

# Fruit Fly Surveillance in Nepal

D. R. Sharma<sup>1</sup>, D. Adhikari<sup>2, \*</sup>, D. B. Tiwari<sup>3</sup>

<sup>1</sup>National Plant Protection Organization, Hariharbhawan, Lalitpur, Nepal

<sup>2</sup>District Agriculture Development Office, Sindhuli, Nepal

<sup>3</sup>Plant Protection Directorate, Hariharbhawan, Lalitpur, Nepal

## Abstract

Fruit flies are among the major pests of most of the horticultural crops (fruits and vegetables). In Nepal, study and research activities were conducted to assess population density, yield loss and management measures to prevent yield loss by fruit fly. Farmers are practicing use of pheromone traps, application of chemical measures and field sanitation as management options. In Nepal, GoN / NPPO and its offices provide the services regarding surveillance, monitoring and management of fruit fly. In context of Nepal-China agreement to export Citrus fruit from Nepal in 2012, for the quarantine fruit fly species in two districts namely; Sindhuli and Syangja, activities of survey is ongoing. *Bactrocera cucurbitae*, *B. dorsalis*, *B. zonata*, *B. tau* and *B. scutellaris* were observed by the preliminary surveillance of fruit flies in Sindhuli, Nepal.

## Keywords

*Bactrocera Spp*, Citrus Fruits, Methyl Eugenol, Quarantine Species, Surveillance

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## 1. Introduction

Fruit flies are one of the world's most destructive horticultural pests and poses risks to most commercial fruit and vegetable crops. Worldwide there are 4,000 species of fruit flies in the family Tephritidae of which around 350 species are of economic importance (Asian Fruit Fly IPM Project, 2011). Tephritid fruit flies cause direct damage to fruits and vegetables which can lead to up to 90-100% yield loss, depending on fruit fly population, locality, variety and season. In addition to the direct losses, fruit fly infestation can also result in serious losses in trade value and export opportunity, due to strict quarantine regulations imposed by most importing countries (Plant Health Australia, 2011). It is therefore important to have knowhow and be able to distinguish several species of fruit flies for proper management and quarantine regulation.

Nepal has vivid geo-climatic conditions and several fruits and vegetables are growing here. Among the different pest

problems of these horticultural crops fruit fly is an important insect pest in Nepal (Adhikari, 2013). Farmers are practicing the use of pheromone traps, application of chemical measures and field sanitation of attacked fruits, as management options (Jaisawal *et al.*, 1997). In Nepal, Ministry of Agriculture Development / National Plant Protection Organization and its offices in regional, district and service centre level, provides the services for the surveillance, monitoring and management of insect pests (Adhikari, 2013). This article highlights the pest surveillance activities regarding the fruit fly in Nepal.

## 2. The Fruit Flies

The family Tephritidae is one of the largest families of insect order Diptera (Drew, 1989), comprising of predominantly medium sized, picture-winged and highly ornamented flies commonly known as "fruit flies". A number of species from this family infest a wide variety of fruits, vegetables, flower heads, seeds, leaves and other plant parts (Prabhakar *et al.*, 2012). They are found in nearly all habitats with suitable

Corresponding author

E-mail address: [debharti@yahoo.com](mailto:debharti@yahoo.com) (D. Adhikari)

plant host. Their distribution is cosmopolitan covering tropical, subtropical and temperate regions (Agarwal and Sueyoshi, 2005). The quarantine fruit fly species to export citrus fruit to China are listed in the table 1. The taxonomic position according to CABI (2007) is:

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Diptera

Family: Tephritidae

Subfamily: Dacinae

Tribe: Dacini

Genus: *Bactrocera*

**Table 1.** The quarantine fruit fly species to export citrus fruit to China.

S N	Scientific Name	Common Name
1	<i>Bactrocera correcta</i> (Bezzi)	Guava fruit fly
2	<i>B. cucurbitae</i> (Coquillett)	Melon fly
3	<i>B. dorsalis</i> (Hendel)	Oriental fruit fly
4	<i>B. tsuneonis</i> (Miyake)	Japanese orange fly
5	<i>B.zonata</i> (Saunders)	Peach fruit fly

### 3. Materials and Methodology

To prepare this article, a review of literature related to fruit flies was done, and the Entomology Laboratory of Fruit Development Directorate, Kirtipur and Entomology Division, NARC, Khumaltar were also visited. The preliminary surveillance data of fruit flies surveillance in selected 64 ha. Sweet orange orchards of Sindhuli on May to December, 2014 were also presented.

