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Severity of San Jose scale, (*Quadraspidiotus perniciosus* Comstock) on apple tree

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Abstract
The study on severity of San Jose scale, *Quadraspidiotus perniciosus* (Comstock) was carried out during the year 2018-19 in Baramulla and Budgam district of Kashmir valley. Highest mean severity on twig and apple fruit was exhibited maximum in Baramulla to the extent of 12.29 and 7.60%, while as, 9.07 and 4.79%, respectively in Budgam. Besides, highest severity% of 15.22 and 9.56 was recorded on twig and fruit in low elevation of district Baramulla followed by 11.87 and 6.17%, respectively in low elevation of district Budgam.

Keywords: San Jose, *Quadraspidiotus perniciosus*, apple tree

Introduction
Apple, Malus domestica (Borkh) belonging to family Rosaceae is undoubtedly the most important fruit, distributed worldwide and plays an important role in nation's economy. The major apple producing countries in the world are China, India, Ukraine, Poland, USA, Turkey, France, Germany, Italy, Brazil and Japan (Thamariakannan *et al*., 2010) [9]. The area under apple cultivation in India is 311.91 thousand hectares with an annual production of 2286.37 thousand metric tonnes; and the productivity of 7.33 metric tonnes per hectare (Anonymous, 2018) [1]. The Union Territory of Jammu and Kashmir leads both in acreage and production of apple in the country; with an area and annual production of 164.85 thousand hectares and 2026.47 thousand metric tonnes, respectively, at the productivity rate of 12.29 metric tonnes per hectare (Anonymous, 2020) [2]. The yield of apple, its quality as well as plant growth is influenced by many environmental factors. However, the apple quality and quantity is subjected to deterioration, which could be attributed to many factors; which among others also include insect pests and diseases. The most important insect pests infesting the apple crop are San Jose scale (*Quadraspidiotus perniciosus* Comstock), European red mite (*Panonychus ulmi* Koch), two spotted spider mite (*Tetranychus urticae* Koch), Woolly Apple Aphid (*Eriosoma lanigerum* Hausmann), Hairy caterpillar (*Lymantria obfuscata* Walker), Apple stem borer (*Aeolesthes sarta* Solsky) and Thrips (Gupta, 2016) [6].

San Jose Scale (SJS) is a predominant pest regularly associated with almost every apple orchard in every nook and corner of the territory. SJS belonging to order Hemiptera and family Diaspididae is the predominant key pest of apple in almost all the apple growing regions of the world, causing both qualitative and quantitative losses (Buhroo *et al*., 2016) [4]. It is especially serious in temperate and sub-tropical regions and occurs in all the temperate fruit producing countries of the world (Edland, 1990) [5]. SJS is a sucking pest that injects a toxin into the different parts of the plant and its feeding cause's discolorations in fruits. This pest can produce several scales in one season. If uncontrolled, they can kill the tree as well as make the fruit unmarketable. It is a problem particularly in larger or older trees where it is difficult to achieve good spray coverage, but in young, unsprayed trees may also be vulnerable. SJS infestation on twigs and limbs can cause an overall decline in tree vigour, growth, foliage, productivity. Damage is caused by feeding of crawlers, which suck plant sap, weaken the plant, reduce fruit and shoot growth and desiccate foliage. The area under the feeding site turns to characteristic purplish red colour.

Material and Methods
Field surveys and data was collected to ascertain the severity of SJS during the year 2018-2019 in two districts Baramulla and Budgam of Kashmir valley. Each selected district was

categorized in three different altitudes (high, medium and low) from each altitude two villages and from each village two orchards were selected. Three trees were randomly selected from each selected orchard. A total of 36 apple trees from each district was screened for the severity of SJS.

Pest severity assessment

Pest severity on twigs

The selection of apple trees to study the pest severity was carried out as per methodology detailed in Table 1. From each selected tree, four infested apple twigs measuring 10 cm representing four geographical directions (East, West, North and South) were randomly selected. Each twig were examined at three places for the presence of scale insect under binocular microscope from February to December during the period from 2018 to 2019.

