

Research Article

Surveillance and Control of Peach Flat-Headed Borer, *Sphenoptera Dadkhani* (Oben.) in Plum Orchards of Khyber Pakhtunkhwa, Pakistan

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Abstract | Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) is the major insect-pest of stone fruit orchards. Survey of three districts of Khyber Pakhtunkhwa revealed the highest mean infestation in plum orchards of district Peshawar (89.60%), followed by Nowshera (75.79%) and Swat (45.42%). In peach orchards, highest mean infestation was recorded in Peshawar (88.33%), followed by Nowshera (72.77%) and Swat (53.72%). The mean infestation of 70.86% was recorded in apricot orchards in Peshawar, followed by Nowshera (62.40%) and Swat (40.73%). Bordeaux mixture treatment applied to tree trunks was very effective in reducing the borer infestation during dormant season. After pruning orchards, Nurelle-D 505EC and Triazofos 40EC @ 75ml of each proved to be the best toxicants, which showed synergistic effect in Bordeaux mixture (Copper oxychloride 75g + Lime 3kg + water 10L) in reducing borer infestation (exit holes/ gum points) in the month of January.

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Keywords | Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.), Surveillance, Bordeaux mixture, Management

Introduction

The climatic condition of Khyber Pakhtunkhwa is congenial for the production of stone fruits. The stone fruit products have a high nutritive value to the human beings. Total cropping acreage of apricot fruit in Khyber Pakhtunkhwa is 2.0 (000) ha with production of 14.0 (000) tons, peach is 5.6 (000) ha, with production of 30.8 (000) tons and plum fruit is 3.0 (000) ha, with production of 27.0 (000) tons (MinFA, 2010-11). A number of insect pests attack these stone fruits but peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) is the most destructive one and is a serious threat to the successful development of these fruit trees in Peshawar valley as shown in the Figures 1 to 6.

One of the major bottlenecks to the successful raising of the peaches cultivation is the incidence of

flat-headed borer, *Sphenoptera dadkhani* (Chughtai et al., 1984; Obenberger, 1955; Chaudhary et al., 1996). This pest has also been recorded from India as a major pest throughout the North-Western peach cultivation area of Punjab, Haryana and Himachal Pradesh, causing 10-60% fruit infestation (Batra and Renjhen, 1950; Chaudhary and Rataual, 1992 and Lakra et al., 1980). The decreasing trend in the area and production of stone fruits orchards is due to cryptic nature of borer infestation which makes them very difficult to detect and they destroy the food transportation channels (xylem and phloem tissues) and lastly the trees become dry (Rebek, 2009). In every orchard, 20-53% trees had been found infested by this borer (Chughtai et al., 1984). Gummosis damage by this borer was recorded as top serious in plum (70.4%) followed by peach (53.3%) and apricot (42.5%) in Peshawar (Raqib, 2003). Red maple trees sustained high levels of



Figure 1: *Adult of Sphenoptera dadkhani (Oben.)*

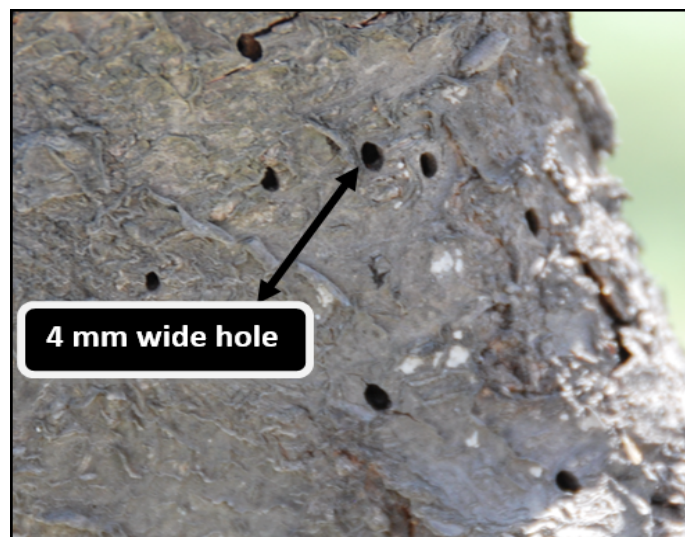


Figure 4: *D- Shape exit holes*



Figure 2: *Larva (Grub)*



Figure 5: *Exudation of gum*



Figure 3: *Pupa*



Figure 6: *Gum spots*

Table 1: List of Chemicals mixed with Bordeaux mixture tested for the control of Peach Flat-headed borer, *Sphenoptera dadkhani* (Oben.)

