Short Communication

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Management of leaf gall midge and stem capsule borer in aonla

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The aonla (*Emblica officinalis* Geartn) belonging to family Euphorbiaceae and sub family Phyllanthoidae is an important indigenous fruit tree of india. It has great medicinal and nutritional value. It is also now- a days gaining popularity among farmers and consumers and has immense potential of cultivation in arid and wasteland. In Rajasthan, it is being cultivated in area of 1,565 ha with an annual production of about 11,187 tons (Anon, 2017). The aonla fruits are a rich source of Vitamin C. The special attribute is its capacity to retain Vitamin C even in a dried stage which is not possible in other fruits. One part or other is used in the cure of cough, bronchitis, jaundice, diabetes, dyspepsia, diarrhea and fever. Fruit pulp contains 14 g of carbohydrate, 0.5 g protein, 1.2 g iron, 0.3 mg vitamin B and 600 mg of Vitamin C per 100g. The probable centres of origin are the South and Central India, Sri Lanka, Malaysia and South China. Though aonla is a subtropical fruit, it thrives very well and comes to yield in tropical humid conditions also. Aonla was supposed to be free from major insect and disease menace. With lapse of time and intensification of its cultivation, number of insects and diseases has started feeding and infecting at various stages and causing considerable damage. Lal *et al*. (1996), Haseeb *et al*. (1990, 2000), and Jhala *et al*. (2003) reported occurrence of fruit borer, midge and leaf cutting weevil for the first time in northern and western India. Though, it is considered to be a hardy fruit crop, not less than 30 insect and mite species have been recorded feeding on this scared tree from different places, mostly from India (Lakra, 1996). Aonla is a widely cultivated arid fruit crop and severely affected by stem capsule borer (*Betousa stylophora* Swinhoe) and leaf gall midge (*Asphondylia phyllanthi* Felt) causing having losses in fruit yield. The larva of *Betousa stylophora* feeds inside the gall on the succulent woody tissues and pushes out excreta through a small hole at one end, kept guarded by a mesh work of silken threads. There is only one larva in each gall which remains confined in an ellipsoidal cavity carved out in gall. The mature galls measure 20-26 mm in length and 10-15 mm across. The gall is a hollow swelling/localized tumescence of the tender shoot, irregular, roughly, spindle shaped- resembling 'Snake charmer's flute'. In the beginning of the infestation terminal shoots swell, which increases in size with the passage of time, full size galls can be seen in the month of October-November.

Asphondylia is a large genus, with a world-wide distribution. It comprises medium- or large-sized, brown, red or black coloured midges, which breed by preference in leaf and flower galls. Seven Indian species of this genus have been described so far. In Rajasthan, the area under aonla cultivation has increased over years and farmers are facing the problem of insect -pests. The present investigation were carried out to find out estimation of avoidable losses caused by leaf gall midge and stem capsule borer in aonla orchards under arid region of Rajasthan.

The experiment was carried out at Asalpur farm, SKN College of Agriculture, Jobner, Distt- Jaipur (Rajasthan) for six consecutive years (2012-2017). The experiment was consisted of four treatments including untreated check with Randomized Block Design (RBD) using aonla variety "Krishna NA-5" with five replications. Four plants were selected in each replication. The treatment were T_1 : Leaf gall midge control (stem capsule caterpillar infested)-Three foliar sprays with Imidachloprid 17.8 SL@0.3 ml/ltr starting from March at 20 days interval. T_2 : Stem capsule caterpillar control (Leaf gall midge infested) Two sprays of spinosad 45 SC @ 0.1 ml/lt at monsoon initiation at 20 days interval followed by removal of twigs (infested). T_3 : Leaf gall midge and stem capsule caterpillar control (T_1+T_2) and T_4 : Untreated checked (infestation of both).

For observation on leaf gall midge, *Asphondylia phyllanthi* three branches were selected and tagged. Observations on leaf gall midge were recorded by observing five twigs on each branch. Number of damaged (having folded leaflets) and healthy leaves, 30 days after completion of three spray and overall fifteen leaflets per plant were observed and then percent damaged leaves due to leaf gall midge was worked out.

After thirty days completion of all sprays from these three branches damage intensity (%) were recorded on five leaves on each branch and then percent damaged leaves due to leaf gall midge was worked out.

For observation on stem capsule caterpillar, *Betousa stylophora*, three branches were selected and tagged. Per cent damage twig due to stem capsule caterpillar, *Betousa stylophora* was worked out by counting of total as well as damaged twig (twig having capsule made by the pest) of per tagged three branches per tree, 30 days after the treatments. The insecticides imidachloprid 17.8 SL@0.3 ml/ltr used in treatment (T_1) and spinosad 45 SC @ 0.1 ml/lt were used in treatment (T_2) and both the insecticide were used in treatment

(T_3) and untreated check were tested in present investigation. One prophylactic spray was made before appearing the pest and subsequent spray made after appearance of damage symptoms on leaf by leaf gall midge and on twig by stem capsule caterpillar. The percent damage of leaf gall midge was recorded on the basis of damaged and healthy leaves and data obtained in percentage were statistically analyzed for analysis of variance after transforming the data into angular transformation values (Bliss,1937). The percent damage of stem capsule caterpillar was recorded on the basis of damaged and healthy leaves and data obtained in numbers were statistically analyzed for analysis of variance after transforming the data into v$\underline{X}$+0.5 values. (Bliss,1937)

The infestation of *Betousa stylophora* was started from June month and relatively higher in the month of July and maximum incidence was observed during September month. The pest survives till the end of December month. The female lays eggs singly on the surface of twigs and shoots of new flush in June-July, preferably near or at the growing tips of branches. The larval activity slows down during winter but the larva resume feeding with the onset of spring season and becomes full grown by April- May.

