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Insect pest complex of apple nurseries at Wadura Sopore in North Kashmir

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Abstract
Apple, *Malus domestica* known as queen of fruits is the major contributor of economy to Jammu and Kashmir. Various factors (viz., diseases, insect pests, disorders, weeds etc) are responsible for limiting the production; among those insect pests are posing major threat to this industry. Present investigations were carried out at the apple nursery of Faculty of Agriculture, Wadura to study the insect pest complex, of apple nursery in the year 2017. It was evident from the experimental data that 16 insect species were recorded 2017. San Jose scale (*Quadraspidiotus pernicious*) two species of leaf roller (*Choristoneura roseceana, Rhopobota navena),* two species of flea beetle (*Altica* spp, *Chaetonema pulicaria*), four species of chaffer beetles (*Melolontha furcicauda, Brahmina* spp *Holotrichia longipennis, Oryctes* spp), Aphid (*Aphis pomi*), Two species of apple hopper Apple hopper (*Typhlocyba pomaria, Stictocephala* spp), flower eating beetle (*Protaetia speciosa*), Stink bug (*Halyomorpha hayls*), Green weevil (*Polydrusus* spp) cutworm (*Agrotis* spp) were reported to infest apple nurseries.

Keywords: apple, pest complex, infestation

1. Introduction
Apple (*Malus domestica* Borkh) is the commonly domesticated fruit tree in all temperate regions of the world. It belongs to the sub family Pomoideae and the family Rosacea and is grown in temperate and subtropical regions of the world. The apple is believed to have been originated in the Caucasus Mountains of South western Asia - Kazakhstan and China [1]. Apple, known as the 'King of temperate fruits' is the most widely grown in temperate areas of the world. It has been cultivated in Southeast Asia and Europe from times immemorial and has been spread by man in all temperate belts of the world. The chief apple producing countries are U.S.A., Germany, France, Japan, Russia, Argentina, Turkey, Italy, Spain and China [2]. History of fruit growing in Jammu and Kashmir dates back to even 2000 BC, when apples are reported to have been cultivated. Lawrence has called Kashmir a fruit country in his famous book "The Valley of Kashmir", however horticulture started in an organised form around 1865 when Ermus, Head gardener of Public Works Department in France, after preliminary survey introduced some fruit plants at Chashma-shahi, Srinagar in 1875. The horticulture sector got further encouragement with the establishment of the Department of Agriculture and Sericulture. Considering the potential of fruits in the state, a separate Department of Horticulture was carved out in 1962, which gave further fillip to the horticulture sector in the state. This was followed by establishment of Department of Horticulture Planning and Marketing and Jammu and Kashmir Horticulture Produce and Marketing Corporation in 1983 [3]. Apple grown in Kashmir holds the national and international pride for its delicacy, but fruit yield, fruit quality and even growth of the apple plants are directly influenced by a number of factors *viz*., insect pests, diseases, disorders etc. Among these factors, number of insect pests and diseases usually at all the stages of growth causing huge economic loss to growers as growers invest so much on pesticide applications. The most important pests attacking apple are, European red mite (*Panonychus ulmi* Koch), two spotted spider mite (*Tetranychus urticae* Koch), San Jose scale (*Quadraspidiotus perniciosus* Comstock), woolly apple aphid (*Eriosoma lanigerum* Hausman), hairy caterpiller (*Lymantria obfuscata* Walker), apple stem borer (*Aeolesthes sarta* Solsky), leaf roller (*Archips pomivora* Meyrick) and Blossom thrips [4]. Among these pests, San Jose scale and European red mite are key pests and cause huge economic losses. Besides these few non insect pests *viz.* rodents and bear are also posing threat in most of the apple growing areas with the intensification and monoculture of selective cultivars of apple there has been considerable increase in insect pest infestation in the state. The pest complex of apple includes a wide range of species with diverse habits. Some are confined to apple and related deciduous fruits, *viz.*, codling moth (*Cydia pomonella* Linn.), *E. lanigearum* Hausmann, whereas, others have wide range of host plants, *viz*., *Q. perniciosus* Comstock, *L. obfuscate* Walker, shot-hole borer (*Scolytus nitidus* Solsky), *P. ulmi* Koch). The incidence of these pests varies from year to year and area to area because of changes in the factors influencing their population dynamics and dispersal. San Jose scale is one of the most destructive pests, which is regularly associated with apple in Kashmir