#	Trade Name	Chemical	Group	Dose/10 L	A.I. (g/l)
1.	Cyren 48EC	Chlorpyrifos	O/P	75 ml	480
2.	Tenekil Plus 40EC	Chlorpyrifos	O/P	75 ml	400
3.	Triazofos 40EC	Triazofos	O/P	75 ml	400
4.	Nurelle-D 505EC	Chlorpyrifos + Cypermethrin	O/P+Pyrethroid	75 ml	500+50
5.	Steward 150EC	Indoxacarb	Oxidiazines	30 ml	150
6.	Thiodan 35EC	Endosulfan	O/C	75 ml	350
7.	Neem oil + Hing	Azadirachtin + Hing	Bio-pesticide	50 +50 ml	----
8.	Control	Untreated	----	----	----

flat-headed borer infestation in 2005 (2.3-39.6%) and 2006 (32.1- 41.0%) trials, indicating almost half of the crop was lost without insecticide application (Olivier et al., 2010). Due to the late detection of the infestation of *S. dadkhani*, the peach trees die before the management applied (Lakra et al., 1980; Chaudhary et al., 1991). These conflicting observations and the introduction of new insecticides in the market; necessitate testing of these compounds for efficacy against the pest on regular basis.

Keeping in view the importance of the stone fruits, the present research work was initiated study the surveillance and effective suppression of *S. dadkhani* (Oben.) with different pesticides, otherwise, Khyber Pakhtunkhwa will be deprived of natural gifted stone fruits and export of this precious fruit commodity will not be further sustained.

Materials and Methods

Survey of Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) infestation in stone fruit orchards of Khyber Pakhtunkhwa

A preliminary survey was conducted in different stone fruit growing areas of district Peshawar (Musazai; Surazai; Urmar Payan; Mera Kachori; Tarnab & Lala Kaley), Nowshera District (Akbar Pura; Qasim Ali Baig and Wazir Garhi) and district Swat (Umar Dara, Mezara, Thana; Kota, Barikot; Manglor, Mingora; Nawakaley, Khuza Khela & Drush Khela, Matta). Presence of gummosis along with exit holes (4 mm wide) on the trees bark was taken as the criterion for insect attack (Raqib, 2003 and Lakra et al., 1980). Borer infestation was recorded using the following formula:

$$\% \text{ Borer infestation} = (\text{No. of trees having D-Shape holes or gum spots} / \text{Total no. of trees examined}) \times 100$$

Effect of different pesticides in Bordeaux mixture against Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) in plum orchards

Efficacy of different pesticides (Table 1) in Bordeaux mixture was evaluated against borer in plum orchard. These insecticides were first mixed with Bordeaux mixture (Copper oxychloride 75 g + Lime 3 kg + water 10 L) and applied on plum trees by using paint brush in 5th January, 2012 (dormant season). Twenty four plum trees of age (15 years old) were selected at the experimental farm of NIFA, Peshawar. The experiment consisted of eight treatments, which was repeated three times in CR design. For data recording, the method described by Chaudhary and Rataual (1993) and Sharma et al. (2004) was employed. Before treatment, the trees were checked from ground level to a height of 2 meter because maximum damage is confined to a height of 2 meter from ground level and counted exited holes, which were marked with color pens. In order to standardize the borer damaged, number of exit holes was recorded as holes/m². The gummosis present on the trunk was scrapped off with the help of scraper from each tree. Effect of insecticides on borer damage and thus emergence of subsequent generation was evaluated by recording freshly made exit holes on 14th May, 2012, two weeks after the first generation adults had completed emergence.

