



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2019; 7(1): 1451-1454

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Received: 07-11-2018

Accepted: 10-12-2018

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First record of peach fruit fly in Gilgit-Baltistan (GB), Pakistan

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Abstract

High quality and juicy contents make peach very popular fruit. However Peach fruit fly causes severe losses to peach quality and juicy contents. It is a serious pest of peach fruit in Pakistan. In the present survey, the peach fruit fly infestation was observed in Nomal Valley, Gilgit Baltistan (GB) region of Pakistan. Damages were determined through photographs and infestation (%) was calculated. Samplings were conducted in different sectors (Sigal, Majini, Jigot, Batot, Kamalabad, Ishphis, Momin Abad, Sadaruddinabad, Das and Khaltarot.) of Nomal Valley and consisted in fruit collection of Samplings were carried out in two sites and consisted in fruits collection on 10 randomly selected mature trees each sector of Nomal Valley (10 fruits/Tree). Healthy and damages fruits were separated and the percent infestation rate was calculated. The rate of damage fruits varied from 89% to 59%, being highest at Sigal and lowest at the Das sector. This study provides preliminary information which will be helpful to identify the peach fruit fly based on morphology and molecular methods and to set up sustainable management of this pest in GB.

Keywords: Gilgit-Baltistan (GB), peach, peach fruit fly, infestation

1. Introduction

Fruits are a rich source of nutrients, therefore, they can be used as a treatment for many diseases. They not only provide minerals vitamins and proteins but also protect against from cancer of the stomach, lungs, oral cavity, pharynx, endometrium and pancreas [1].

True fruit flies belong to *Diptera: Tephritidae* consists of four thousand and five hundred species. These fruit flies are considered as a serious pest of soft fruits. Out of these, about forty species belong to genus *Bactrocera* is considered a very serious pest.

These pests are attacking on fresh fruit and vegetables and caused significant damage. They lay eggs under the skin and damage fruits and vegetables. The eggs hatch into larvae and eat the flesh of fruits or vegetables. Infected fruits and vegetables start dying and become inedible or drop to ground prematurely, as a result, a significant loss in production occurs [2]. They also attack on many high commercial values cultivated fruits. It has been adapted to various climates and has spread throughout the world. Moreover, effects tropical and sub-tropical agriculture across the world and results in severe economic loss and posing an increased threat of establishment into new areas [3]. The phenology and population dynamics of these pests are extensively studied in tropics, however lesser attention has been given in temperate areas whereas least studies have been carried out within northern and cold areas of its current geographical distribution [4]. Studies in temperate areas showed that the main factor regulating the population in these areas are relatively low winter temperatures. In cooler temperate areas of Europe, the phenology and population dynamics of these pests are affected by low winter temperatures [4].

Pakistan is rich in agricultural resources and earned billion from major and minor crops including horticulture [5]. There are three species of fruit fly (Genus: *Bactrocera* (B)) commonly found in Pakistan are *B. dorsalis*, *B. zonatus* and *B. cucurbitae*. Among these species, the peach fruit fly *B. zonatus* is the most significant pest of fruit orchards in the world. Apple, Peach, guava, mango, citrus, apricot, fig and apple are infested by this pest. The pest is also very serious in vegetables such as tomato, pepper and eggplants [6]. The pest was initially recorded in 1916 in Bihar, India [7] and now distributed throughout most countries of South East Asia, including Pakistan, India, Nepal, Sri Lanka, etc [8].

About 24% losses due to *B. zonatus* was recorded in cucurbits of Pakistan. About 50 to 80% of infestation has been recorded in pear, peach, apricot, fig and other fruits.

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This species is becoming rapidly a very serious pest of citrus and other fruits and vegetables [9]. It has been recorded in almost all region of Pakistan from coastal to subcoastal regions of Baluchistan and Sindh to the Northern parts of Punjab and in the foothills of Islamabad and Peshawar valleys. Hence the peach fruit fly is dominant species containing higher populations as compared to other two species of genus *Bactrocera*. The cucurbit fruit fly *B. Cucurbitae* is found in a very small number and does not cause serious threats to fruits. *B. Dorsalis* caused infestation to various types of fruits especially Guava, Citrus, Mango, Papaya and Jaman [10]. Overall 30-100% yield loss occurred due to fruit fly depending on fruit species and season. These fruit flies can be controlled by management practices such as by growing fly resistant genotypes, augmentation of biological control and insecticides, by fruit begging filed sanitation and protein bait. Field sanitation method found to be the most effective method to control fruit fly. Growers need to remove all un-harvested fruits or vegetables from a field by completely burying them into the soil to break the

