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RESEARCH ARTICLE

BIOLOGY OF *ALCIDODES SIGNATUS* ON *PHASEOLUS VULGARIS* L. FROM KISHTWAR (J&K, INDIA)

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ABSTRACT

Phaseolus vulgaris popularly known as Rajmash is characterised as a nearly perfect food cultivated throughout the globe for its edible fruit either the green pods or dry seeds. It is an important economic crop acting as ready cash for the growers. Because of having so much food value and economic importance, it becomes an important aspect to know more about this crop. Keeping this in view, the present work was done for the first time in the District Kishtwar of Jammu and Kashmir state. During investigation several insects were found causing significant damage to the standing crop and out of all, *Alcidodes signatus* (Coleoptera:Curculionidae), a gall inducing weevil was recorded as a major insect pest. Adults and grubs both feeds upon the host plant but grubs were seen more destructive. After hatching, the grubs tunnels inside the stem or branches and makes galleries where they pass all its larval stages. Infestation results in the formation of a characteristic rough nodule like structure known as galls on the stem and branches of plant and thus decreases the yield as well as the market value of this important cash crop of the area.

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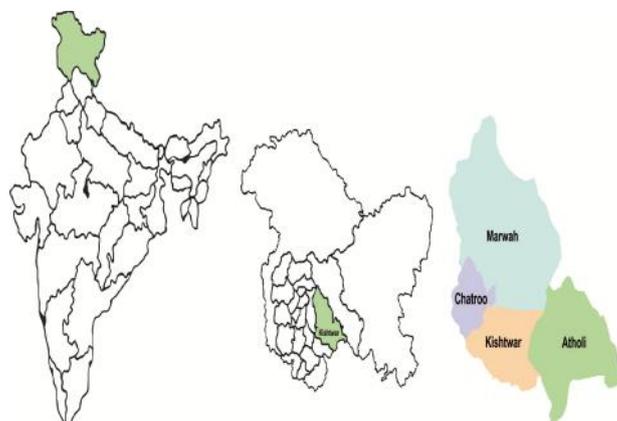
INTRODUCTION

Primitive men begun as food gatherers but as the time passed and number of human grew, food production was the solution. Without agriculture, a measureable degree of civilization was not possible. In agriculture, cultivation of pulses is an essential part. Pulses are basic ingredients in the diet of majority of Indian population as they are a good source of proteins especially to the vegetarian people. Out of many pulses grown in Jammu and Kashmir, *Phaseolus vulgaris*, popularly known as rajma is the worth mentioning. District Kishtwar is richly endowed by nature with flora and fauna. There are many things which are given to its credit by the nature, out of which the Rajmash cultivation is famous throughout for its taste and aroma. It is an important cash crop grown in the area and potential host of several insect pests. These insects attack the crop at different stages during their life cycle so the protection of standing crop from insect infestation is very demanding. Despite the immense need, no research work regarding the insect pest documentation of *Phaseolus vulgaris* has been done in Kishtwar area so far. However many workers viz. Barwal from Meghalaya (1990), Sachan and Garg from Uttar Pradesh (1992) Abrol *et al.* from Bani (2006) have studied the insect pests of *Phaseolus vulgaris* in India. But information in this regard is lacking from Kishtwar where this crop is very

famous. Keeping this in view, the present research work was done in the district Kishtwar during the cultivation season of *Phaseolus vulgaris* from mid of April to mid of October 2014.

MATERIAL AND METHODS

This study was carried out in the study area Kishtwar from April to mid October, 2014 at four different stations i.e Kishtwar, Atholi, Marwah and Chatroo (as shown in map) in the crop fields and also in the makeshift lab.



Maps showing the location of study site Kishtwar, J&K, India

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The standing crop was scanned properly and *Alcidodes signatus* was found as one of the major pest. Infested twigs having eggs were collected from the crop fields and were placed in the makeshift lab. Insect pest passes its entire larval period inside the stem feeding upon the soft tissue of plant. Larvae are internal feeders and remain inside a swelling known as gall. To determine the individual larval period, newly hatched larvae and subsequent larvae of different stages were collected and subjected to Dyar's law for subsequent analysis. To determine the pupal period, mature larvae collected from infested plants were observed at regular intervals till the emergence of adults. The mode and extent of damage caused by the adults as well as by the larvae were studied both in the crop fields and under makeshift lab conditions by observing the symptoms of damage.