Data Analysis

The data obtained were transformed by square root transformation and subjected to ANOVA and LSD tests at 5% level of significance ($P < 0.05$) for the interpretation of specific results by using the statistical package Statistix 8.1 (Analytical Software, Tallahassee, FL). Mean separation was performed by using LSD test.

Results and Discussion

Surveillance of Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) infestation in stone fruit orchards

The data regarding the percentage of infested trees in different stone fruit orchards by peach flat-headed borer in various locations of Peshawar, Nowshera and Swat districts is presented in Table 2. Surveys were conducted during January 17 to February 8, 2013. Peach flat-headed borer infestation was recorded in all the three districts (14 villages) of Khyber Pakhtunkhwa.

District Peshawar

By the average of the gum points and exit holes, the mean values showed that percentage of the infestation of peach flat-headed borer in plum orchards was highest in Lala Kaley (97.78) followed by Tarnab (92.42) and lowest in Musazai (83.83) in district Peshawar. In peach orchards, village Tarnab was found to be highly infested (94.65) followed by Lala Kaley (92.22) whereas 83.34 percent infestation was recorded in village Musazai. In apricot orchards, maximum infestation (86.96) was observed in village Urmur, whereas minimum infestation (54.16) in Lala Kaley.

District Nowshera

The mean values for the infested percentage in plum orchards of district Nowshera showed that the borer infestation was highest (96.97) in village Balu followed by Dag Besud (89.03) and the lowest (56.06) in Wazir Garhi. Peach orchards of Akbar Pura were found to be highly infested (85.90) followed by Dag Besud (78.12) while (50) infestation percentage was recorded in Wazir garhi. Similarly, apricot orchards in Akbar Pura had maximum infestation (83.79) whereas, minimum (41.38) in Wazir garhi.

District Swat

Different locations in district Swat showed low infestation of the pest as compared to Peshawar and Nowshera. The mean values for percent infested trees in plum orchards showed that infestation was maximum (48.61) in village Mezara followed by Drush Khela (47.50) and the minimum (40.00) in Manglor. But peach orchards in Manglor were found to be highly infested (58.33) followed by Mezara (55.83) whereas 51.11% infestation was recorded in Nawakaly. In apricot orchards, maximum borer infestation (43.33) was observed in Nawakaly followed by village Drush Khela (42.85) whereas the lowest (38.09) in village

Mezara. By averaging the data of various locations of the three districts, the overall mean values showed that percent infestation in plum orchards was highest (89.60) in Peshawar followed by Nowshera (75.79) and the least in district Swat (45.42). In peach orchards, maximum percent infestation (88.33) was recorded at Peshawar followed by Nowshera (72.77) and Swat (53.72). Similarly, apricot orchards in Peshawar were more infested as compared to Nowshera and Swat, where maximum infestation (70.86) was recorded followed by Nowshera (62.40) whereas, district Swat had minimum infestation of 40.73%.

Results indicated that the maximum infestation of peach flat-headed borer as indicated by the presence of gum points and exit holes was found in district Peshawar followed by Nowshera and Swat. Moreover, it is obvious from the survey results that plum was the most preferred host followed by peach whereas, apricot served as the least preferred host for peach flat-headed borer. During survey (2013), the maximum infestation of peach flat-headed borer was recorded in plum (89.60%) followed by peach (88.33%) & minimum in apricot (70.86%). *Sphenoptera dadkhani* is a serious pest and is responsible for the destruction of peach orchards. Maximum adult emergence of *S. dadkhani* (94.3%) was recorded from mid-March to mid-May; second fortnight of June and first week of September (Sharma et al., 2004). These observations support the findings of Raqib (2003) who reported maximum infestation in plum (70.4%), followed by peach (53.3%) and apricot (42.5%) in Peshawar. However, these results were in contradiction to those Sharma et al. (2004) who found that cherry was the preferred host of *Sphenoptera lafertei* (Thom.) followed by peach, plum, almond and no apricot trees were infested. Low temperatures in Swat are not conducive for the development of borer. In Peshawar and Nowshera, longer and warmer periods (March to November) for development and reproduction result in greater incidence of the borer. Location variation in orchards was more evident in Nowshera whereas, in Peshawar and Swat, such differences were not observed. These results revealed that density of infestation varies along various localities. Chaudhary and Rataul (1993) also observed similar trends of infestation in various localities and reported that maximum infestation was recorded in Ludhiana (63.1%) followed by Haryana Ambala (57.4%), Amritsar of Punjab (44.7%), Shimla, Himachal Pradesh (42.9%), Solan (35.9%) and minimum in Hisar (18.9%) during survey of India.

