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RESEARCH ARTICLE

BIOLOGICAL STUDY OF THYSANOPLUSIA ORICHALCEA ON PHASEOLUS VULGARIS FROM KISHTWAR, J&K, INDIA

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ABSTRACT

Agriculture is one of the most important industries in India. In agriculture, cultivation of pulses is an essential aspect. It acts as a source of food, nutrition and generates revenue for the country as well. Out of many pulses grown in Jammu &Kashmir, *Phaseolus vulgaris* commonly known as Rajmash is worth mentioning. District Kishtwar of J&K state is best endowed by nature in having rich biodiversity. Rajmash (*Phaseolus vulgaris*) grown in this area is famous throughout India for its best taste and aroma. Besides its important food value, it also acts as ready cash for the growers of the district. Due to such significance, 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. During observations, a number of insects were found causing significant damage to the standing crop and out of all, *Thysanoplusia orichalcea* (Lepidoptera: Noctuidae), a defoliating moth was recorded as a serious insect pest. Adult moth visit crop plant and lays eggs on the lower side of leaves. Larval stage exhibits the destructive phase. Freshly emerged larvae show scrapping of epidermal part of leaves while the maturing larvae feed voraciously on entire leaves even upon the veins and midribs of leaf. This behaviour of larvae interferes with the photosynthetic activity of plant and affects growth of plant. Infestation results in the skeletionization of the leaves, thereby, affecting badly the yield of this important cash crop of the area.

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INTRODUCTION

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. Rajmash (*Phaseolus vulgaris*) is the 'king of pulses' being cultivated for its edible pods and seeds. Kishtwar is known for its Rajmash cultivation. Insects cause significant damage to the crop plant in their attempt to secure food. These insect pests attack crop at different stages of their life cycle and damages the standing crop. This calls for the protection of Standing crop against these insect pests and thus minimising the loss in this crop yield. Despite the eager need, no research work has been done on the documentation of insect pests associated with *Phaseolus vulgaris,* an important cash crop of District Kishtwar. However many workers have worked on the insect pests of *Phaseolus vulgaris* from other parts of India like Barwal from Meghalaya (1992), Sachan and Garg from Uttar Pradesh (1992), Abrol *et al* from Bani (2006). But information is lacking in this regard from Kishtwar. Keeping this in view, the present research work was done in Kishtwar for the first time from April to October, 2014.

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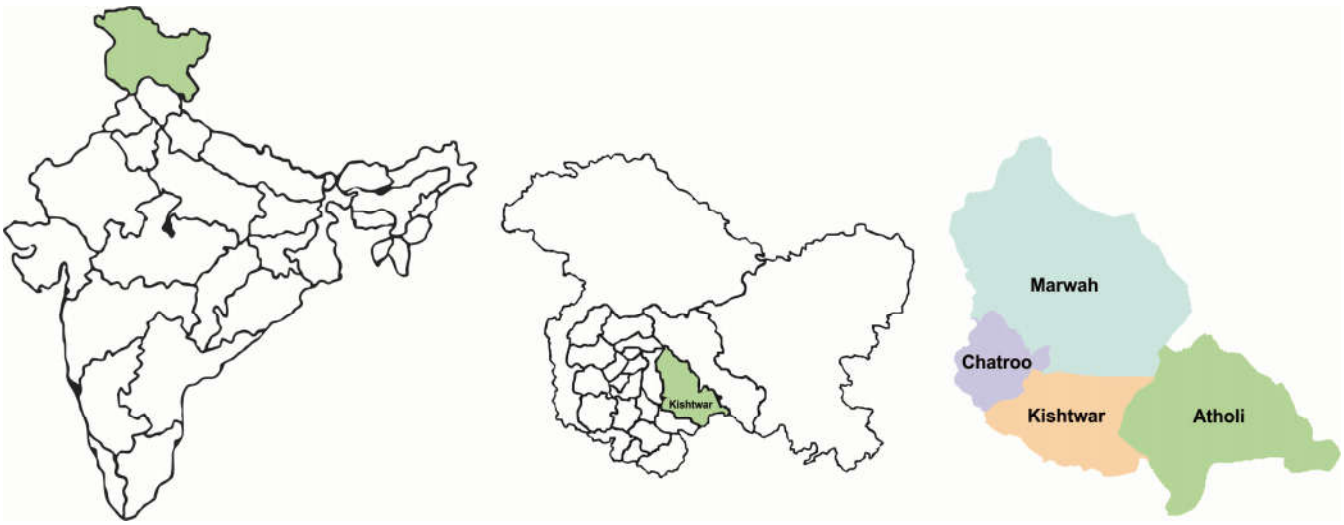
Thysanoplusia orichalcea is a noctuid moth commonly known as slender burnished moth and Golden wing moth. It is also called as green semilooper but it is not a member of looper moth family. It is a Polyphagus insect pest feeding upon economically important crops like Soyabean (Laute, 2015) Sunflower (Goel *et al*., 1987). The present study has found the association of *Thysanoplusia orichalcea* on *Phaseolus vulgaris* as a major pest in Kishtwar, for the first time.