## 4. Result and Discussion

### 4.1. Fruit Fly in Nepal

In Nepal, Fruit flies are among the major pests of cucurbitaceous vegetables and citrus fruits. Several study and research activities were conducted to prevent yield loss. A study was conducted to estimate the population density and to identify species of fruit flies in Kathmandu and Kavre during 1994 to 1996. Six different species of fruit flies

namely *Bactrocera cucurbitae*, *B.dorsalis*, *B.zonata*, *B.tau*, *B.scutellaris* and *B.yashimotoi* were reported by the study (Shrestha, 2006).

Shrestha (2006) mentioned the highest population of *Bactrocera dorsalis* and *B. yoshimotoi* was found during August and *B. cucurbitae*, *B. tau*, *B. scutellaris* during November. Whereas, that of *B. zonata* was found during June. The species and its population were found affected by temperature and density of vegetation in the locality. GC in 2001 mentioned 42-68% fruit attack by this insect in bittergourd. Shapkota et al. (2009) studied the farmers' practice of fruit fly management which were: indigenous (70%), chemical (32%), mechanical (80%) and combination of two or more methods (68%).

During the working period of Japanese expert (1990-1995), 6 reference fruit fly species were collected and stored at the Entomology laboratory of Fruit Development Directorate, Kirtipur (Fig. 1). Accordingly, there are 9 fruit flies species of Nepal reported by Entomology Division of NARC, Khumaltar, Nepal (Table 2).



**Fig. 1.** Fruit flies species of Nepal stored at the Entomology laboratory of FDD, Kirtipur.

**Table 2.** Fruit flies species of Nepal reported by Entomology Division of NARC, Khumaltar.

Fruit flies species					
1	<i>Bactrocera caudatus</i> (Fabricius, 1805)	4	<i>B. diversus</i> (Coquillett, 1904)	7	<i>B. scutellaris</i> (Bezzi, 1913)
2	<i>B. correctus</i> (Bezzi, 1913)	5	<i>B. dorsalis</i> (Hendel)	8	<i>B. tau</i> (Walker)
3	<i>B. cucurbitae</i> (Coquillett, 1899)	6	<i>B. minax</i> (Enderlein)	9	<i>B. zonatus</i> (Saunders, 1841)

The fruit fly trap (pheromone trap) was found very useful in terms of minimizing damage caused by fruit fly and farmers also liked this technology very much (Jaisawal *et al.*, 1997). In Nepal, The pest management programme of fruit fly included the farmer's awareness; male mass capture by using pheromones (cue lure for *B. cucurbitae* and methyl eugenol for *B. dorsalis*) and field sanitation have received tremendous interest and support of the farmers and should be continued.

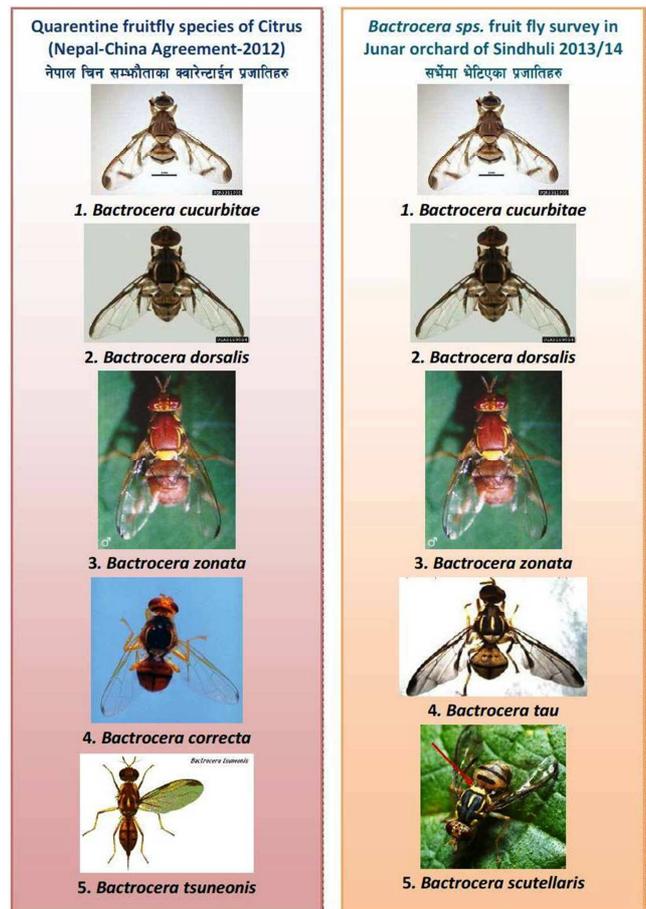
#### 4.2. Citrus Fruit Fly Surveillance Activities in Nepal

