

Research Article

FARMER'S PERCEPTION OF FRUIT FLY *Bactrocera* spp. IN MANDARIN ORANGE AND THEIR MANAGEMENT IN SANKHUWASABHA DISTRICT OF NEPAL

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ABSTRACT

The study was conducted from October to December, 2020 to evaluate farmers' understanding of loss incurred by *Bactrocera* spp. on mandarin orange and practices adopted by farmers for their management. Eighty households of mandarin orange growers and 15 agro-vets were purposively selected and information was collected using a semi structured questionnaire. The findings indicated severe infestation of fruit fly in mandarin with 53% of the farmers having low (>15%), 36% having medium (15-30%) and 11% having high (>30%) level of fruit damage in their orchards. The survey identified several management practices like collection and destruction of fallen fruits, pruning, use of traps and chemical pesticides in controlling fruit fly. About two-third (61.25%) of the respondents used chemicals and 15% of the farmers collected and destroyed affected fallen fruits. Some farmers also practiced pruning in the study area for the control of fruitfly. The use of traps was a rarity and its use was limited to only 10% of the total respondents. Since farmers were not much aware of the impact, life cycle and different species of fruit fly, lacked adequate training, support, and supervision, effective management of fruit fly was not possible and resulted in a much greater damage in mandarin fruit.

Keywords: *Fruit fly, fruit damage, mandarin, management*

INTRODUCTION

Citrus, a genus of several economic horticultural crops are commercially cultivated in 60 districts in Nepal (Acharya, 2016). Mandarin orange (Suntala), Sweet orange (Junar), Lime (Kagati), and Hill lemon (Nibuwa) are some of the major citrus fruits grown in Nepal. Among these, mandarin orange is one of the widely cultivated fruits in the mid-hills (1000 - 1500 masl) (Gurung, 1989). The total area covered by mandarin is 27,951 ha with the production of 1,77,381 mt and productivity of 10.30 mt/ha (MoALD, 2019). Citrus particularly has been identified as one of the most important high-value crops that can help

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in livelihood improvement and quality of mid-hill people (NPC, 1995) and since mandarin is cultivated mainly in the mid hills of Nepal from east to west, it plays a significant role in the uplift of economic status of farmers with small landholding. In Nepal, there is a dominance of commercial cultivation of local varieties and these local varieties differ in fruit size, morphology, quality and productivity but the time of fruit ripening remains the same between October to December. Although the productivity of local varieties is less than the improved varieties, the quality and taste preference has limited the cultivation of improved varieties (Acharya *et al.*, 2019).

Citrus is susceptible to several insect pests and pathogens that are continuously emerging which severely affects production. The smooth growth and production of citrus depends on the effectiveness of long-term pathogen and pest management strategies (Tennant *et al.*, 2009). Fruit fly is one of the most destructive horticultural pests that deplete quantity and quality of fruits and vegetable crops and is one of the most serious threat to citrus in Nepal. In Nepal, about 17 species of fruit fly have been recorded namely, *B. dorsalis*, *B. zonata*, *B. correcta*, *B. cucurbitae*, *B. tau*, *B. scutellaris*, *B. diversus*, *B. caudatus*, *B. minax*, *B. yashimoto*, *Dacus longicornis*, *B. nigrofemoralis*, *B. latifrons*, *B. aritfacts*, *B. tuberculate*, *Dacus ciliates* and *B. minax*. (Adhikari *et al.*, 2020) Fruit flies belong to the family Tephritidae of order Diptera. They are one of the major agricultural pests in South East Asia (Waterhouse, 1993). These pests are medium-sized, pictured winged, and highly ornamented. They are found nearly in all habitats with suitable host plants. Their distribution is cosmopolitan covering tropical, subtropical, and temperate regions (Agarwal and Sueyoshi, 2005). *Bactrocera minax* is a major pest of sweet orange and hill lemon in the eastern hill of Nepal (Adhikari and Joshi, 2018). The pest entered Nepalese citrus orchards from China through Bhutan and western hilly parts of India (Joshi and Manandhar, 2001). It is different from other species of *Bactrocera* because of its oligophagous and univoltine nature, while other species are polyphagous and multivoltine (ShengHai *et al.*, 2008). It is larger in body size: larvae and adult measure as long as 16 mm and 24 mm in size. *B. minax* is also cold tolerant with larvae able to survive freezing temperatures a day (Xia *et al.*, 2018). This study was carried out to outline information on areas covered under mandarin production, types of variety and seeds used, problems regarding production (market, input supply, technical support), most severe insect pests and diseases, damage caused by the fruit fly, people's knowledge on fruit fly and prevailing management practices to control fruit fly in Sankhuwasabha. The study mainly focused on pest management approaches used by farmers to combat infestation of mandarin orange fruit fly (*Bactrocera* spp.) in Khadbari, Sankhuwasabha.