reproduction cycle and population increase [11]. As aforementioned this pest has been reported from all the provinces of Pakistan except Gilgit Baltistan (GB) region. Therefore this is the first record of the peach fruit fly in Gilgit Baltistan (GB) region of Pakistan. Moreover, we estimated the damage caused by this pest to peach fruits.

2. Materials and methods

2.1 Study Site

The study was carried out in the Gilgit Baltistan(GB) region at one site: Nomal Valley in June, 2016. Nomal valley is located at a distance of 25 km north of Gilgit city (35°55'15"N 74°18'30"E) in the Gilgit District with an altitude of 1,582 m. the valley is divided into *mohallahs* or sectors. Nomal valley is divided into ten sectors i.e. Sigal, Majini, Jigot, Batot, Kamalabad, Ishphis, Momin Abad, Sadaruddinabad, Das and Khaltarot. The climate is characterized by a dry climate. The site is dominated by fruits such as apple, pear, peach, grapes, almonds and apricots and vegetable such as potato, tomatoes, Cabbages and Cucumbers.

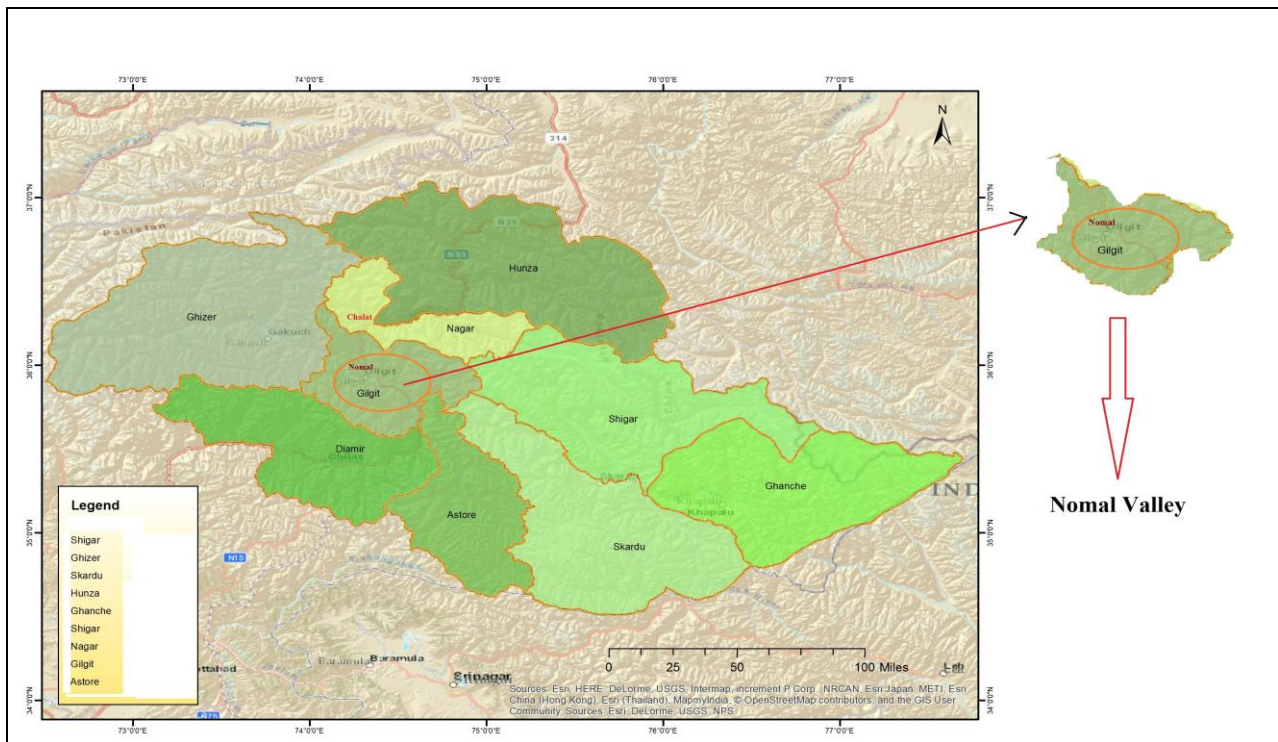


Fig 1: Major districts of Gilgit Baltistan; Red circle indicates the study area

2.2 Methodology

A collection of photographs were performed during the maturation period on 28 August 2018. About 5 peach trees were randomly observed from each sector of Nomal valley. Samples of ripe peach fruits were obtained by harvesting at least 10 fruits per mature peach tree. To estimate the damage imposed by peach fruit fly following formula was used.