To record the pest severity on twigs following scale were adopted:

0 = Nil
1 = 1-5 scales/cm 2
2 = 6-10 scales/cm 2
3 = 11-15 scales/cm 2
4 = 16-20 scales/cm 2
5 = 21-25 scales/cm 2

$$\text{Pest severity} = \frac{\sum (n \times v)}{N \times G} \times 100$$

Where
$\sum$ = summation
n = number of infested twigs
v = numerical value
N = No. of twigs
G = maximum numerical value

Pest severity on apple fruit

In order to determine the pest severity on apple fruit, three trees were randomly selected from each orchard as per methodology detailed in Table 1. From each tree, ten apples were randomly selected and each apple fruit was examined for the presence of pinkish circular spots inflicted by SJS from June to September during the two years, 2018 to 2019.

The pest severity on apple fruit were calculated as per scale advocated by Sofi (2006) [8]

Description Score assigned

S.No	No. of Spots	Numerical Ratings
1	0	0
2	1-3	1
3	4-6	2
4	7-9	3
5	10-12	4
6	>12	5

$$\text{Pest severity score} = \frac{\text{Sum of all numerical ratings}}{\text{Max. grade value} \times \text{Total fruits observed}} \times 100$$

Result and discussion

Location wise pest severity on apple twig

Studies conducted to ascertain the severity at Baramulla and Budgam during the year 2018-19 revealed that in all the selected villages of district Baramulla, the severity of SJS commenced from last week of February (8th SW) gradually increased till it attained peak severity in 2nd week of August (32nd SW) and thereafter, continued to decline till last week of December (52nd SW). The cumulative pooled mean pest severity was recorded lowest as 10.05% at high altitude and highest as 15.22% at low altitude while as, at medium altitude cumulative pooled mean pest severity was 11.58% during the survey carried in district Baramulla for the year 2018-19 (Table-2). The data presented in Table-3 revealed that in all the selected villages of district Budgam, the severity of SJS commenced from last week of February (8th SW) gradually increased till it attained peak severity in 2nd week of August (32nd SW) and thereafter, continued to decline till last week of December (52nd SW) during the year 2018-19. The cumulative pooled mean pest severity was recorded lowest as 7.08% at high altitude and highest as 11.87% at low altitude while as, at medium altitude cumulative pooled mean pest severity was 8.25% during the survey carried in district Budgam for the year 2018-19. The present results are more or less in conformity with Botha (2008) [3].

Elevation and month wise mean pest severity on apple twig

The data was recorded from different elevations of district Baramulla and Budgam in different months. Perusal of data in Table-4 revealed that in district Baramulla, lowest cumulative mean scale severity of 10.41% was recorded at high altitude followed by 11.93% at medium altitude whereas, at low altitude, highest of 15.62% cumulative mean pest severity was observed during the survey carried out from 2018-19. However, cumulative mean pest severity of all three elevations were statistically different from each other. The overall cumulative mean pest severity in district Baramulla for all the altitudes was recorded highest as 23.46% in August followed by 21.59% in July, which differed significantly with each other, however, lowest 2.44% was found in the month of February. However, the cumulative mean pest severity on twig in April (5.41) and December (5.35) was statistically at par with each other and differed significantly from the other months. Perusal of data in Table-5 revealed that in district Budgam cumulative mean pest severity of three elevations differed significantly from each other. At low altitude, the highest cumulative mean pest severity was 12.28% followed 8.48% in the medium altitude during the survey carried out from 2018-19. However, high altitude showed the lowest cumulative mean pest severity of 7.30%. The overall cumulative mean pest severity in district Budgam for all the altitudes was recorded highest as 16.96% for the month of August followed by 15.71% in July and the lowest cumulative mean pest severity was recorded in the month of February (1.46%). While as, the cumulative mean pest severity on twig of all eleven months differed significantly from each other (Table-5). Similar findings were observed by Nissar *et al.* (2020) [7].