MATERIAL AND METHODS

This survey was conducted in two wards of Khandbari Municipality; 4 and 5 and Ward 6 of Madi Municipality of Sankhuwasabha district based on area coverage, production, and access to road facility. A purposive sampling technique was used to select 80 respondents

and 15 agro-veterinary shops. Information was collected using a semi structured questionnaire regarding the socioeconomic status, demographic and topographical settings of the site. An agro-vet survey was done to collect information on the availability of traps and lures for fruitflies. Face-to-face interview was done to fill questionnaires from selected farmers. Secondary data was collected from various sources like statistical data from journals, Agriculture Knowledge Center (AKC), magazines, PMAMP reports, administrative ward office, MoALD, and Central Bureau of Statistics (MOALD, 2019). The collected information and data were presented using charts and diagrams and other tools. Farmer's perception towards the insect and disease problem was presented in five-point scaling technique of Likert scale comprising most severe, severe, moderate, mild and most mild. The scale values of 1, 0.8, 0.6, 0.4 and 0.2 were used for most severe, severe, moderate, mild and most mild problems, respectively. It was computed using the following formula:

Mathematically,

$$I_{imp} = \frac{\sum (S_i \times F_i)}{N}$$

Where I_{imp} = Index of importance
 S_i = scale value
 N = Total number of respondents
 F_i = frequency of respondents.

RESULTS AND DISCUSSION

Problems faced by farmers

The major problem faced by mandarin growers were found to be insects and diseases. Other problems included the market, efficient technical support, and input supply. Majority of the respondents reported fruit fly as the most problematic insect followed by stink bug, leaf miner, aphids and scale insect. Similar to this, fruit flies are one of the most important pests of fruits and vegetables in the world (Dejen and Hassen, 2018).

Table 1. Insect problem of mandarin producers in the study area

Insects	Scale value					Weightage	Index	Rank
	1	0.8	0.6	0.4	0.2			
Fruit fly	58	22	0	0	0	75.6	0.94	1
Leaf miner	3	10	48	19	0	47.4	0.59	3
Scale insect	0	0	6	17	57	21.8	0.27	5
Aphids	2	0	11	44	23	30.8	0.385	4
Stink bug	17	48	15	0	0	64.4	0.805	2

Source: Field survey 2021

The majority of the respondents in the survey site reported powdery mildew as the first problematic disease affecting mandarin followed by footrot, sooty mold, felt disease and greening (Table 2).

Table 2. Disease problem of mandarin producers in the study area

Disease	Scale value					Weightage	Index	Rank
	1	0.8	0.6	0.4	0.2			
Powdery mildew	38	26	12	4	0	67.6	0.845	1
Sooty mold	15	20	22	23	0	53.4	0.6675	3
Greening	0	0	0	8	72	17.6	0.22	5
Foot rot	17	22	30	11	0	57	0.7125	2
Felt disease	10	12	16	34	8	44.4	0.555	4

Farmers knowledge on the life cycle of fruit fly

Among the 80 respondents in the survey, only 18 respondents were aware of the life cycle of fruit fly. Those respondents who were aware of the life cycle of fruit flies were able to identify different stages of the insect.