2. Material methods
Apple nursery located at FoA, Wadura were surveyed for various insect pests during 2017 respectively. Insect specimens collected/observed from the experimental site were sent to Zoological Survey of India and IARI, New Delhi for taxonomic studies. Weekly observations were taken in the apple nursery to know the status of insect pest. Insect pests *viz.* sap suckers (aphids, hoppers, San Jose Scale, bugs), foliage feeders (Chaffer beetles, green weevil, cutworm, flea beetle, flower eating beetle, leaf roller), root feeders (white grubs) and mining insect leaf miner were recorded in the apple nurseries.
Various methods of estimation are discussed here under on the basis of the pest habitat:

2.1 Soil borne Insect Pests

Weekly observations on pests hiding in the soil debris (white grubs) were quantified by digging three pits of (20 x 20 x 21) cm^3 size near the root zone of apple plantations as per the procedure described by [5]. Mean number of grubs from three pits was calculated and correlated with important weather parameters.

2.2 Sucking insects

Among sucking insect pests aphid population was counted on the leaf basis. However, hoppers and bugs were counted on plant basis. It is well established fact that San Jose scale feeds on twigs and fruits hence, population was counted on cm^3 of the twigs/nursery plant stems. There was no need to count population on fruits as nursery plantations were not bearing fruits. Weekly observations were carried out from 10 tagged plants in the experimental plots. In addition to this non insect pests were counted on leaf basis. Population of these sucking pests was correlated with important weather parameters.

2.3 Foliage feeders

Chaffer beetles, and flower eating beetles feed on foliage of apple nursery plantations were recorded in light traps weekly and such catches in the light traps were correlated with the important weather parameters. Damage of chaffer beetles, leaf roller, flower eating beetle, flea beetle, green weevil and cutworm was calculated in the experimental plots on leaf and plant basis.

Damage percentage was calculated as

$$\text{Damage percentage} = \frac{\text{No. of damaged plants}}{\text{Total number of plants}} \times 100$$

Table 1: Pest complex on apple nursery at Faculty of Agriculture, Wadura during 2017

S. No.	Scientific name	Common Name	Family: Order	Infestation period	Peak period of infestation	Status
1	*Quadraspidiotus perniciosus*()	San Jose Scale	Diaspididae; Hemiptera	January-December	1st Fortnight of July	Major
2	1.*Choristoneura rosaceana* 2.*Rhopobota navena*	Leaf roller	Tortricidae: Lepidoptera	April-September	1st Fortnight of July	Major
3	1, *Altica spp* 2, *Chaetocnema pulicaria*	Flea beetle	Chrysomelidae: Coleoptera	May-October	2nd Fortnight of July	Minor
4	*1.Melolontha furcicauda* *2.Brahmina* spp *3.Holotrichia longipennis* *4.Oryctes* spp	Chaffer beetle	Scarabaeidae: Coleoptera	May-September	1st Fortnight of June	Minor
5	*Aphis pomi*	Aphid	Aphididae: Hemiptera	April-September	1st Fortnight of June	Minor
6	*Halyomorpha hayls*	Stink bug	Pentatomidae: Hemiptera	April –September	2ndFortnight of August	Minor
7	*Typhlocyba pomaria* *Stictocephala* spp	Apple hopper Buffalo hopper	Cicadellidae: Homoptera	April-September	1st Fortnight of August	Minor
8	*Protaetia speciosa*	Flower eating beetle	Cetonidae: Coleoptera	June-August	2nd Fortnight of July	Minor
9	*Polydrusus* spp	Green weevil	Curculionidae: Coleoptera	June-August	1stFortnight of July	Minor
10	*Agrotis* spp	Cut worm	Lepidoptera: Noctuidae	May-June	1st Fortnight of June	Minor