Location wise pest severity on apple fruit

Perusal of data in Table-6 revealed that in all the selected villages of district Baramulla, the severity of SJS on apple fruit commenced from 1st week of June (22nd SW), gradually increased till it attained peak severity in 2nd week of August (32nd SW) and thereafter, continued to remain static till last week of September (38thSW) during the survey from 2018-19. The cumulative pooled mean severity of SJS on apple fruit was observed lowest as 5.42% at high altitude followed by medium altitude as 7.82%, while as, at highest altitude the

mean SJS severity was lowest as 9.56% (Table-6). Perusal of data in Table-7 revealed that in all the selected villages of district Budgam, the severity of SJS on apple fruit commenced from 1st week of June (22nd SW), gradually increased till it attained peak severity in 2nd week of August (32nd SW) and thereafter, continued to remain static till last week of September (38th SW) during the survey from 2018-19. The cumulative pooled mean pest severity on apple fruit was observed lowest as 3.52% at higher altitude followed by 4.68% at medium attitude while as, highest of 6.17% was observed at lower altitude (Table-7). Similar findings were observed by Gupta (2016) [6].

Elevation and month wise mean pest severity on apple fruit

Perusal of data in Table-8 revealed that in district Baramulla, lowest cumulative mean pest severity on apple fruit of 5.46% was observed at high altitude followed by 7.91% at medium altitude whereas, at low altitude highest of 9.64% cumulative mean pest severity was recorded. However, mean pest severity of all three elevations were statistically different from each other. The overall cumulative mean pest severity in district Baramulla for all the altitudes was recorded highest as 10.77% in August and September followed by 7.00 and 2.16% in July and June, respectively. However, the cumulative mean pest severity on apple fruit in August and September was statistically at par with each other and differed significantly from the other months (Table-8). Perusal of data in Table-9 revealed that in district Budgam cumulative mean pest severity on apple fruit of three elevations differed significantly from each other. At high altitude, the lowest cumulative mean pest severity was recorded as 3.60% followed 4.76% in the medium altitude. However, low altitude showed the highest cumulative mean pest severity of 6.25%. The overall cumulative mean pest severity on apple fruit in district Budgam for all the altitudes was recorded highest as 7.07% for the month of August and September followed by 4.18 and 1.14% in July and June, respectively. While as, the cumulative mean pest severity on apple fruit in August and September was statistically at par with each other and differed significantly from the other months (Table-9). The present findings are in agreement with the work of Gupta (2016) [6].

Table 1: Classification of villages on the basis of elevation in two different districts

District	Elevation	Villages
Baramulla	High (1700-1800 m ASL)	Fatehgadh
		Badmul
	Medium (1600-1700 m ASL)	Buran
		Yaal
	Low (1500-1600 m ASL)	Singpora
		Kisanbagh
Budgam	High (1800-1900 m ASL)	Balpora
		Khudpora
	Medium (1700-1800 m ASL)	Nambalhar
		Krimshore
	Low (1600-1700 m ASL)	Bugam
		Chadoora

Table 2:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) on twigs of apple at different locations in district Baramulla during 2018-2019

