazi: Helped in data collection.

Conflict of interest

The authors have declared no conflict of interest.

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