MANAGEMENT OF WALNUT STEM BORER *AEOLESTHES SARTA* SOLSKY (COLEOPTERA: CERAMBYCIDAE) IN DISTRICT SWAT, PAKISTAN

Naveed Ahmed[1] and Ghulam Ali Bajwa[2]

ABSTRACT

The present study was carried out at Kaydam Swat to assess the bio-efficacy of different treatments viz., Karate 2.5 EC, Emmamectin Benzoate 1.9 EC, Confidor 20 SL,DDVP 80 EC and untreated check against the Walnut Stem borer, *Aeolesthes sarta* Solsky on Walnut trees. In all the treatments the borer holes were plugged with mud after treatment application while plain mud plastering was done in control. Results of the post-spray data recorded after 7 and 14 days revealed that all the insecticides were significantly effective in reducing the larval population of the pest as compared to the untreated check but DDVP gave best results (82.32%) in terms of reducing the pest population 14 days after treatment.

INTRODUCTION

Walnut (*Juglans regia* L.) is the most widespread tree nut in the world. It is native in a region stretching from the Balkans eastward to the western Himalayan chain. At present, walnut is cultivated commercially throughout southern Europe, northern Africa, eastern Asia, the USA and Western South America. World production of whole walnut was around 1.5 × 106 t in 2008 (FAO, 2008).

Walnuts have been growing in the Northern Areas of Pakistan since time immemorial and are one of the most important nut crops grown in Malakand division which contributes about 82% of the total walnut production of the country (MINFAL 2000). In Malakand division, due to the extensive local use of walnut bark and timber, the specie is being aggressively harvested. Swat valley is the best place for walnut production and account for 35 percent of the country's walnut population where it occupies 500 ha out of the total 1,497 ha. Most of the Swat walnut is being exported due to its high quality and demand. Kernels of good quality have good price and there is especially a high demand for thin-shelled walnut (*Kaghzi akhrot*) in market (Ali *et al.*, 2010). But despite being the main asset and source of income of many families, the numbers of walnut trees are on the decline and only about 5-10 per cent of the potential in the area has been utilized so far. There are number of reasons for decline of walnut production in Swat such as deforestation, non-plantation of new trees and attack of long horned beetles or Quetta borer (*Aeolesthes sarta* Solsky) which has endangered this great forest assets.

1 Forest Entomologist, Pakistan Forest Institute, Peshawar
2 Director (NTFP), Pakistan Forest Institute, Peshawar

Aeolesthes sarta (Coleoptera: Cerambycidae) commonly known as Quetta borer is polyphagous in nature. It is generally believed that it is originated from Pakistan and western part of India with wide distribution in Afghanistan, Iran and up to Central Asian countries (Orlinski 2006, Farashiani *et al.*, 2001).

It has limited distribution in Quetta, Karez Inayatullah, Kalat, Ziarat, Mastung and Zhob Districts of Baluchistan province (Ahmad *et al.*, 1977). The high level of infestation was reported in Quetta city where more than 3000 trees were dropped during the period 1904-1906 (Stebbing 1914). *A. sarta* shows extraordinary tendency to attack the main trunk and large branches of Walnut trees where they reproduce successfully (Farashiani *et al.*, 2000). It can result in a decline of popular trees forest which is an important source in wood industry and can also show infestation on mountain forests (Arshad *et al*., 1983).

A. sarta is one of the most important pests of many forests, ornamental and deciduous fruit trees in the region of its present distribution (Yagdyev & Tashlieva, 1976; Ahmad *et al*., 1977; Sengupta & Sengupta, 1981). It attacks both stressed and healthy trees of different ages. Successive generations remain on the same tree for several consecutive years, eventually causing its death. Sometimes, young larvae encircle a tree feeding on the cambium, which leads to the rapid death of the tree.

A. sarta is found in mountains up to an altitude of 2000 m. The area of origin of the pest is thought to be Pakistan and Western India, from which it spread westwards to Afghanistan and Iran and northwards to the Central Asian countries of the former USSR where it was first found in 1911 (Orlinskii *et al*., 1991). Keeping in view the destructive nature of *A. sarta*, the present study was, therefore, designed to find out and compare the efficacy of different chemicals against this pest under field conditions.

METHODOLOGY

The trial was conducted in Randomized Complete Block Design having 4 replications at Kaydam, Swat to determine the comparative efficacy of different insecticides against stem borer on walnut trees. All the insecticides used in this study were obtained from the local market in the sealed condition. Before injecting into the live bored holes, the tunnels were cleaned or loosened with the help of hard metal wire. For injecting insecticidal solution, 10 ml sized common injection needle was used. Insecticide quantity used was in proportion with the tunnel length i.e. solution is injected till the tunnel got filled up. After injecting in to the tunnels, the bored holes were plugged with wet mud. Pre-treatment observations on live tunnels were taken 24 hours before the application of insecticides. Percent reduction in population was accomplished 7 days and 14 days after treatment application (DAT).