Farmer's knowledge on damaging stages of fruit fly in mandarin

About 52 of the respondents mentioned that the fruit fly damage started in the fruiting stage whereas 28 of the respondents mentioned that most of the damage of the fruit fly occurs in the ripening stage.

Yield loss caused by fruit fly

About 53% of the respondents felt that the damage level of fruit fly in mandarin was low (>15%). Similarly, 36% of farmers reported a medium (15-30%) level of damage while 11% of farmers reported a high above 30% level of damage. Farmers experienced the change in color of fruits (like ripening) from September-October in advance of ripening season and the infected fruits started to drop from the plants. Those infected fruits were sour in taste and at an advanced stage fruits lacked juice content and became lighter in weight. Similar symptoms were also observed in other citrus fruits reported by the farmers.

Management practices adopted for fruit fly by the farmers

Among different practices of management of fruit fly, 68.75% of the farmers practiced pruning while 61.25% of farmers used chemical pesticides. Likewise, 56.25% of farmers collected and destroyed the fallen fruits while 10% used traps as a management technique for the fruit fly in mandarin (Table 3). Pruning was carried out either soon after the harvesting of the fruits or in the month of March and April with the help of Secateur, Khukuri, etc. and when flies started to appear in the orchard from the month of April people sprayed chemical pesticides with the help of sprayer. People were not satisfied with

chemical spray as it did not kill the pest effectively but managed to keep the pest away from the orchard for a short period and needed a frequent application which is hazardous, costly and time-consuming. But respondents mentioned that spraying of chemical pesticides helped in getting rid of other pests present in the field. The use of traps was not common since most of the people were unaware of the traps. The traps like methyl eugenol and cue lure were found in the application of 10% of the population but they were unaware of the protein bait spray for controlling the citrus Chinese fruit fly species effectively.

Table 3. Practices of fruit fly management in mandarin

Responses	Chemical pesticide (%)	Fallen fruits destroy (%)	Use of traps (%)	Pruning (%)
Yes	61.25	56.25	10	68.75
No	38.75	43.75	90	31.25

Source: Field survey (2021)

Management of fallen fruits

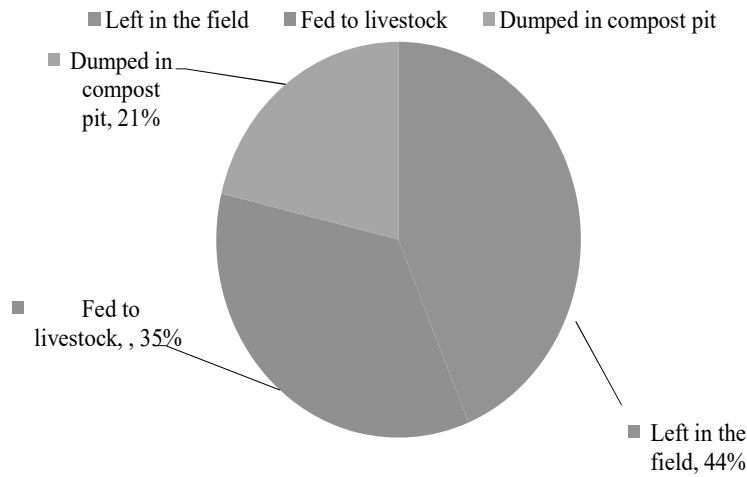


Fig. 1. Management of fallen fruits

About 44% of the growers did not manage fallen fruits i.e. they left fruits unattended in the field. Those farmers rearing livestock collected the fruits and fed it to their animals which accounted up to 35% and remaining 21% of the farmers dumped fallen fruits in a compost pit (Fig.1).