Citrus fruit flies are the most serious insect pest of sweet orange and hill lemon in the eastern hills of Nepal. Chinese citrus fly (*B. minax*) is very serious insect causing up to 97 % loss by the end of harvesting season. It has been recognized as a serious pest of commercial sweet orange, especially in eastern regions of Nepal and is considered one of the major limiters of production. Despite several years of effort to control fruit flies through male mass capture using methyl eugenol and affected fruits sanitation practices, fruit losses of sweet orange did not decrease at the farm of NCRP Dhankuta and farmer's fields of eastern region of Nepal. In last five years even mandarin fruits are being damaged (about 15%) by the fruit flies (NCRP, 2012). A study in National Citrus Research Program (NCRP), Paripatle Dhankuta in 2006 confirmed that Chinese citrus fly (*B. minax*) is the species affecting the citrus fruits of NCRP, Dhankuta and vicinity areas but not the oriental fruit fly. An extensive survey of the fruit flies infesting citrus orchards were undertaken especially in five districts i.e. Dhankuta, Tehrathum, Gorkha, Lamjung and Syangja and studied its biology to identify the species. The adult fruit flies emerged from the samples taken from Tehrathum were identified to be *B. minax* but no adults emerged from the samples taken from Gorkha, Lamjung and Syanja (NCRP, 2011). These results confirm previous studies that referred *B. minax* as the problematic fruit fly species in eastern part of Nepal. Thus, there is strong need to develop an appropriate method of monitoring and management.

Mid hill district of Nepal is renowned for citrus fruits and has potential to produce quality and more fruit not only for national market but also for export. Moreover, Nepalese government and Chinese government had signed in the agreement to export Citrus fruit (Mandarin from Syangja and Sweet orange from Sindhuli) from Nepal in 2012. For the exportable citrus fruits farmers should produce quality fruits and there should not be presence of quarantine pests in fruit

to export and citrus orchard too. Citrus orchard should make pest free and for that National Plant Protection Organization (NPPO) had conducted general survey surveillance of fruit fly regularly.

To know the species of fruit fly and other diseases and pest in citrus orchard general pest status survey were conducted in Sindhuli and Syangja districts during 2012-13. Surveys involved experts from different sectors such as Plant Protection Directorate, Regional Plant Protection Laboratory, Entomology and Plant Pathology Division of NARC, National Citrus Development Program, National Plant Quarantine Program, Regional Agriculture Directorate, District Agriculture Development Office (Adhikari, 2013). Report on Pest Status Survey in 2013 mentioned two species of fruit fly: *B. cucurbitae* and *B. dorsalis*.



**Fig. 2.** *Bactrocera* species of quarantine concern and trapped in Sweet orange orchard in Sindhuli, Nepal.

Recently, NPPO had endorsed the protocol for the surveillance of fruit fly in two districts namely Sindhuli and

Syanja, ongoing. Fruit fly traps according to the protocol has been fixed with pheromone lures for monitoring of fruit fly species, their identification and preparation of database.

The surveillance of fruit flies in selected Sweet orange orchard of Sindhuli Nepal during May to Dec., 2014 revealed that the trapped species of *Bactrocera* were *B. cucurbitae*, *B. dorsalis*, *B. zonata*, *B. tau* and *B. scutellaris*. Among them only the first three species were quarantine concern to export Nepalese Citrus to China (Fig. 2).

In Sweet orange orchard of Sindhuli pheromone traps (Cue lure and Methyl eugenol) were fixed one set in one hectare. There were all together 64 sets of traps in selected orchards. Fruit flies trapped in Cue lure and Methyl eugenol in Sweet orange orchard of Sindhuli on May- Dec., 2014 is shown in Fig 3. Accordingly, specieswise data of trapped fruit flies in traps of Cue lure and Methyl eugenol is presented in Fig. 4. The higher number of fruit flies were trapped in Methyl eugenol and highest number of fruit flies trapped during July-August. The highest number of fruit fly species trapped during 15 days interval from 25th May to 9th Dec., 2014 in 64 traps of cue lure in selected Sweet orange orchard was *Bactrocera dorsalis* followed by *B. tau*, *B. cucurbitae*, *B.*

*scutellaris* and *B. zonata* respectively. Similarly, *Bactrocera dorsalis* followed by *B. zonata*, *B. tau*, *B. scutellaris* and *B. cucurbitae* were trapped in Pheromone trap of Methyl eugenol (Fig 4).