MATERIALS AND METHODS

The present research work was carried out in the study area Kishtwar (see in the map given below) during the cultivation season of *Phaseolus vulgaris* from mid of April to ending October, 2014. The study site was divided into four different stations covering four tehsils of the said District i.e Kishtwar, Chatroo, Atholi and Marwah. The observations were made in the satnding crop fields and in the makeshift laboratory as well. During studies, *Thysanoplusia orichalcea* was found as one of the major insect pest. Adult Female lays eggs on the lower side of leaves. The leaves infested with eggs were plucked and taken to the make shift laboratory for studying the biology of the pest. Larval stage exhibit the damaging phase of moth's life. Fresh leaves of *Phaseolus vulgaris* were used to feed



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

larval stages. The mode of damage was also studied. Morphometric studies were studied using traditional graph paper method. Photography was done to show the different stages during life cycle of *Thysanoplusia orichalcea*.

RESULTS

In the present investigation, following aspects were observed while studying of biology and life cycle of *Thysanoplusia orichalcea*, a major pest of *Phaseolus vulgaris* in Kishtwar of J&K, India;

Copulation

Thysanoplusia orichalcea is a noctuid moth i.e they are active at night. They prefer night hours and early mornings for copulation. The couple join in such a manner that abdomen of one comes in close contact of other. Copulation takes about 1 – 1.5 hours and then the couple separates.

Oviposition

After copulation, the female lays eggs on the lower surface of leaves. The moth lays single egg at a time but sometimes eggs were laid in cluster. Egg is shiny, round, creamish with greenish tinge. Egg is 0.5- 0.7mm in length and 0.4- 0.5mm in width.

Incubation

Incubation leads to the hatching of a small worm like larva from egg, representing ist instar stage. Incubation duration was recorded between 3.5 – 5.0 days. As the egg proceeds for hatching, change in the colour of egg was observed from shiny creamish to dusty brown.

Larval stage

The larvae of *Thysanoplusia orichalcea* represents the damaging phase and affects the development of crop plant. The caterpillars show a characteristic half loop movement and thus acquires semilooper as a common name to its credit. Newly hatched larvae feed by scrapping upon the epidermis of leaf thereby, making translucent feeding windows on leaves. The maturing larvae show voracious attack and engulf the leaves including their vein and midrib part. This pattern of feeding makes this noctuid moth to fit under the category of skeletionizor and defoliator insect pest. Newly hatched larvae are small, greenish. Mature instars show presence of two white coloured lateral lines running over the entire body. 4th and 5th instar posses an extra blackish mid dorsal line with prominent black head. It took 15- 20 days to complete larval phase. Table no. 1 shows the morphometric calculations of five larval stages observed during the study.

Prepupa

After voracious feeding, mature 5th instar contracts its body, appendages and stops feeding. This marks the prepupal behaviour of the moth. It is a shorter phase and remains for about 1-1.2 days.