RESULTS

Present study includes observation of following biological aspects during life cycle of *Alcidodes signatus*, a major insect pest of *Phaseolus vulgaris* in Kishtwar of J&K, India;

Copulation

During copulation male *Alcidodes signatus* supermounts its female using its pro, meso and metathoracic legs. Copulation lasts for about 35- 40 minutes in the field while under controlled conditions the couple showed copulating behaviour for about 38 to 45 hours. Early mornings and evening time was preferred for showing this behavior.

Table 1 Morphometry of body length and head capsule of various instars of *Alcidodes signatus*

Stages	Body length			Body width			Head width		
	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
Larvae									
1 st	1.12	1.39	1.25±0.10	0.45	0.56	0.49±0.04	0.46	0.5	0.48±0.01
2 nd	1.58	2.6	1.94±0.39	0.47	1.1	0.71±0.25	0.51	0.76	0.60±0.09
3 rd	4.9	5.5	2.51±2.28	1.42	2.0	1.73±0.23	0.9	1.1	1.04±0.06
4 th	6.7	8.0	7.34±0.54	2.1	3.1	2.68±0.40	1.2	1.6	1.45±0.16
5 th	8.7	12.2	10.22±1.28	4.0	5.0	4.5±0.41	1.6	1.9	1.77±0.12

Table 2 Table showing period of development during life cycle of *Alcidodes signatus*

Life Stage	Duration (days)
Copulation	35-40 min. (37.6 ± 2.07)
Incubation period	4-7 (5.4 ± 0.53)
Oviposition	5-6 (5.5 ± 0.5)
Larval period	38-50 (43.8 ± 4.9)
Pupal period	12-13 (12.4 ± 0.41)
Life cycle duration	58-70 (64.2 ± 4.5)

Oviposition

After copulation is a done, the couple disperses. Female moves over the plant for selection of suitable site for egg laying. Soft, tender stem and branches are best spots in this regard as female find these easy to tear. Female encarves a small hole on the selected site using her snout and then insert her ovipositor inside it for laying eggs. Female *Alcidodes signatus* donot lays eggs in cluster but lays it at rate of single egg per hole. In some branches 2 – 3 eggs were seen but in some only one egg was found.

Egg

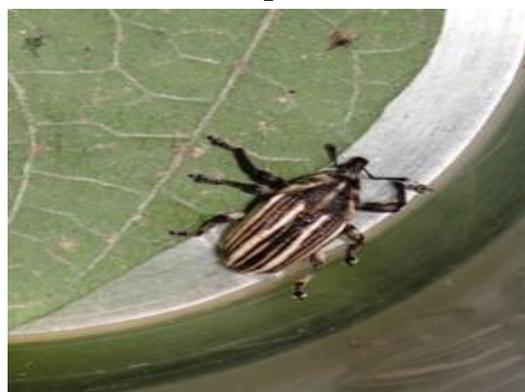
Female lays shiny, yellowish white, cylindrical shaped eggs having round ends during the mid of June. It measures 0.9 – 1.45 mm in length and width lies between 0.5 – 0.91 mm.



1



2



3



4



5



10



6



11



7



12



8



13



9

Figure 1 Different stages during biology of *Alcidodes signatus*: 1) Spread of Crop, 2) Male *Alcidodes signatus*, 3) Female *Alcidodes signatus*, 4) Copulation, 5) Egg, 6) Newly hatched larva with egg cover, 7) Larvae feeding inside the stem, 8) Gall formation, 9) Pupa, 10), 11), 12) & 13) Damage caused by *Alcidodes signatus* on *Phaseolus vulgaris* L.

Incubation period

Incubation period which causes emergence of small, yellowish white apodous larva from egg varies from 4- 7 days with an average of 5.4 ± 0.53 days. However, Azam (2008) reported incubation period of 5-7 days with an average of 5.8 ± 0.25 days in Poonch area.