### 5. Conclusions

Fruit fly is one the production problem of horticultural crops both vegetable and fruits. This review paper on fruit fly survey in Nepal indicated that fruit fly is a problem causing considerable loss in productivity of citrus fruits and cucurbit vegetables. Fruit fly management tactics includes the use of pheromone trap, application of chemical pesticides and sanitation. Some activities were accomplished to monitor and manage fruit fly in Nepal. Recently, the surveillance activities were concentrated on quarantine fruit fly species to export Nepalese citrus to China. *Bactrocera cucurbitae*, *B. dorsalis*, *B. zonata*, *B. tau* and *B. scutellaris* were found by the preliminary surveillance of fruit fly in selected Sweet orange orchard of Sindhuli, Nepal. Nepal has not so strong capacity to diagnose fruit fly species. Thus, it is necessary to maintain a national surveillance system.

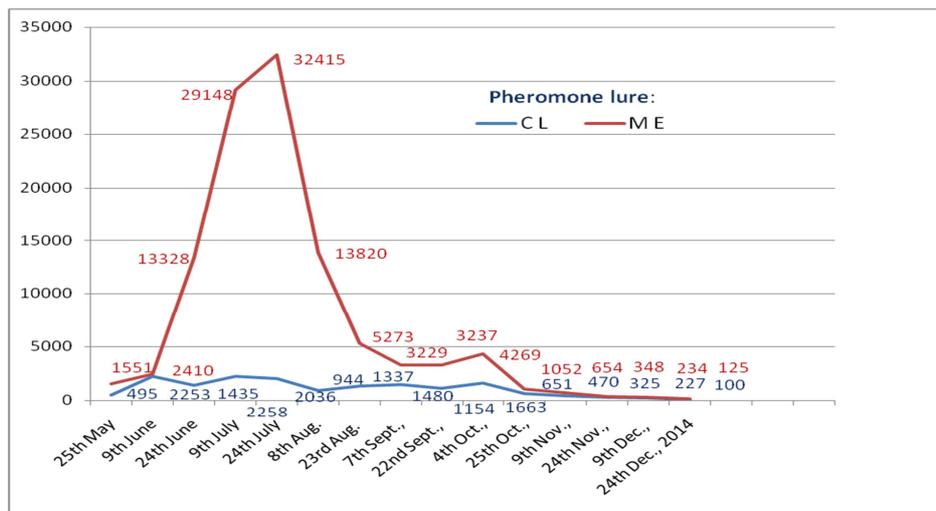


Fig. 3. Fruit flies trapped in Cue lure and Methyl eugenol in Sweet orange orchard of Sindhuli.

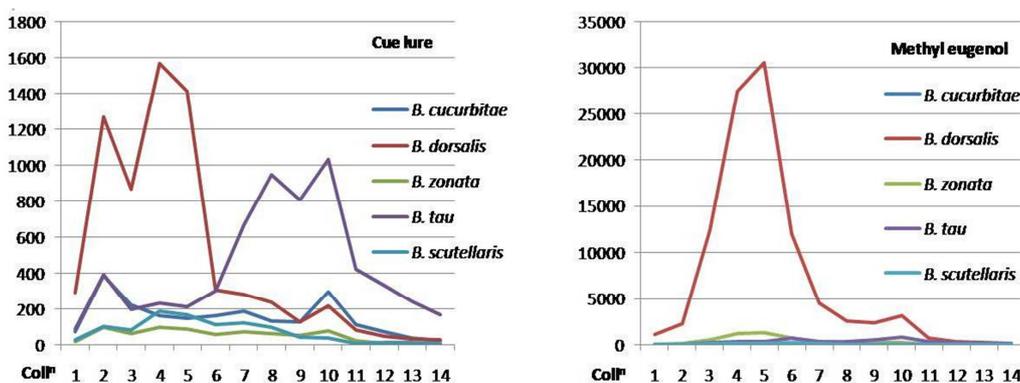


Fig. 4. Fruit flies species trapped in Cue lure and Methyl eugenol in Sweet orange orchard of Sindhuli.

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