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Jayant Yadav

Ph.D. Student, Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Ram Karan Gaur

Assistant Scientist, Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Meenakshi Devi

Ph.D. Student, Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Varietal/germplasm screening of Ber, *Ziziphus mauritiana* (Lamk) against Ber fruit fly, *Carpomyia vesuviana* (Costa) under semi-arid conditions of Haryana

Jayant Yadav, Ram Karan Gaur and Meenakshi Devi

Abstract

The present study was carried out to screen various varieties/germplasms of ber, *Ziziphus mauritiana* (Lamk) against ber fruit fly, *Carpomyia vesuviana* (Costa) during 2016-17 at ber orchard of Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Bawal. The study on varietal/germplasm screening revealed that there were marked differences in per cent fruit fly infestation on different varieties/germplasms. Kaithali exhibited maximum fruit fly infestation (51.06%) and BS-1 showed minimum fruit fly infestation (1.51%). Out of total 39 varieties/germplasms, maximum no. of varieties/germplasms *i.e.* 14 fell in the category of susceptible (31.00 - 40.99% infestation). Two varieties BS-1 and Illaichi fell in the category of resistant (1.00-10.99% infestation). The data on fruit fly infestation showed that there is huge scope of utilizing host plant resistance as a pest management strategy and thus the ill effects of pesticides can be minimized.

Keywords: Ber, *Ziziphus mauritiana* (Lamk), fruit fly, *Carpomyia vesuviana* (Costa), screening, resistant

1. Introduction

Ber (*Ziziphus mauritiana* Lamk) is an ancient fruit of India and many Asian countries. It has been grown for hundreds of years all over the country. Among the fruit crops, ber cultivation requires the least in puts and care. It is a major fruit crop extensively grown in the arid and semi-arid regions of Rajasthan, Haryana, Punjab, Gujarat and other parts of the country. According to National Horticulture Board, total area under ber crop was 42,120 hectares in India and in Haryana it was 4,190 hectares whereas total production on country level was 4,10,000 MT and was 39,090 MT in Haryana during 2015-16. It is an old and well established fruit of Haryana state.

Ber trees have been reported to be attacked by about 80 species of insect pests (Butani, 1979) [2]. Due to climate change new insect species appears and causes huge loss to the crop. In a particular insect species, the peak activity period may vary substantially in different regions. Most of these have been known as minor pests with the exception of the ber fruit fly, *Carpomyia vesuviana* (Costa). It is a well established major insect pest of ber in all the countries wherever ber is grown. It is one of the notorious monophagous pests of ber in India. The fruit fly infests most of the *Ziziphus spp.* grown in the world and causes the damage internally. In serious cases, it causes severe yield loss up to 80% or even up to 100% damage (Karuppaiah, 2014) [3]. The losses caused by the fruit fly are so high that it has now proved to be a limiting factor in the successful cultivation of ber in all ber producing districts of Haryana and Rajasthan. There is hardly any ber tree that is free from its attack (Lakra and Singh, 1984) [4]. Several species grow in the state but the cultivated orchard trees (*Ziziphus mauritiana* Lamk) are by far most important. Bushes of *Z. rotundifolia* (Lamk) and *Z. numularia* (Lamk) are the other two species which predominantly grow wild in uncultivated and neglected areas and therefore may exceeds the cultivated trees both in area and number but may not possibly in total yield. Ber has about 50 genera and more than 600 species (Pareek, 1983) [5]. The genus *Ziziphus* consist of 135 species, of which nearly 90 species are found in the old world and 45 species are confined to the new world. The choice of varieties/germplasms for a particular region depends upon the agro-climatic conditions of that place. Mainly the genotypes are classified into three categories as early, medium and late harvesting.

Correspondence

Jayant Yadav

Ph.D. Student, Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Umran, Chuhara, Illaichi, Kathaphal, BS-2 and Desi alwar are late bearing varieties/germplasm while Gola, Gola Gurgaon No. 3, Safeda Rohtak, Katha Rajasthani, Laddu and Akrota comes under early bearing varieties/germplasms. Kaithali and Dandan are categorised as mid season varieties/germplasms. All the ber genotypes have different physio-chemical characters of the fruit viz., fruit weight, shape, size, surface colour, pulp stone ratio (PSR), total soluble solids (T.S.S), sugars, acidity, ascorbic acid and phenol content (Singh and Vashishtha, 2002) [10].