Location	Altitude	Standard weeks												
		8th	10th	12th	14th	16th	18th	20th	22nd	24th	26th	28th	30th	32nd
Fatehgadh	(H)	1.90*	2.43	3.22	3.96	5.40	6.75	8.61	10.62	11.45	13.84	16.78	20.67	22.26
Badmul		1.69	2.27	2.86	3.93	5.32	6.57	7.84	10.42	11.39	12.97	15.05	20.21	21.38
Buran	(M)	2.48	2.76	3.66	4.58	6.58	8.18	10.48	13.07	16.75	18.31	20.46	21.68	23.34
Yaal		2.22	2.59	3.44	4.41	6.27	7.91	9.71	12.08	15.62	17.74	20.28	21.25	22.52
Singpora	(L)	3.40	3.77	4.69	5.47	7.09	11.40	15.89	20.08	24.75	27.33	28.66	29.76	31.83
Kisanbagh		3.00	3.47	4.37	5.15	6.77	10.34	14.10	18.88	23.78	26.32	28.19	29.20	31.35
Mean (%) ±SE		2.44±0.26	2.88±0.24	3.70±0.28	4.58±0.25	6.24±0.29	8.52±0.79	11.10±1.30	14.19±1.72	17.29±2.37	19.42±2.49	21.57±2.32	23.79±1.81	25.44±1.96

Location	Altitude	Standard weeks										Mean (%)±SE	Cumalative pooled mean(%) ±SE
		34th	36th	38th	40th	42nd	44th	46th	48th	50th	52nd		
Fatehgadh	(H)	18.40	16.35	14.87	13.78	12.80	11.10	7.66	6.18	4.84	3.16	10.30 ±1.26	10.05±0.25
Badmul		17.72	16.05	14.44	13.01	11.97	9.83	7.25	5.70	4.56	3.10	9.80 ±1.22	
Buran	(M)	20.42	17.11	15.30	14.36	13.39	11.98	10.58	7.23	5.57	3.60	11.82±1.37	11.58±0.23
Yaal		18.93	16.80	15.20	14.23	12.87	11.82	9.29	7.02	5.47	3.46	11.35 ±1.33	
Singpora	(L)	26.92	22.30	19.50	16.10	14.57	13.32	11.54	7.84	6.25	4.69	15.53 ±1.96	15.22±0.30
Kisanbagh		26.50	22.10	17.99	15.41	14.45	12.66	11.30	7.48	6.00	4.35	14.92 ±1.93	
Mean (%) ±SE		21.48±1.69	18.45±1.19	16.22±0.83	14.48±0.45	13.34±0.41	11.78±0.49	9.60±0.75	6.90±0.33	5.45±0.26	3.72±0.26		12.29±1.53

* Each figure is a mean of 6 observations
***** H-High altitude (1700-1800 m ASL)
*M-Medium altitude (1600-1700 m ASL)
*L-Low altitude (1500-1600 m ASL

Table 3:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) on twigs of apple at different locations in district Budgam during 2018-2019

Location	Altitude	Standard weeks												
		8th	10th	12th	14th	16th	18th	20th	22nd	24th	26th	28th	30th	32nd
Fatehgadh	(H)	0.94*	1.77	2.15	3.24	4.40	5.35	6.75	8.81	9.70	11.74	13.28	14.48	15.55
Badmul		0.71	1.54	2.02	3.05	3.71	4.96	6.09	8.20	9.26	10.88	12.10	13.70	14.87
Buran	(M)	1.60	2.10	2.83	3.87	4.87	6.64	8.07	10.29	12.98	14.22	15.11	15.97	16.89
Yaal		1.25	1.97	2.57	3.52	4.73	5.65	7.52	9.33	11.40	12.93	14.22	15.02	15.86
Singpora	(L)	2.38	3.02	3.87	4.90	6.27	9.26	12.13	14.99	17.48	19.08	20.22	21.48	22.35
Kisanbagh		1.90	2.35	3.40	4.66	6.10	8.18	11.22	13.50	16.16	17.78	19.90	20.79	21.73
Mean (%) ±SE		1.46±0.25	2.12±0.21	2.80±0.29	3.87±0.30	5.01±0.40	6.67±0.70	8.63±1.00	10.85±1.12	12.83±1.38	14.43±1.35	15.80±1.40	16.90±1.37	17.87±1.34