Table 1. Morphometric calculations of different larval stages during life cycle of *Thysanoplusia orichalcea*

Stage	Length (mm)	Breadth (mm)
First Instar	2-3	0.3- 0.5
Second Instar	7.5- 10	1- 1.3
Third Instar	16- 18	2-3
Four Instar	23- 25	3.5- 4.0
Five Instar	33- 36	4.5- 5.5

Pupa

As the Prepupa has contracted its appendages, it usually falls on the ground and rests in the leaves debris near the crop plant. It starts to spin white silken cocoon around and secures it externally by leaf fold. Pupa is obtect type. Early pupa is light cremish in colour which turns into dark brown towards maturity. It was observed that male pupa was slightly smaller than female pupa in size. Pupa size ranges between 19- 23.5 mm (length) and 4.5- 6.0 mm in breadth. Pupal period was

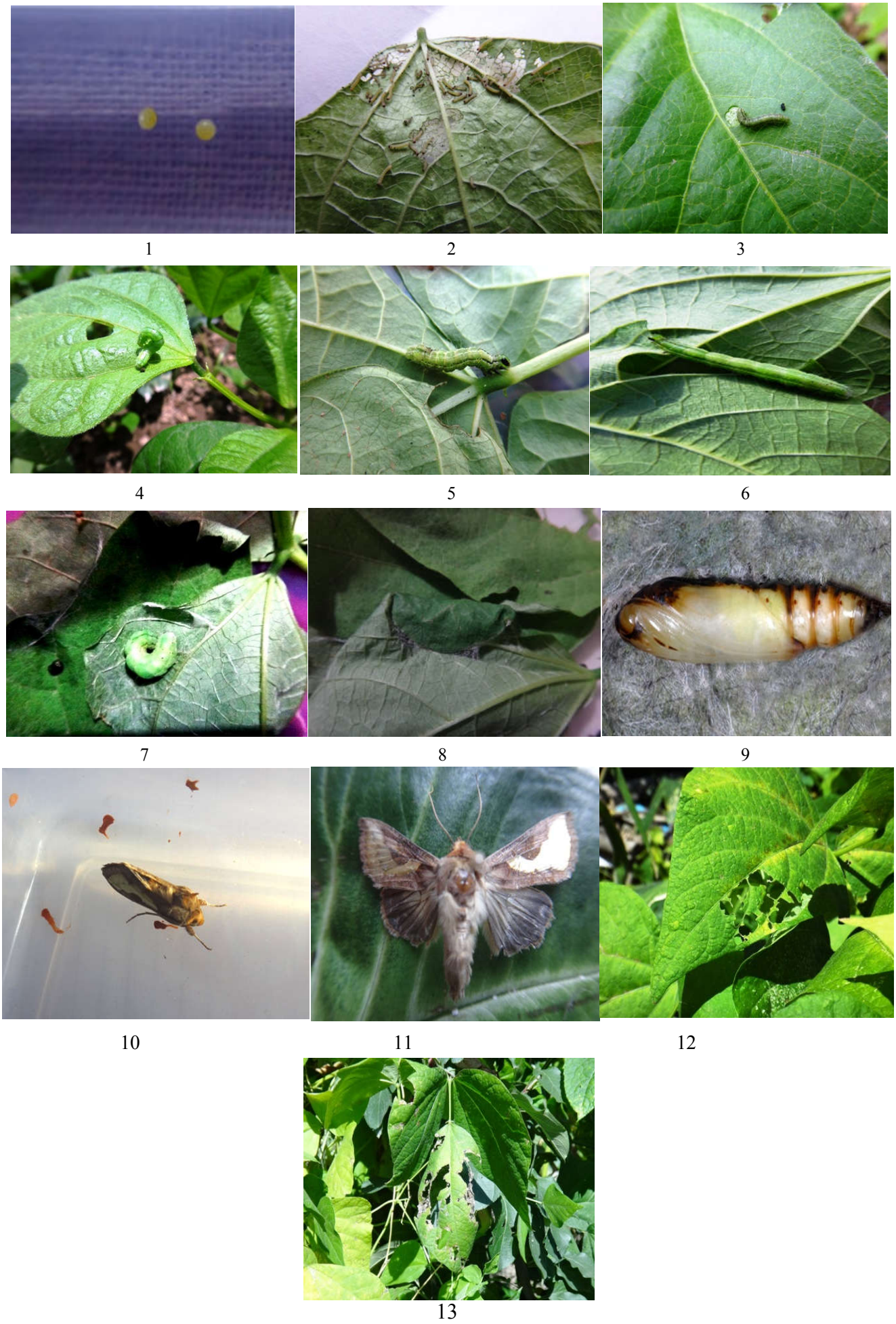


Figure 1. Different biological stages during life cycle of *Thysanoplusia orichalcea*: 1) Freshly laid eggs 2) Newly hatched larvae 3) 2nd stage larva 4) 3rd stage larva 5) 4th stage larva 6) Mature larva 7) Pre Pupa stage 8) Pupal chamber 9) Pupa inside pupal fold 10)Newly emerged moth 11) Adult *Thysanoplusia orichalcea* 12) and 13) Damage caused by *Thysanoplusia orichalcea* in the standing crop of *Phaseolus vulgaris* at Kishtwar

observed between 14- 15.5 days. Table 2 shows the development period of various life stages observed during the present study.

Table 2. Development Period of various stages observed during life cycle of *Thysanoplusia orichalcea*

Life Stage	Duration (in days)
Copulation	1.0- 1.2
Incubation	3.5- 5.0
Larval Period	15.0- 20.0
Prepupa Period0	1.0- 1.2
Pupal Period	14.0- 15.5
Total Life Cycle	34.5- 43.7

Adult

Adult punctures an escape hole and comes out of pupal chamber. While emerging out of pupal case, it secretes brick red coloured liquid. After emergence, adult keeps vibrating its wings. Adult is a noctuid moth with smooth, filliform antennae and a characteristic golden patched forewing. Abdomen is flurry and covered with velvet like hairs. Hind wing is greyish brown with darker margins. Total life cycle takes about 34.5-43.7 days. Male moth is slightly smaller in size than female. Size varies from 20- 21.5 mm (length) in case of female while 18- 19.5 mm (length) in male. Wings being a characteristic feature, so due attention was given to study the wing span of adult moth. Wing span of female was recorded as between 35-38.5mm. Male being smaller shows smaller wing span of 30-32mm (length). As far as the adult longevity is concerned, females have shorter life span and die first.