3. Results

Experimental findings depicted that 16 insect species were recorded during the year 2017, among these 4 insects belonged to Hemiptera; 8 to Coleoptera; 3 to Lepidoptera and 2 to Homoptera. Hemiptera includes (*Quadraspidiotus pernicious*, *Aphis pomi*, *Eriosoma lanigerum*, *Halyomorpha hayls*); Coleoptera includes (*Altica* spp, *Chaetonema pulicaria*, *Melolontha furcicauda*, *Brahmina* spp, *Holotrichia longipennis*, *Oryctes* spp., *Protaetia speciosa*, *Polydrusus* spp); Lepidoptera includes (*Choristoneura roseceana*, *Rhopobota navena; Agrotis* spp); Homoptera (*Typhlocyba pomaria*, *Stictocephala* spp).All these pests recorded in table 1 depicted that san jose scale was present throughout the year having peak period of infestation on 1st Fortnight of July while as other pests were seen active in different period of the year having different peak period of infestation. Among these pests san jose scale and leaf roller were major insects and caused severe damage to nurseries, while as others were recorded as minor pests, all these insect pests damaged plant parts like leaves, flowers twigs, roots, while as sucking insects sucked the plant sap.

4. Discussion

Although for agricultural crops, plant protection problems such as pests and diseases are the major factors decreasing apple production. Codling moth, mites, aphids, scale insects, leaf rollers, leaf miners, jewel beetles and bark beetles are the main pests and apple scab, powdery mildew, cedar apple rust, brown rot, fire blight, collar rot and apple mosaic virus are the main diseases of apple trees [6, 7]. Similarly [8], found San Jose scale, wooly aphid, Tortricid moth, hairy caterpillar, stem borer etc on apple [9]. reported San Jose scale, wooly aphid, tent caterpillar, European red mite, codling moth, root borer, stem borer, Indian gypsy moth and bark beetle infesting apple. A number of white grub species have been reported in Jammu and Kashmir State. These include *Protacta neglecta* (Hope), *Melolontha furcicauda*, *Hilyotrogus holosericus* (Redt), *Articaphia battalina* (Bates), *Adoretus ladakansis*, *Adoretus* sp., *Brahmina* sp., *Heteronychus subhoeois* [10]. Recently, *Holotrichia longipennis*, *Anomala dimidiata*, *Brahmina flavosericea*, *Brahmina coriacea*, *Maladera* sp. and *Anomala rufiventris* have also been recorded damaging economically important crops [11].

Our results were in close conformity with [12] during their surveys, reported 19 pest species belonging to 4 orders. Among these codling moth and mites were observed in all experimental locations. Apple leaf roller, San Jose scale and leaf miners were pests frequently found in some locations. Apple ermine moth, aphids and coccids were rarely

observed in some orchards but reach economical threshold time to time. *Scolytus mali* and *Capnodis* species were mostly found in old and neglected orchards. The variation of experimental results from co-workers might be attributed due to changes in weather parameters and locations. It is clear that weather parameters have an important role on development of insect pests.

5. Conclusion

Pests belonging to different insect orders were reported during the investigation infesting plants parts like leaves, flowers, and roots. Among these pests San Jose scale, leaf rollers were recorded as major pests, and San Jose scale was present throughout the year. Apple leaf roller damaged the apical portion of plants as a result infested plants become weak and prone to other diseases like dieback. Further investigations are needed to study the pest complex of apple nurseries, so that nursery growers would b able to produce quality material.

5. References

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