Till now use of insecticides is the chief mode of control but this method suffers from several limitations such as development of pesticide resistance over continued usage, residual hazards of pesticides, high operational cost and indiscriminate killing of natural enemies and pollinators. The probable solution to these problems is the planting of resistant varieties. The deep knowledge of the population dynamics related to the potential activity of the ber fruit fly in the ber crop ecosystem and host resistance would help to facilitate the decision of when to initiate the control measures. The knowledge of the activity of fruit fly and plant resistant and susceptible varieties against it would help us to develop the management strategy against this pest that will enhance the income of the farmers. Therefore screening of promising varieties/germplasms under field conditions was performed.

2. Materials and Methods

Field experiments for screening of various varieties/germplasms of ber against ber fruit fly, *C. vesuviana* (Costa) were carried out at ber orchard of Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station Bawal, Haryana, during 2016-17. Thirty nine varieties/germplasms (as shown in plate 1, 2 and 3) raised at the research farm of CCSHAU, Regional Research Station, Bawal were evaluated.

Table 1: Category of different varieties/germplasms on the basis of infestation

S. No.	Category	Fruit infestation (%)
1.	Highly Resistant	0
2.	Resistant	1.00-10.99
3.	Moderately Resistant	11.00-20.99
4.	Moderately Susceptible	21.00-30.99
5.	Susceptible	31.00-40.99
6.	Highly Susceptible	>41.00

There were three replications of each variety/germplasm. Hundred fruits of one plant in each replication, from each variety/germplasm were randomly collected during 1st and 2nd picking and observed for ovipositional punctures (as shown in plate no. 4) and dissected to ascertain the infestation of the pest.



Plate 1: Ber fruits of different varieties/germplasms on semi-ripe stage



Plate 2: Ber fruits of different varieties/germplasms on semi-ripe stage



Plate 3: Ber fruits of different varieties/germplasms on semi-ripe stage



Plate 4: Symptoms of ber fruit fly infestation

Table 2: Fruit fly infestation in different varieties/germplasms

Sr. No.	Varieties/Germplasm	Fruit infestation (%)
1.	Akrota	33.20
2.	Bahadurgarhia	38.34
3.	Banarasi	19.00
4.	BS-1	1.51
5.	BS-2	13.37
6.	Chhuhara	36.22
7.	Dandan	42.07
8.	Desi Alwar	19.82
9.	Gola	49.06
10.	Gola Gurgaon No. 2	34.61
11.	Govindgarh Selection	29.66
12.	Illaichi	10.63
13.	Illaichi Jhajjar	26.03
14.	Jhajjar Selection	24.38
15.	Jhajjar Special	31.85
16.	Kaithali	51.06
17.	Kakrola Gola	33.51
18.	Katha Bombay	22.31
19.	Katha Gurgaon	18.93
20.	Katha Rajasthani	20.96
21.	Kathaphal	18.47
22.	Laddu	31.93
23.	Lakhan	27.11
24.	Mundia Murhara	34.68
25.	Narkeli	25.06
26.	Narna	33.17
27.	Nauki	30.63
28.	Nazuk	40.58
29.	Popular Gola	21.78
30.	Reshmi	18.01
31.	Safeda Rohtak	40.06
32.	Sanaur No. 3	18.75
33.	Sandhura Narnaul	33.17
34.	Seo Bahadurgarh	36.49
35.	Sua	37.03
36.	Tasbtso	16.00
37.	Thornless	21.72
38.	Umran	14.35
39.	Vilaiti	24.19

Averages of infested fruits in respect of each variety/germplasm were worked out. According to the scales as suggested by Singh and Vashishtha (1984)^[9] and Sharma *et al.*, (1998)^[7], the varieties/germplasms were categorized in six categories (with slight modifications) as described in table no. 1. A pre-determined number of ber trees, for studies on the varietal/germplasm screening, were kept free from pesticide application during the course of the study.