Location	Altitude	Standard weeks										Mean (%) ±SE	Cumalative pooled mean (%) ±SE
		34th	36th	38th	40th	42nd	44th	46th	48th	50th	52nd		
Fatehgadh	(H)	13.11	11.49	9.52	8.31	7.08	6.05	4.98	4.36	3.61	2.20	7.34 ±0.91	7.08±0.26
Badmul		12.49	10.84	8.98	7.86	6.45	5.52	4.66	4.17	3.43	1.70	6.83 ±0.87	
Buran	(M)	14.72	13.16	10.67	9.21	7.95	6.97	5.92	5.02	4.15	3.09	8.53 ±1.01	8.25±0.28
Yaal		14.17	12.35	10.18	8.82	7.83	6.89	5.57	4.76	3.90	2.93	7.97 ±0.95	
Singpora	(L)	21.10	19.24	16.76	14.65	13.55	11.74	9.05	6.95	5.32	4.01	12.16 ±1.40	11.87±0.29
Kisanbagh		20.72	18.52	16.13	14.45	13.02	11.42	8.72	6.90	4.98	3.75	11.58 ±1.37	
Mean (%) ±SE		16.05±1.56	14.26±1.49	12.04±1.41	10.55±1.27	9.31±1.27	8.10±1.12	6.48±0.78	5.36±0.50	4.23±0.31	2.94±0.36		9.07±1.44

* Each figure is a mean of 6 observations
***** H-High altitude (1700-1800 m ASL)
*M-Medium altitude (1600-1700 m ASL)
*L-Low altitude (1500-1600 m ASL

Table 4: Percent severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) at different altitudes on twigs of apple in district Baramulla during 2018-2019

Month	% severity			Mean% severity
	High altitude	Medium altitude	Low altitude	
February	1.79(1.33)*	2.35(1.53)	3.20(1.78)	2.44(1.56)^{j}
March	2.69(1.64)	3.11(1.76)	4.07(2.01)	3.29(1.81)^{i}
April	4.65(2.15)	5.46(2.33)	6.12(2.47)	5.41(2.32)^{h}
May	7.44(2.72)	9.07(3.01)	12.93(3.59)	9.81(3.11)^{g}
June	10.97(3.31)	14.38(3.79)	20.47(4.52)	15.27(3.87)^{d}
July	16.58(4.07)	19.95(4.46)	28.24(5.31)	21.59(4.61)^{b}
August	19.94(4.46)	21.30(4.61)	29.14(5.39)	23.46(4.82)^{a}
September	15.43(3.92)	16.10(4.01)	21.87(4.67)	17.80(4.20)^{c}
October	12.89(3.58)	13.71(3.70)	15.13(3.89)	13.91(3.72)^{e}
November	8.95(2.99)	10.91(3.30)	12.20(3.49)	10.68(3.26)^{f}
December	4.58(2.14)	5.39(2.32)	6.09(2.46)	5.35(2.31)^{h}
Mean	10.41(3.22)^{C}	11.93(3.45)^{B}	15.62(3.95)^{A}	

CD (P=0.05), Month (A): (0.037), Elevation (B): (0.021), Month × Elevation (A×B): (0.058)
Figure in parentheses are square root transformed values, Values superscripted by same letter (s) are statistically identical

Table 5:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) at different altitudes on twigs of apple in district Budgam during 2018-2019

Month	% severity			Mean% severity
	High altitude	Medium altitude	Low altitude	
February	0.82(0.90)*	1.42(1.19)	2.14(1.46)	1.46(1.20)^{k}
March	1.87(1.36)	2.36(1.53)	3.15(1.77)	2.46(1.56)^{j}
April	3.60(1.89)	4.24(2.06)	5.48(2.34)	4.44(2.09)^{h}
May	5.78(2.40)	6.97(2.63)	10.20(3.19)	7.65(2.74)^{f}
June	8.90(2.98)	11.00(3.31)	15.53(3.94)	11.81(3.41)^{d}
July	12.69(3.56)	14.57(3.81)	19.87(4.45)	15.71(3.94)^{b}
August	14.00(3.74)	15.41(3.92)	21.47(4.63)	16.96(4.10)^{a}
September	10.20(3.19)	11.59(3.40)	17.66(4.20)	13.15(3.60)^{c}
October	7.42(2.72)	8.45(2.90)	13.91(3.73)	9.92(3.12)^{e}
November	5.30(2.30)	6.33(2.51)	10.23(3.19)	7.28(2.86)^{g}
December	3.24(1.80)	3.97(1.99)	5.31(2.30)	4.17(2.03)^{i}
Mean	7.30(2.70)^{C}	8.48(2.91)^{B}	12.28(3.50)^{A}	