Larval Stages

The larvae of *Alcidodes signatus* are internal feeders i.e. remains inside the stem and branches till emergence of adult. As the larval phase is completed inside stem so for determining the number of larval stages an important formula i.e. Dyar's law was used. This law speaks "width of head capsule of larva in its successive stages follows a regular geometrical progression". The law finds its applicability in those cases where moulting of larvae cannot be seen easily. Larval stages shows marked similarities with one another and differs in the size only. First larval instar is shining, yellowish white, legless, slightly curved covered with minute hairs. Prominent head with bidentate mandibles was found. Segmentation of the body not distinguished. This larva starts feeding upon the soft tissue of the stem. As the size of larva grows, it needs more space which it gets by gnawing around. This feeding behaviour causes the swelling of stem and leads to formation of a wart like structure called gall. Fresh galls are light green in colour but with growth it turns brownish. Fifth instar is large, white coloured apodous larva and with visible segmentation. Mandibles are prominent and dark brown. Total larval period remains for about 38-50 days. Morphometric studies regarding the larval forms shown in the Figure 1 while the developmental period of various stages is shown in Figure 2.

Pupa

The final instar stops feeding and becomes compact with slight swelling. It utilises the used tissue and prepares a pupal chamber for itself. Mature larva changes into light whitish exarate pupa. As the pupation proceeds the colour of pupa turns dark. Size of pupa ranges between 10.5-12 mm in length and 4- 5 mm (width). After transformation into adult it remains inside the gall till its soft body turns hard. Pupation remains for 12-13 days.

Adult

Adult is a weevil with long snout bearing mouth parts, dorsal side of body convex, elytra having alternate black and grey strips. Head small, rounded which tapers anteriorly into slightly curved snout. Snout bears mandibles and a pair of eyes. Antenna is geniculate type. Male is smaller and dull in appearance than female. Female is shinny, larger in size having broader abdomen. Size varies from mm 8.2- 13.2 mm in length and 4- 4.8 mm in width. Adults are able to show short flights.

As the standing crop of *Phaseolus vulgaris* is harvested in the mid October, *Alcidodes signatus* shifts to cracks, crevices and left stalks of crops and exhibit the phenomenon of winter sleep till the next crop season of *Phaseolus vulgaris*.

DISCUSSION

Nature has endowed Kishtwar with many blessings in which Saffron, Sapphire, Kala zeera and Rajmash (*Phaseolus vulgaris*) are worth mentioning. Besides its best taste and health benefits, *Phaseolus vulgaris* is an important cash crop of the area.

As we know that insect pests are significantly important in decreasing the yield of crops so it is important to know more about them in order to minimize the loss. Out of four study sites, maximum infestation was reported from main Kishtwar station. Abrol *et al.* (2006) recorded 95% damage at Bani while Azam (2007) reported 56.07% damage at Rajouri. The infestation values observed during the present study lies between 40% at Chatroo to 52% at main Kishtwar. Barwal (1990) has studied bean weevil, *Alcidodes signatus* Boh. as a pest of temperate beans in Shillong and Kullu and has found that feeding of grubs causes formation of galls. Adults fed on the soft tissues by excavating through the pith. Abrol *et al.* (2006) recorded 8 species of insects which cause considerable damage to red kidney beans (*Phaseolus vulgaris* L.) from Bani region of Jammu and Kashmir. They described *Alcidodes signatus* and *Cyaneolyta coerculea*, as the insect pests of red kidney bean. Azam (2008) who was working on the weevil diversity of Rajouri and Poonch also found *Alcidodes signatus* affecting the growth of *Phaseolus vulgaris*. The duration of life cycle in this research work was found between 58 -70 days. However, Azam (2008) has calculated the duration of total life cycle of *Alcidodes signatus* between 56 -62 days. Perhaps the climatic variability and weather parameters could be the reason behind this variation in readings as Kishtwar and Poonch are at different geographical locations.

CONCLUSION

In India amongst various sectors of economy, agriculture plays a prominent role in generating income for the country. However, the agricultural sector faces significant losses due to pests and their diseases. The damage caused by insect pests is one of the primary factors leading to reduced production of major crops. Many workers are doing their research in this regard on variety of economical important crops. This study was also designed with motto to know more about the insect pests associated with *Phaseolus vulgaris* L. at one of the remote district of J&K state. The findings recommend that certain preventive measures should be used against this *Alcidodes signatus* so as to minimise the extent of damage caused to this crop by its larvae and adult as well. This will help to minimize the loss in the yield of this most important cash crop of Kishtwar.

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