3. Results and Discussion

It is evident from table no. 2 that the fruit fly infestation varied from variety/germplasm to variety/germplasm. Out of 39 varieties/germplasms studied, the maximum infestation (51.06%) was recorded in the fruits of variety Kaithali followed by Gola (49.06%), Dandan (42.07%), Nazuk (40.58%) and Safeda Rohtak (40.06%), respectively. However, the minimum infestation (1.51%) was recorded in variety/germplasm BS- 1 followed by Illaichi (10.63%), BS- 2 (13.37%), Umran (14.35%) and Tasbtso (16.00%), respectively. Table no. 3 showed that out of 39 varieties/germplasms, maximum no. of varieties/germplasms *i.e.* 14 were fell in the category of susceptible (31.00 - 40.99% infestation).

Table 3: Categorization of different varieties/germplasms on the basis of infestation

S. No.	Category	Fruit Infestation (%)	Varieties/Germplasm
1.	Highly Resistant	0	Nil
2.	Resistant	1.00-10.99	BS-1 and Illaichi (2)
3.	Moderately Resistant	11.00-20.99	Banarasi, BS-2, Desi Alwar, Kathaphal, Katha Gurgaon, Katha Rajasthani, Reshmi, Sanaur No. 3, Tasbtso and Umran (10)
4.	Moderately Susceptible	21.00-30.99	Govindgarh Selection, Illaichi Jhajjar, Jhajjar Selection, Katha Bombay, Lakhan, Narkeli, Nauki, Popular Gola, Thornless and Vilaiti (10)
5.	Susceptible	31.00-40.99	Akrota, Bahadurgarhia, Chhuhara, Gola Gurgaon No. 2, Jhajjar Special, Kakrola Gola, Laddu, Mundia Murhara, Narna, Nazuk, Safeda Rohtak, Sandhura Narnaul, Seo Bahadurgarh and Sua (14)
6.	Highly Susceptible	>41.00	Dandan, Gola and Kaithali (3)

The varieties/germplasms like Dandan, Gola and Kaithali were found to be highly susceptible (>41.00% infestation). However ten varieties/germplasms like Banarasi, BS-2, Desi Alwar, Kathaphal, Katha Gurgaon, Katha Rajasthani, Reshmi, Sanaur No. 3, Tasbtso and Umran were found to be moderately resistant. None of the varieties/germplasms was observed as highly resistant or immune (0% infestation) but the two varieties BS-1 and Illaichi fell in the category of resistant (1.00-10.99% infestation). Remaining ten varieties/germplasms were categorized as moderately susceptible (21.00-30.99% infestation).

The present findings are in confirmation with Singh (1984)^[8] who found that the cultivars Dandan, Gola and Nazuk were preferred for egg laying over other cultivars but the cultivars like Illaichi and Umran were less susceptible to fruit fly attack due to the small percentage of larval hatching. Similarly, Singh and Vashishtha (1984)^[9] described the varieties like Dandan, Gola and Kaithali as highly susceptible varieties and Illaichi as resistant one. Similar results were recorded by

Sharma *et al.*, (1998) ^[7] who stated that none of the varieties was immune to ber fruit fly. They also reported that Tikdi and Illaichi were highly resistant cultivars, the Umran, Tas Batso and Desi Alwar were moderately resistant and Dandan, Seo and Gola were highly susceptible. Similarly Pramanick *et al.*, (2005) ^[6] described that the variety Gola was proved to be highly susceptible. These findings are in close agreement with Baloda *et al.*, (2012) ^[1] who mentioned that the variety Umran was found resistant to ber fruit fly.

4. Conclusion

The studies on varietal/germplasm screening revealed that the variety Kaithali was severely damaged by fruit fly (51.06%) followed by Gola (49.06%) and Dandan (42.07%) and categorized as highly susceptible varieties/germplasms. The variety/germplasm BS- 1 with minimum fruit fly infestation (1.51%) followed by Illaichi (10.63%), categorized as resistant whereas BS- 2 (13.37%) and Umran (14.35%) categorized as moderately resistant varieties/germplasms. Majority of the varieties/germplasms *i.e.* 14 were found susceptible (31.00-40.99% infestation). So we can suggest farmers to go for resistant varieties/germplasms like Illaichi which harbor less fruit fly damage and thus the cost of cultivation is reduced.

5. Acknowledgement

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