Statistical Analysis

The data collected during experimentation were analyzed statistically by using analysis of variance (ANOVA) and means were separated by least significance difference (LSD) test at 5% probability level using computer software STATISTIX Version 8.1.

Table 1. Insecticide products, chemical group, application rate and method for Walnut trees treated against *Aeolesthes sarta*

Technical name	Chemical group	Application rate (%)	Application method
Karate 2.5 EC	Pyrethroid	0.5	Trunk Injection
Emmamectin Benzoate 1.9 EC	Avermectin	0.5	Trunk Injection
Confidor 20 SL	Neonicotinoid	1.0	Trunk Injection
DDVP 80 EC	Organophosphate	0.01	Trunk Injection

RESULTS AND DISCUSSION

Percent mortality of Quetta borer individuals observed at different post-treatment time intervals was subjected to one way analysis of variance. The insecticides ($F_{4, 12}$ = 122.58, P= < 0.001)

7 DAT and ($F_{4, 12}$ = 229.61, P= < 0.001)14 DAT had a significant influence on the mean mortality of Quetta borer population (Table 2).

Table 2. Analysis of variance for mean mortality of Quetta borer (*Aeolesthes sarta* Solsky) exposed to label recommends dose rates of different insecticides under field conditions.

(7 DAT)						14 DAT		
Source	DF	SS	MS	F	P	MS	F	P
Block	3	95.0	31.65				48.71	
Treatment	4	11690.2	2922.54	122.58	0.0000***	3697.62	229.61	0.000***
Error	12	286.1	23.84				16.10	
Total	19	12071.2						
CV			10.57			7.78		

Probability level at 5%, P ≤ 0.001***, DAT = days after treatment,
CV = Coefficient of Variation

Results presented in Table 3 revealed that all the treatments were significantly effective against the pest compared to check. The results revealed highly significant differences among treatments at all the post treatment intervals. On numerical basis, however, borer larval population reduction gradually increased from 7 DAT to 14 DAT in all the treatments. Among treatments, DDVP proved the most effective against Quetta borer from 7 DAT to 14 DAT as compared to all other tested treatments (Table 3). On 7 DAT, the highest population reduction with DDVP was 70.99% followed by Emmamectin Benzoate (58.14%), Confidor (52.10 %) and Karate (49.52%).

Table 2. Percentage reduction in Quetta borer population after 7 and 14 DAT of different insecticides

Treatments	Population reduction (%)	
	7 DAT	14 DAT
DDVP 80 EC	70.99A	80.32A
Emmamectin Benzoate 1.9 EC	58.14B	65.44B
Confidor 20 SL	52.10BC	53.24C
Karate 2.5 EC	49.52C	58.64C
Control	0.16D	0.33D
LSD	7.5228	6.1826

Means sharing the common letters are not significantly different at P=0.05, DAT=days after treatment, LSD=Least Significant Difference

On 14 DAT, DDVP remained at the top for its effectiveness with highest Quetta borer population reduction (82.32%) followed by Emmamectin Benzoate (65.44%). Karate (58.64%) showed better percent reduction of larval population 7 DAT as compared to Confidor with (53.42%) mortality.

Thus, the comparison between insecticides revealed that all the insecticides were found effective on both 3 DAT and 7 DAT as compared to check.

Similar results have also been recorded in many research studies. Poland *et al*. (2006) found that imidacloprid injection of infested trees resulted in significant mortality in *A. glabripennis* adults feeding on leaves and twigs and larval stages feeding within infested trees.Imidacloprid could cause higher mortality to the *A. glabripennis* beetles than other tested insecticides (disulfoton, oxydemetonmethyl, methamidophose, and acephate), especially when applied through trunk injection (Wang *et al*., 2000). In McCullough et al.'s study (2004), high-pressure soil injections of imidacloprid (Merit® 75 WP) provided 88-92% control of *A. planipennis* larvae and trunk injection of Imicide® (Mauget capsules of imidacloprid) reduced *A. planipennis* density by roughly 60 to 96 percent.

Injecting trees with systemic insecticides would be one tool in a comprehensive program for managing longhorned beetle populations when the eradication program fails. Mortality of SLB adults feeding on insecticide-treated trees as well as mortality of larval stages within the injected trees would reduce pest populations and damages. Furthermore, it is possible that mortality of a significant percentage of the longhorned beetle population within a tree shall reduce the pest damage to levels that the tree could withstand. Insecticide injection may complement other tools in an eradication program by protecting uninfested trees in areas surrounding removed infested trees. If very low residual population remains in the tree-removal area that is below the detection threshold, individuals would encounter insecticide-treated hosts and significant numbers would die. This could help to reduce the residual population to a level below a minimum viable population size and thus lead to ultimate eradication.

It can be concluded that Karate 2.5 EC, Emmamectin Benzoate 1.9 EC, Confidor 20 SL and DDVP 80% EC could be used effectively against *A. sarta* on Walnut trees. Further investigations on the effects of various doses of systemic insecticides are required to determine the minimum effective dosage. Studying of theresidual effects of these insecticides/application methods on the adult beetle, during its long period of emergence is also suggested.

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