DISCUSSION

Insect pests are significantly important in decreasing the yield of crop so it is needed to protect crop from the attack of these insect pests. Keeping this in view, the present research work was done in district Kishtwar for the first time. However, *Thysanoplusia orichalcea* has been studied as insect pest of soyabean by Laute *et al*. (2015) and observed the incubation period of 2.8 days. They reported the larval period and pupal period of 16- 23 days and 6- 7 days respectively. Some earlier worker Basu and Chatterjee (1969) studied the larval period as 16- 29 days.

Different workers had given different values for adult longevity. Laute *et al*. (2015) reported adult female survived for 6 to 7 days with an average of 6.40 days and adult male survived for 7 to 8 days with an average of 7.40 days while Goel and Kumar (1987) reported the longevity of male and female moths as 7.40 and 6.4 days. These results show variation from the calculations observed in present study. Perhaps the variant climatic conditions could be responsible for this change. Also the earlier workers have studied the association of *Thysanoplusia orichalcea* on Soyabean while the present study has been carried out on *Phaseolus vulgaris*, an important cash crop of Kishtwar.

Conclusion

In Kishtwar, agriculture is a major occupation. A number of crops are being cultivated in the area but the most important is Rajmash (*Phaseolus vulgaris*). The present study is a pioneer step in the documentation of insect pest associated with rajmash. *Thysanoplusia orichalcea*, a polyphagous moth has been reported as a major insect pest on *Phaseolus vulgaris* in Kishtwar for the first time.

The larval stage represents the destructive phase. Larvae targets on the leaves of this plant and leads to defoliation. This affects the developement of plant and thus affects the production and yield. It is recommended to develop certain protective measures against this defoliator so as to protect standing crop from the slaughter of this insect pest.

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