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INFLUENCE OF APPLE CULTIVARS, AGE AND EDAPHIC FACTORS ON INFESTATION BY THE STEM BORER, *AEOLESTHES SARTA* SOLSKY

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ABSTRACT

Field survey was undertaken during the year 2007 to evaluate the influence of different cultivars, age of apple trees at three elevations (low lying areas, karewas and higher belts) and the mean soil moisture on the severity of infestation by the apple stem borer (*Aeolesthes sarta* Solsky) in district Baramulla of Kashmir valley. Among the seven apple cultivars screened, the maximum severity of infestation (23.23%) on the trunk and scaffold limbs was recorded in Red Delicious, while the lowest (6.47%) in American Apirogue. Apple trees above 30 years of age recorded the highest mean infestation (27.04%); whereas, significantly lowest (5.51%) infestation was observed in 10-15 year-old trees. The soil moisture analyzed for the three elevations had a significant negative correlation with pest infestation and the r- values were -0.652 (low lying areas), -0.937 (*karewas*) and -0.930 (higher belts).

Key words: Apple stem borer, infestation, elevations, cultivars, soil moisture

INTRODUCTION

Kashmir valley has unique agro climatic conditions, suited for the production of high quality fruits like apple, pear, plum, peach, cherry, walnut, almond, etc.; of which apples occupy 1.15235 lakh hectares with an annual production of about 12.94158 lakh metric tones, wherein the share of district Baramulla alone is 23,595 hectares with an annual production of 4.59953 lakh metric tones (Anonymous, 2007). The stem borer, *Aeolesthes sarta* Solsky commonly known as *kush chum* in Kashmiri is considered a major pest of many broad leaved trees of importance in forestry and horticulture. Shiekh (1985) reported *A. sarta* as a serious pest of apple and other temperate fruit trees in Jammu and Kashmir. As a result of feeding by the grubs, the affected trees may not die for many years, but their vitality and productivity is impaired. Usually several generations develop on the same tree until it is eventually killed.

MATERIALS AND METHODS

An extensive field survey was carried out during 2007 for a comparative study on the infestation by the apple stem borer (*Aeolesthes sarta* Solsky) on different apple cultivars of different age groups and the influence of prevailing mean soil moisture from three elevations (low lying areas, karewas and higher belts) on the severity of infestation in district Baramulla of Kashmir valley.

Low lying areas: These are flat lands with meager slope (0-5^o), assured irrigation and shallow water table. The soils are alluvium (recent) with no run off.

Karewas or up lands: They have gentle to moderate slope (5-10^o), deep water table and are usually rainfed. These table lands are locally called as *wudars* or *karewas*. The soils are nascent, poor in organic matter and have little water retaining capacity.

Higher belts: These are mountain ecosystems having gentle to undulating topography and slope ranges between 10-20^o. The soils are alluvium (old- coarse) and usually shallow and skeleton in nature. These soils are rich in organic matter with good water retaining capacity.

Infestation was recoded from three elevations on seven apple cultivars *viz*., Red Delicious (Red Delichan), American Apirogue (American trel), White Dotted Red (Maharaji), Royal Delicious (Delichan), Benoni (Hazratbali), American Jolly Flower (Razakwari) and Cox's Orange Pippin (Kaseri). Five borer infested apple trees from each cultivar were randomly selected from one location at each of the three elevations. A total of 105 apple trees (5×7×3) were observed for infestation. Observation were also recorded on apple trees of different age groups 10-15, 16-20, 21-25, 26-30 and more than 30 years, which were correlated with pest severity. Five borer infested trees from each group were randomly selected from one location of low lying

area, karewa and higher belt. In all 75 apple trees (5×5×3) were selected to compare tree age with pest infestation.

The infestation was recorded at tree trunk and scaffold limbs of apple trees. The trunk of each sampled tree was divided into three equal parts, i.e. lower, middle and upper part. Each part was observed for the number of borer holes. Similarly, one foot uniform length from four scaffold limbs (from four directions) in each sampled tree was observed for the number of borer holes. Each tree served as a unit and each sub- divided part as a replicate. The number of holes from each replicate was determined by using the 0-5 scale:

0 = No hole	(Healthy)
1 = 1.0 to 2.0 holes	(Low infestation)
2 = 2.1 to 3.0 holes	(Moderate infestation)
3 = 3.1 to 4.0 holes	(High infestation)
4 = 4.1 to 5.0 holes	(Severe infestation)
5 = more than 5.0 holes	(Extremely severe infestation)

The mean per cent pest severity (PPS) was calculated as:

$$PPS = \frac{\Sigma of\ pest\ severty\ ratings\ from\ 1\ to\ n}{N\ X5} X100$$

Where,

Σ = Summation;

n = Total severity ratings;

N = Number of replications;

5 = Maximum grade value.

Thirty three (33) soil samples, one from each site, were collected for soil moisture analysis with the help of oven dry method. The per cent soil moisture thus obtained was correlated with pest severity.

$$Soil\ moisture\ content\ (\%) = \frac{Wet\ Weight - Dry\ Weight}{Wet\ Weight} X100$$

Statistical Analysis : The data generated during the present investigations were subjected to statistical analysis (at P = 0.05) in R-software, to check the significance of data.