$$\text{Infestation rate (Ir)} = \text{NIFS} / \text{TNFS} \times 100$$

NIFS = Number of infested fruit in the sample and TNFS = Total number of fruits in the sample.

2.3 Statistical Analysis

Statistical analysis was carried out using Statistic 8.1 software. The data were subjected to LSD and the figures were generated in Graph Pad Prism 6 software and in R 3.5.2 version. The significant threshold was kept at 5%.

3. Results and Discussion

3.1 Percent infestation

A significant difference was observed between the rates of damaged peach fruits at different sectors of Nomal valley (Fig. 2). Highest% infestation rate was observed in sector Sigal followed by Jigot and Khaltarot however no significant difference was noted between the rates of damaged fruits at these sectors. This high rate of infestation could be explained by the fact that these sectors are favourable for the development of the peach fruit flies. However low percent infestation was noted at Das and Ishphis where farmers normally spray pesticides to control fruit flies. The percent infestation of fruit fly was high in the Ishipis as compare to Kamalabad, though there was no significant difference in the percent infestation between these two sectors. These two sectors are situated along the river are relatively cool as compared to other sectors and always subjected to severe land

degradation due to flooding that could explain the relatively lower infestation rate of peach fruit flies [12]. This current survey described for the first time the presence of peach fruit fly on peaches of the study area. These pests have already been reported on other fruit trees and even peach fruits of other provinces of Pakistan. For instance infestation of guava orchard by *Dacus* spp. in Peshawar valley was reported by (Marwat, Hussain, and Khan [13]. These pest is causing severe economic losses to fruit trees of Pakistan [14]. Severe infestation of guava orchards was recorded in Rawalpindi, Pakistan by fruit fly [15]. In Sindh province, guava, banana, citrus, ber, chikoo and apple were severely infected by peach fruit fly [16]. Currently, the fruit fly has severely infested mango orchards of Faisalabad, Pakistan [17].

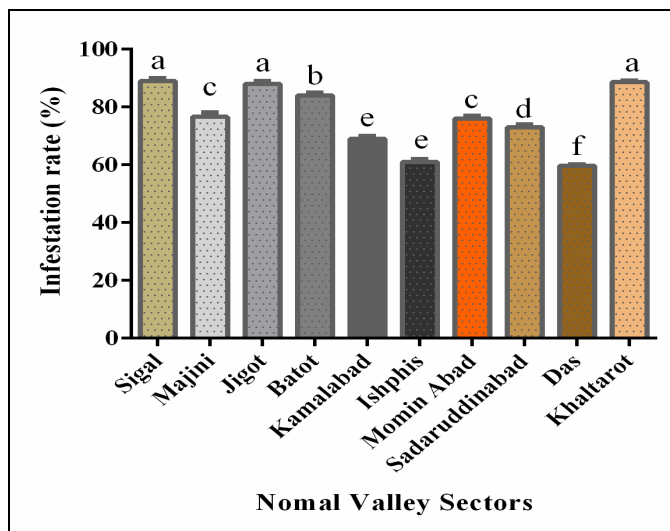


Fig 2: Estimation of the rate of damaged peach fruits by peach fruit fly at sectors of Nomal valley. Different letters over bars followed by the same letters are not significantly different at $p < 0.05$.

3.2 Dissection of peach fruits

Peach fruit flies were hovering over the peach fruit as shown in Fig. 3. Peach fruits were dissected to confirm the presence of the larvae in the pulp of the peach fruit. The larvae and damage peach fruit can be seen in Fig. 4 and Fig. 5. The damage caused by pest results in brownish stains, rots and discolourations. The quality was reduced and most of the infested peach fruits were found to be shrivelled. Furthermore, the maximum peach fruit fly infestation was

observed during the month of August as shown in Fig. 6. However in the month of July and June the percent infestation was very low. More peach fruit flies in the month of August, might be due to the peak fruiting period of peach fruits of this area [20]. The damage on peach fruits was similar to the damage of peach fruits as previously mentioned by [19-22].