CD (P=0.05), Month (A): (0.035), Elevation (B): (0.020), Month × Elevation (A×B): (0.055)
Figure in parentheses are square root transformed values, Values superscripted by same letter (s) are statistically identical

Table 6:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) on apple fruit at different locations in district Baramulla during 2018-2019

Location	Altitude	Standard weeks									Mean (%) ± SE	Cumulative pooled mean (%)± SE
		22nd	24th	26th	28th	30th	32nd	34th	36th	38th		
Fatehgadh	(H)	1.33*	1.66	3.16	5.33	7.66	8.00	8.00	8.00	8.00	5.68± 0.96	5.42± 0.26
Badmul		1.16	1.33	2.33	4.66	6.99	7.49	7.49	7.49	7.49	5.16± 0.94	
Buran	(M)	1.99	2.66	4.49	7.50	10.83	11.50	11.50	11.50	11.50	8.16± 1.36	7.82± 0.33
Yaal		1.83	2.33	3.83	6.66	9.49	10.83	10.83	10.83	10.83	7.49± 1.29	
Singpora	(L)	2.83	3.49	5.66	9.66	12.83	13.99	13.99	13.99	13.99	10.05± 1.60	9.56± 0.49
Kisanbagh		2.33	2.99	4.83	8.16	11.99	12.83	12.83	12.83	12.83	9.07± 1.51	
Mean (%) ± Se		1.91± 0.25	2.41± 0.33	4.05± 0.49	6.99± 0.75	9.96± 0.95	10.77± 1.05	10.77± 1.05	10.77± 1.05	10.77± 1.05		7.60± 1.20

*Each figure is a mean of 6 observations and each observation comprised of 10 apples
H-High altitude (1700-1800m ASL)
M-Medium altitude (1600-1700m ASL)
L-Low altitude (1500-1600m ASL)

Table 7:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) on apple fruit at different locations in district Budgam during 2018-2019

Location	Altitude	Standard weeks									Mean (%) ± SE	Cumulative pooled mean (%)± SE
		22nd	24th	26th	28th	30th	32nd	34th	36th	38th		
Fatehgadh	(H)	0.83*	0.99	1.33	3.16	5.16	5.66	5.66	5.66	5.66	3.79± 0.73	3.52± 0.27
Badmul		0.66	0.83	1.16	2.33	4.33	5.00	5.00	5.00	5.00	3.25± 0.65	
Buran	(M)	0.99	1.16	2.50	4.49	6.33	7.66	7.66	7.66	7.66	5.12± 0.96	4.68± 0.43
Yaal		0.83	0.99	1.99	3.66	5.49	6.33	6.33	6.33	6.33	4.25± 0.80	
Singpora	(L)	1.66	1.83	3.16	6.16	8.66	9.49	9.49	9.49	9.49	6.60± 1.16	6.17± 0.42
Kisanbagh		1.33	1.66	2.66	5.66	7.16	8.33	8.33	8.33	8.33	5.75± 1.01	
Mean (%) ± Se		1.05± 0.15	1.24± 0.16	2.13± 0.32	4.24± 0.60	6.19± 0.63	7.08± 0.69	7.08± 0.69	7.08± 0.69	7.08± 0.69		4.79± 0.76