Table 2: Survey of Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) infestation in stone fruit orchards

Locations	Plum orchards (%)			Peach orchards (%)			Apricot orchards (%)		
	Gum Points	Exit holes	Mean	Gum Points	Exit holes	Mean	Gum Points	Exit holes	Mean
District Peshawar									
Musazai	91.18	76.47	83.83	86.67	80.00	83.34	100.00	66.67	83.34
Surazai	100.00	75.00	87.50	91.84	83.67	87.76	69.39	67.35	68.37
Urmar	92.59	81.48	87.04	100.00	75.00	87.50	95.65	78.26	86.96
Mera Kachori	96.88	81.25	89.07	100.00	69.05	84.53	84.00	64.00	74.00
Tarnab	96.96	87.87	92.42	96.43	92.86	94.65	66.67	50.00	58.34
Lala Kaley	100.00	95.55	97.78	93.33	91.11	92.22	55.55	52.77	54.16
Mean	89.60%			88.33%			70.86%		
District Nowshera									
Akbar Pura	75.55	46.66	61.11	97.43	74.36	85.90	97.30	70.27	83.79
Balu	100.00	93.94	96.97	79.16	75.00	77.08	88.88	44.44	66.66
Dag Besud	97.56	80.49	89.03	90.62	65.62	78.12	75.55	40.00	57.78
Wazir Garhi	72.73	39.39	56.06	71.86	28.13	50.00	62.07	20.68	41.38
Mean	75.79%			72.77%			62.40%		
District Swat									
Mezara, Thana	55.55	41.66	48.61	66.66	45.00	55.83	42.85	33.33	38.09
Kota, Barikot	54.28	34.28	44.28	67.50	35.00	51.25	41.66	37.50	39.58
Manglor, Mingora	48.57	31.42	40.00	70.00	46.66	58.33	42.59	37.03	39.81
Nawakaly, Khuza Khela	54.34	39.13	46.74	66.66	35.55	51.11	48.33	38.33	43.33
Drush Khela, Matta	56.66	38.33	47.50	62.50	41.66	52.08	46.42	39.28	42.85
Mean	45.42%			53.72%			40.73%		

Table 3: Effect of different pesticides in Bordeaux mixture against Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) in plum orchards

S. No.	Treatments	Dose/ 10L	Gum points/m ²	Exit holes/m ²
1.	Cyren 48EC	75 ml	9.483 b	8.230 b
2.	Tenekil plus 40EC	75 ml	8.643 bc	5.580 bc
3.	Steward 150SC	30 ml	5.253 bc	4.107 bcd
4.	Neem oil + Hing	50+50 ml	5.160 bc	2.073 cd
5.	Nurelle-D 505EC	75 ml	3.207 bc	1.413 d
6.	Thiodan 35EC	75 ml	1.817 c	1.967 cd
7.	Triazofos 40EC	75 ml	3.000 bc	1.547 d
8.	Control	Untreated	24.040 a	24.760 a

** Means within columns followed by same letter (s) are not significantly different at 5% level of significance. LSD value for gum point/m² = 1.5154. LSD value for exit holes/m² = 0.9654.