Fig 3: The peach fruit fly on peach fruits in Nomal Valley

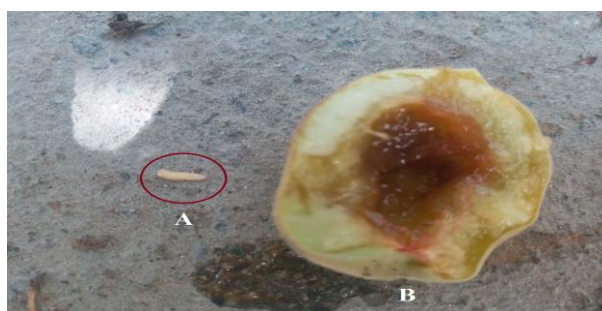


Fig 4: A. Larva of the Peach fruit fly. Head is to the right. B.



Fig 5: Larva inside the damage peach fruits

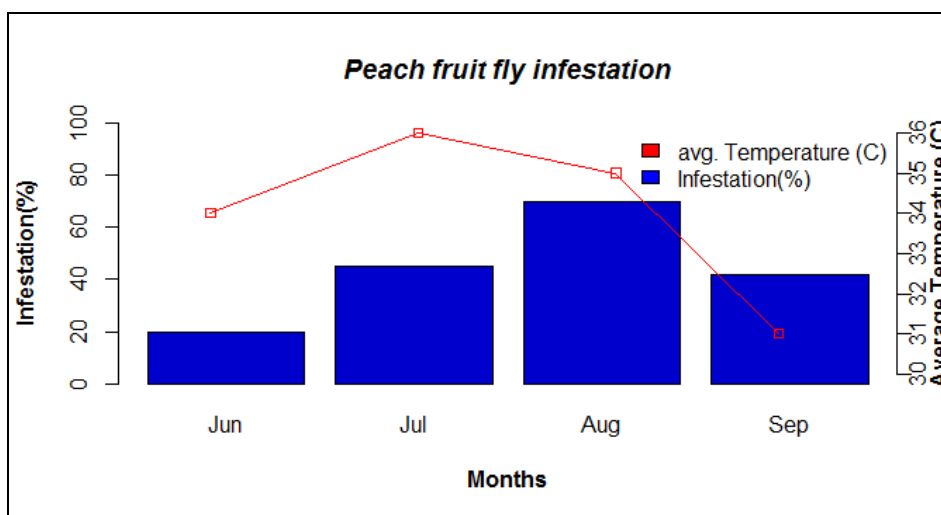


Fig 6: Percent infestation of peach fruit fly in relation to temperature ($^{\circ}\text{C}$)

4. Conclusion

This current survey reported for the first time the presence of peach fruit fly on peach trees in Gilgit-Baltistan Pakistan. Considerable damage on peach trees of this region has been noted. If this species gets established it could become a serious pest to fruit trees of the region.

Therefore further investigation is needed to know about the morphology and genomics of this pest. Moreover, biological agents and environmentally safe chemicals in combination with good sanitation can effectively reduce the infestation of peach fruit fly in Gilgit-Baltistan Pakistan.

5. Conflict of interest

The present research was conducted by the authors during summer vacations in August 2018. This survey was not supported by any kind of grants from any institute. No institute or other researcher was involved in this study. The authors confirm that this article content has no conflicts of interest.

6. Acknowledgements

The authors are grateful to the local farmers who gave permission to visit peach orchards. Babar Hussain (BH) wrote the manuscript and recorded the data. Aqleem Abbas (AA) analyzed the data and prepared figures using R package and Graph pad prism. We thanked Mr Almgeer Hussain Geoscience expert from Nomal Valley for creating Fig. 1. GIS expert from Nomal Valley, GB Pakistan.

7. Supplementary materials

During our research, we have uploaded a video about peach fruit fly, which can be viewed at this link. <https://www.youtube.com/watch?v=kxL-0sBBmHs&t=52s>

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