*Each figure is a mean of 6 observations and each observation comprised of 10 apples
H-High altitude (1700-1800m ASL)
M-Medium altitude (1600-1700m ASL)
L-Low altitude (1500-1600m ASL)

Table 8:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) at different altitudes on apple fruit in district Baramulla during 2018-2019

Month	% severity			Mean% severity
	High altitude	Medium altitude	Low altitude	
June	1.37(1.17)*	2.20(1.48)	2.91(1.70)	2.16(1.45)^{c}
July	5.02(2.24)	7.13(2.66)	8.85(2.97)	7.00(2.62)^{b}
August	7.74(2.78)	11.16(3.34)	13.41(3.66)	10.77(3.26)^{a}
September	7.74(2.78)	11.16(3.34)	13.41(3.66)	10.77(3.26)^{a}
Mean	5.46(2.24)^{C}	7.9125(2.70)^{B}	9.64(3.00)^{A}	

CD (P=0.05), Month (A): (0.033), Elevation (B): (0.028), Month × Elevation (A×B): (0.061)
Figure in parentheses are square root transformed values, Values superscripted by same letter (s) are statistically identical

Table 9:% severity of San Jose scale (*Quadraspidiotus perniciosus* Comstock) at different altitudes on apple fruit in district Budgam during 2018-2019

Month	% severity			Mean% severity
	High altitude	Medium altitude	Low altitude	
June	0.83(0.90)*	0.99(0.99)	1.62(1.27)	1.14(1.05)^{c}
July	2.91(1.70)	4.07(2.01)	5.57(2.36)	4.18(2.02)^{b}
August	5.33(2.30)	6.99(2.64)	8.91(2.98)	7.07(2.64)^{a}
September	5.33(2.30)	6.99(2.64)	8.91(2.98)	7.07(2.64)^{a}
Mean	3.60(1.80)^{C}	4.76(2.07)^{B}	6.25(2.40)^{A}	

CD (P=0.05), Month (A): (0.056), Elevation (B): (0.048), Month × Elevation (A×B): (0.104)
Figure in parentheses are square root transformed values, Values superscripted by same letter (s) are statistically identical

References

1. Anonymous. District wise area and production of major horticultural crops in Jammu and Kashmir for the year 2018. Department of Horticulture, Jammu and Kashmir; c2018.
2. Anonymous. Area and production of major horticultural crops for J and K. Directorate of Horticulture Kashmir; c2020. p. 18.
3. Botha A. The population dynamics and its role in controlling *Quadraspidiotus perniciosus* by *Aphytisproclia*. Bulgarian Journal of Agricultural Science. 2008;1(2):250-252.
4. Buhroo AA, Rasheed FN, Khanday AL. An assessment on population density of San Jose scale *Quadraspidiotus*

perniciosus (Comstock) (Hemiptera: Diaspididae) and its biological control in Kashmir. Munis Entomology and Zoology. 2016;11(1):33-38.
5. Edland T. San Jose scale *Quadraspidiotus perniciosus* (Comstock) a dangerous pest of many plants. Gartneryrket. 1990;80(8-9):19-22.
6. Gupta AD. Studies on the distribution and ecobiology of San Jose scale, *Quadraspidiotus perniciosus* (Comstock). Journal of Advanced Zoology. 2016a**;**16(1):23-26.
7. Nissar T, Gull A, Mir MA. Infestation rate of San Jose scale, *Quadraspidiotus perniciosus* (Comstock) in the fruit orchards of Baramulla, Kashmir, India. Journal of Entomology and Zoology Studies. 2020;8(2):928-932.
8. Sofi MA. Studies on the current status of San Jose scale *Quadraspidiotus perniciosus* (Comstock) and its management on apple. Ph. D. thesis submitted to Sher-e-Kashmir University of Agriculture Science and Technology of Kashmir; c2006. p. 158.
9. Thamariakannan M, Palaniappan G, Sengottuval C. Can India beat imports in quality and price? Facts for You; c2010. p. 7-11.