Effect of different pesticides in Bordeaux mixture against Peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) in plum orchards

Data regarding the effect of different white wash mixtures for the control of peach flat-headed borer in plum orchard is presented in Table 3. In January, 2012, seven insecticides, i.e., Cyren 48EC, Tenekil plus 40EC, Steward 150SC, Neem oil + Hing, Nur-

elle-D 505EC, Thiodan 35EC, Triazofos 40EC mixed in bordeaux mixture (Copper oxychloride 75 g + Lime 3 kg + water 10 L) were evaluated in plum orchard during the dormant season. A significant effect of insecticides was observed over the untreated control, i.e., ($F_{7,16} = 15.6, p < 0.000$). The mean density of new PFB exit holes/m² of bark surface area was lowest (1.413) and (1.547) in treated with Nurelle-D

505EC and Triazofos 40EC respectively compared to the untreated control (24.760).

In case of gum points, a significant effect of insecticides was observed over the untreated control, i.e., ($F_{7, 16} = 5.06$, $p < 0.0035$). Mean number of new gum points per m² of bark surface area treated with Thiodan 35EC was significantly lower (1.817) followed by Triazofos 40EC (3.00) as compared to the untreated control (24.040).

Bordeaux mixture application is very effective against peach flat-headed borer (PFB) infestation in stone fruit orchards during dormant season. In 1929, Burke reported that the painting of tree trunks with different effective insecticides in Bordeaux mixtures is very useful in fruit orchards for protecting trees from sunburn and insects attack but it definitely does some good, but usually a few beetles get in and often it has little effect. Fitch (1856) and Riley (1875) recommended that the trunks and branches be white washed with soap, lime and Paris green toward the end of May and again in July and August to keep the flat-headed borer away. Since that time most of the economic entomologists have recommended the use of Bordeaux mixture. Only lime treatment is not very effective, therefore, different insecticides were tested in Bordeaux mixtures against PFB in our study. All the tested insecticides gave good control by reducing PFB infestation; however, no tree dissections were made to evaluate what PFB life stages were affected by treatments. These findings are in conformity with those of Batra and Renjhen (1950) and Diane (2004), who reported that white washing with lime only was not effective in preventing oviposition of the adult borer but Chlorpyrifos, Endosulfan, Malathion Triazophos & Nurelle-D in bordeaux mixture were found very effective against PFB in painting of tree trunks and branches (Diane, 2004). Kakar et al. (1998) also reported the efficacy of Chlorpyrifos (0.08%) & Methyl parathion (0.05%) were more superior to Triazophos (0.16%) and Neem oil (0.5%) on trees against borer infestation. Sharma et al. (2004) reported that the chemical control with chlorpyrifos and lindane each at 0.04% were found very effective against *S. dadkhani* (Oben.) during 2001 to 2003 in India. The results revealed that three applications made during February-June-October registered the minimum incidence of flat headed borer with chlorpyrifos.

Various botanicals are known to have repellent and insecticidal properties and neem oil can also be in-

corporated as environment-friendly component in an IPM model (Osman and Port 1990; Stark and Walter, 1995; Regnault, 1997; Riga et al., 2006). We found that all the three botanicals mixed with Bordeaux mixtures were able to decrease in damage symptoms caused by PFB but their combined effect was better than when used alone. After pruning the plum orchards, Nurelle-D 505EC, Triazophos 40EC and Thiodan 35EC @75 ml of each showed a synergistic effect in Bordeaux mixture in reducing the peach flat-headed borer infestation as indicated by the presence of new exit holes and gum points after 30 days in the months of January to February and kept fruit trees in vigorous growing condition.

Conclusion and Recommendation

Maximum infestation of peach flat-headed borer, *Sphenoptera dadkhani* (Oben.) was recorded in plum orchards followed by peaches and minimum in apricot orchards in the three districts of Khyber Pakhtunkhwa. Nurelle-D 505EC and Triazofos 40EC @ 75 ml of each proved to be the best toxicants, which showed synergistic effect in Bordeaux mixture (Copper oxychloride 75 g + Lime 3 kg + water 10 L) in reducing borer infestation in the month of January.

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