The infestation of *Asphondylia phyllanthi* were observed on the leaves and shoots in *orchards , the* galls were formed between February and May, and maximum incidence was observed during September month and were oval, scaly, hollow, soft, dehiscent and sessile. The infestation damaged the auxiliary buds, inhibiting growth and normal branching.

On the basis of pooled data (2012-2017) revealed that minimum number of capsule caterpillar damage was found in (T_3) imidachloprid 17.8 SL @0.3 ml/lt and spinosad 45 SC @ 0.1 ml/lt followed by removal of infested twigs treated plot (3.23) in number in comparison to followed by individual plot treated with (T_2) spinosad 45 SC @ 0.1 ml/lt followed by removal of infested twigs (5.03) in number and (T_1) imidachloprid 17.8 SL @0.3 ml/lt (12.27) in number. The treatment (T_3) imidachloprid 17.8 SL @0.3 ml/lt and spinosad 45 SC @ 0.1 ml/lt was found significantly superior over rest of the treatment and at par with the treatment (T_2) spinosad 45 SC @ 0.1 ml/lt in their efficacy for the control of capsule caterpillar damage in aonla.

Minimum number of leaf gall midge damage was found in (T_3) imidachloprid 17.8 SL @0.3 ml/lt and spinosad 45 SC @ 0.1 ml/lt treated plot (9.72%) in comparison to followed by individual plot treated with (T_1) imidachloprid 17.8 SL @0.3 ml/lt (16.82%) and (T_2) spinosad 45 SC @ 0.1 ml/lt (37.39). The treatment (T_3) imidachloprid 17.8 SL @0.3 ml/lt and spinosad 45 SC @ 0.1 ml/lt was found significantly superior over rest of the treatment in their efficacy for the control of leaf gall midge damage in aonla (Table 1). These results were in agreement with Bharpoda et al. (2009) and Patel et al. (1999) who reported that *Betousa stylophora* Swinhoe was a major pest of aonla and cause maximum infestation of *B. stylophora* during second fortnight of August and also reported that pest commenced from first fortnight of June. Nayar *et al*. (1976) and Uma and Verghese (2008) reported a gall formers on aonla crop and cause damage. The treatment (T_3) was found significantly superior over rest of the treatment including untreated plot for the control of both the pest occurring on aonla crop, twig damage by stem capsule caterpillar and leaf damage by leaf gall midge in aonla.

Table 1. Comparative incidence of different pests (2012-2017)

Treatments	2012		2013		2014		2015		2016		2017		Pooled 2012 -2017	
	Capsule caterpillar damage (Number)*	Leaf gall midge damage (Percentage)**	Capsule caterpillar damage (Number)*	Leaf gall midge damage (Percentage)**	Capsule caterpillar damage (Number)*	Leaf gall midge damage (Percentage)**	Capsule caterpilla damage (Number)*	Leaf gall midge damage (Percentage)**	Capsule caterpillar damage (Number)*	Leaf gall midge damage (Percentage)**	Capsule caterpillar damage (Number)*	Leaf gall midge damage (Percentage)**	Capsule caterpillar damage (Number)*	Leaf gall midge damage (Percentage)**
T_1	10.80 (3.77)	27.18 (23.87)	11.40 (3.44)	15.00 (22.88)	12.40 (3.58)	15.48 (23.12)	14.40 (3.83)	15.86 (23.52)	13.20 (3.68)	13.37 (21.42)	11.40 (3.45)	14.01 (21.94)	12.27 (3.63)	16.82 (22.79)
T_2	4.00 (1.28)	57.37 (49.40)	3.40 (1.96)	31.00 (34.06)	4.40 (2.20)	31.04 (33.91)	6.20 (2.58)	34.86 (36.16)	6.40 (2.61)	35.86 (6.75)	5.80 (2.50)	34.20 (35.74)	5.03 (2.19)	37.39 (32.67)
T_3	2.80 (0.91)	21.37 (27.40)	2.20 (1.62)	11.00 (19.53)	3.40 (1.91)	9.91 (18.34)	3.40 (1.97)	6.01 (14.13)	4.00 (2.09)	5.21 (13.13)	3.60 (2.00)	4.79 (12.10)	3.23 (1.75)	9.72 (17.44)
T_4	25.75 (7.12)	81.43 (70.91)	24.80 (5.02)	45.00 (41.92)	25.80 (5.12)	44.16 (41.63)	26.20 (5.15)	40.49 (39.49)	29.20 (5.40)	43.34 (41.25)	31.00 (5.68)	44.43 (41.79)	27.13 (5.58)	49.81 (46.17)
SEM ±	0.93	1.81	0.12	0.16	0.11	0.33	0.09	0.62	0.14	0.62	0.16	0.36	0.16	0.35
CD at 5%	2.81	5.63	0.37	0.48	0.34	0.99	0.27	1.86	0.42	1.88	0.47	1.09	0.44	0.96

*One month after treatment ** One month after 3 spray

Values given in Parentheses are v$\underline{X}$+0.5 and angular transformed values.

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