Farmers perception on effectiveness of different management methods

Nearly half of the respondents (46%) mentioned the use of chemicals as the most effective measure for the management of fruit fly while 29% mentioned a combination of different methods as the most effective for fruit fly. Likewise, 15% mentioned the collection and destruction of fallen fruits (orchard sanitation). Only 10% mentioned the use of traps as an effective management practice for fruit flies (Fig. 2). The use of methyl eugenol and cue-lure trap was found and chemicals used in farmer’s practice were dichlorvos, cypermethrin, chlorpyrifos, dimethoate and malathion. Some of the farmers suggested that the combination of different methods was effective.

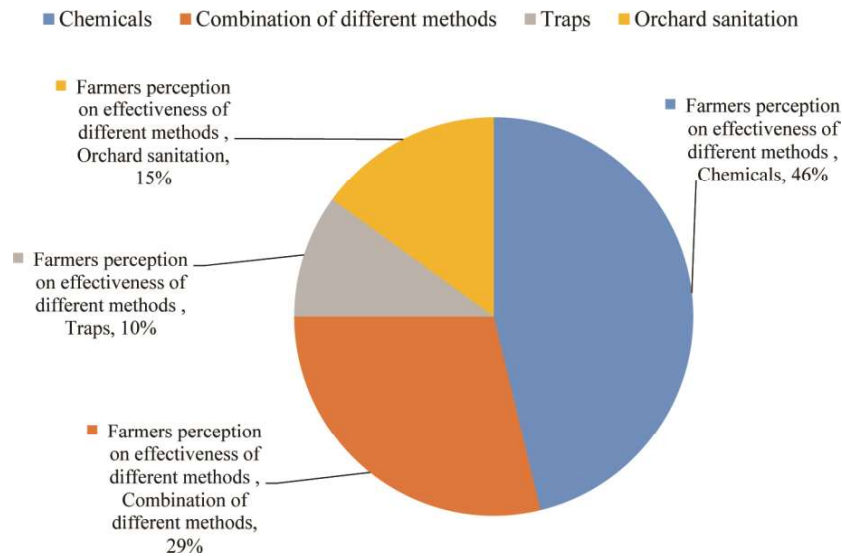


Fig. 2. Farmer's perception on the effectiveness of different methods

Source of knowledge about control measures of fruit fly

The main source of knowledge for the growers/farmers about control measures of fruit fly was from government agencies, own knowledge, agro-vet, and other means (e.g. training, family and friends) as shown in Table 4.

Table 4. Source of knowledge about control measures of fruit fly

Source of knowledge	Frequency	Percentage
Own knowledge	28	35
Government agencies	42	52.5
Agro-vet	26	32.5
Others	38	47.5

Source: Field survey (2021)

Availability of traps in the agro-vet of study sites

The use of methyl eugenol and cue-lure traps was found in the study area. But there was no availability of these traps in majority of the agro-vets. There were a total of 15 agro-vets in the surveyed area of which only three of the agro-vets had the traps and lures since the use of traps was less common in the study area. The concerned farmers imported traps from other districts or local agro-vets helped them in importing traps based on the customer's demand.

CONCLUSION

Farmer surveys indicated that fruit fly was the major insect and powdery mildew was the major disease affecting mandarin in the Sankhuwasabha district. Different management practices were deployed like collection and destruction of fallen fruits, use of chemical pesticides, pruning, and use of traps. More commonly farmers opted for practices like pruning, use of chemical pesticides, and orchard sanitation as compared to traps due to the lack of technical information, awareness, and unavailability of it. Few people were found using traps in the field. Most of the farmers didn't have proper knowledge about the life cycle of the fruit fly and their species. Although a comprehensive and effective approach was not followed to manage fruit fly in the study site, combination of different preventative measures namely orchard sanitation, use of traps and baits, and rational use of pesticide was identified as the ultimate solution in fruit fly management.

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