RESULTS AND DISCUSSION

Apple trees of 10-15 year-age recorded the lowest pest infestation (5.51%), while trees above 30 years of age recorded the highest (27.04%) infestation (Table 1). The influence of age on the severity was statistically significant. Ojo (1981), Sharma *et al.* (1999) and Orlinski (2001) earlier reported that stem borers attack trees of all ages. *A. sarta* have high reproductive potential, adults are not strong fliers and prefer to attack trees from which they have emerged. The newly established populations of *A. sarta* may go undetected for many years due to their cryptic habitat, concealed activity and slow development of damage symptoms. These may result in increased infestation with the increase in tree age. Shylesha and Veeresh (1995) reported that the incidence of coffee stem borer (*Xylotrechus quadrupes*) was influenced by the age of the plants in the coffee growing belts of Karnataka, India. They reported a higher incidence of coffee stem borer in older trees as compared to younger plants. The maximum infestation of

Table 1. Severity of apple stem borer, *Aeolesthes sarta* Solsky as influenced by the elevation and age of trees under natural conditions

S. No.	Age in years	Pest Infestation (%)			
		Low lying area	Karewa	Higher belt	Pooled mean
1	10 – 15	4.56	6.28	5.71	5.51
		(2.618)	(3.614)	(3.280)	(3.171)[a]
2	16 - 20	6.85	10.28	9.71	8.94
		(3.933)	(5.929)	(5.601)	(5.155)[a]
3	21 – 25	11.99	17.71	17.71	15.80
		(6.896)	(10.258)	(10.377)	(9.177)[b]
4	26 – 30	13.14	21.71	23.42	19.42
		(7.561)	(12.574)	(13.807)	(11.314)[b]
5	> 30	16.57	32.57	31.99	27.04
		(9.539)	(19.371)	(19.290)	(16.067)[c]
	Pooled mean	10.62	17.71	17.70	15.34
		(6.110)	(10.349)	(10.471)	(8.976)

* Significant; CD (P = 0.05): *Age = 5.456 ; Elevation = NS; Age x Elevation = NS

● Each figure is a mean of 05 replications and each replicate is based on 07 observations per tree.

● Figures in parentheses are arcsine transformed values. ● Values superscripted with same letter(s) are statistically at par.

Table 2. Severity of apple stem borer, *Aeolesthes sarta* Solsky as influenced by the elevation and cultivars of apple

S. No.	Age in years	Pest Infestation (%)			
		Low lying area	Karewa	Higher belt	Pooled mean
1	Royal Delicious	19.42	21.70	25.70	22.28
		(11.263)	(12.569)	(14.927)	(12.920) [c]
2	American Apirogue	5.70	7.99	5.70	6.47
		(3.280)	(4.596)	**(3.280)**	(3.719) [a]
3	White Dotted Red	6.85	19.99	17.13	14.66
		(3.933)	(11.860)	**(9.896)**	(8.563) [b]
4	Red Delicious	18.28	26.85	24.56	23.23
		(10.545)	(15.806)	**(14.476)**	(13.609) [c]
5	Benoni	11.99	25.70	18.85	18.85
		(6.911)	(14.929)	**(10.922)**	(10.921) [b]
6	American Jolly Flower	9.13	12.56	11.42	11.04
		(5.261)	(7.243)	**(6.575)**	(6.360) [a]
7	Cox's Orange Pippin	11.42	26.28	19.42	19.04
		(6.576)	(15.295)	**(11.205)**	(11.026) [b]
	Pooled mean	11.83	20.15	17.54	16.511
		(6.824)	(11.662)	(10.278)	(9.588)

* Significant; CD (P = 0.05): *Cultivar = 4.276; *Elevation = 2.800; Cultivar x Elevation = NS
● Each figure is a mean of 05 replications and each replicate is based on 07 observations per tree.
● Figures in parentheses are arcsine transformed values. ● Values superscripted with same letter(s) are statistically at par.

Table 3. Infestation severity by *Aeolesthes sarta* Solsky on apple trees as influenced by soil moisture at different elevations in district Baramulla

Elevation	Mean Soil Moisture (%)	Mean Infestation Severity (%)	r- values
Low lying areas	13.34 ± 0.409	15.37 ±1.66	-0.652*
Karewa	11.14 ± 0.32	23.37 ± 2.27	-0.937*
Higher belt	12.83 ± 0.42	18.68 ± 1.83	-0.930*

Note: Data are mean values ± Standard Error; * Significant at 5%

8.3 per cent was recorded in 6 to 10 year-old coffee trees; whereas, 0.74 per cent in very young plants.

Comparison of pest infestation at the different elevations revealed that *karewas* recorded the mean highest infestation (19.99%) followed by higher belts (17.70 per cent) and low lying areas (11.83 per cent).Among the seven cultivars, the maximum infestation (23.23%) was recorded on Red Delicious, while the lowest (6.47%) on American Apirogue. The order of preference of cultivars with regard to pest infestation severity was Red Delicious > Royal Delicious > Cox's Orange Pippin > Benoni > White Dotted Red > American Jolly Flower > American Apirogue (Table-2). The influence of cultivars and elevation on the severity was statistically significant. The cultivar American Apirogue has thicker bark as compared to Red and Royal Delicious cultivars. The time spent in excavating for oviposition scars by female *A. sarta* increases with bark thickness; therefore, greater effort is required to oviposit into thicker bark, which may account for the lower fecundity of *A. sarta* in American Apirogue. In addition to bark toughness, nutritional substances are also among the woody tissue characteristics that affect the preference. Orlinski (2001) and Smith *et al.* (2002) reported that trees with thin bark are more susceptible to *A. sarta* and *Anoplophora glabripennis.*

The study on influence of soil moisture on pest infestation revealed that highest mean pest severity (23.37 per cent) was recorded at *karewas* followed by higher belts (18.68 per cent) and low lying areas (15.61per cent). The mean soil moisture content was lowest at *karewas* (11.14 per cent) followed by higher belts (12.83 per cent) and low lying areas (13.34 per cent). This implies that increase in soil moisture led to decrease in pest infestation severity and vice versa. The r- values between

soil moisture and pest severity were significantly negative, being -0.652, -0.937 and -0.930 for low lying areas, *karewas* and higher belts, respectively (Table 3).

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