

ORIGINAL ARTICLE

Bionomics of the jute hairy caterpillar, *Spilarctia obliqua* (order: *Lepidoptera*, family: *Arctiidae*; walker) of *Corchorus olitorius* jute

Md.N. Islam, Md.S. Polan, S. Ahmmed, Md.S. Rahman* 

Department of Entomology, Bangladesh Jute Research Institute, Dhaka, Bangladesh

*Corresponding author E-mail: sohanbau2010@gmail.com

Received: 11 March, 2022; **Manuscript No:** UJE-22-56984; **Editor assigned:** 13 March, 2022, **PreQC No:** P-56984; **Reviewed:** 24 March, 2022, **QC No:** Q-56984; **Revised:** 30 March, 2022, **Manuscript No:** R-56984; **Published:** 07 April, 2022

Background and objective: Jute hairy caterpillar is one of the most serious polyphagous and widely distributed insect pests causing damage to a large number of cultivated as well as non-cultivated plants species. It is urgent to know the biology of a pest if we want to control that pest. So, a research work was taken to study the bionomics of Jute hairy caterpillar.

Materials and methods: The research work was conducted in Completely Randomized Design (CRD) with twelve replications. Larvae of Jute hairy caterpillar, *Spilarctia obliqua* were collected from the jute field and reared in the rearing insect box. Old leaves and exuviate were cleaned every day and records on moulting maintained regularly. After emergence, the adults were allowed to mate in the potted jute plants which were covered mosquito net. Data on moulting, larval and pupal period, growth stages were carefully taken.

Results: The incubation period varied from 4 to 7 days with an average of 5.17 ± 0.270 days. The length and width of pupae were found with an average of 17.25 ± 0.217 and 5.375 ± 0.164 mm respectively. The duration of first, second, third, fourth, fifth and sixth instar was found with an average of 2.83 ± 0.67 , 5.25 ± 0.278 , 7.92 ± 0.228 , 10.83 ± 0.33 , 16.42 ± 0.312 and 19.75 ± 0.304 days respectively. The total larval period was ranged from 17 to 22 days with an average of 19.91 ± 0.47 days. The total life span of male and female was found 37.99 ± 0.55 and 41.41 ± 0.49 days respectively.

Conclusion: The results showed that the biology of jute hairy caterpillar indicates the different stage of this insect. Further research is highly recommended for more accuracy of the result.

Keywords: Egg, Larva, Pupa, Adult, Longevity, Oviposition, Life span, Jute hairy caterpillar, Jute.

Introduction

Jute, a fibre crop of international eminence, is the most important cash crop and one of the major foreign exchange earners of Bangladesh. Jute is liable to damage by various insect and mite pest at all stages of its growth from seedling to harvest.

Jute hairy caterpillar, *Spilosoma obliqua* Walker is one of the major pests and highly polyphagous which infests many economically important crops, often causing severe economic damage including jute (Gupta and Bhattacharya, 2008). Both species of cultivated jute crop (*Corchorus olitorius* and *C. capsularis*) are highly susceptible to *S. obliqua* particularly during the active growth period of the crop. In jute, it causes yield loss up to 30% (Bandyopadhyay, et al., 2014).

S. obliqua earlier considered as a sporadic and irregular pest of jute, however, in recent years, outbreaks of this pest were reported from jute growing areas causing substantial loss to the fibre (Selvaraj, et al., 2015).

About 40 species of insects and mites are considered as pest of jute in Bangladesh. Due to their attack the yield is greatly reduced. Among them, jute hairy caterpillar, *Spilarctia obliqua* (Walker) is the most common and very destructive (Islam, et al., 2020).

Jute hairy caterpillar is one of the most serious polyphagous and widely distributed insect pests causing damage to a large number of cultivated as well as non-cultivated plants species.

Besides Bangladesh, this pest has also been reported from India, Myanmar, Pakistan, Chiana and many other countries of the world.

S. obliqua is a polyphagous but sporadic pest. Although it has been reported from Bangladesh, Myanmar, Pakistan, Phillipines and Sri Lanka, its occurrence in India especially in North and North Eastern states is very common particularly during June-September (Rahman et al. 2020).

S. obliqua attacks crop throughout the year, the infestation of jute by this pest begins in the month of April, when the plants are about two to three feet high, but heavy infestation occurs in the month of June-July. The adult female lays eggs in clusters on lower surface of the leaves and after hatching of eggs, the young caterpillars begin to feed on the lower epidermis of the leaves in clusters condition. The early damage of leaves assumes a peculiar membranous appearance. *S. obliqua* larvae pass through six instars (Varatharajan 1998).

The first and second instars larvae are gregarious having different color patterns greenish yellow to dark orange. The third, fourth, fifth, sixth instars larvae are dispersed over the entire field. The fifth instar larvae are the most damaging stage (Warad Mallikarjun and Kalleshwaraswamy 2017). The whole leaf tissues are eaten up by the caterpillars, leaving only the ribs and the plants may be completely defoliated.

Although the caterpillars prefer mature leaves, the top shoots are also eaten up in case of severe attack. As a result of infestation, the plant growth becomes stunted and the yield is reduced considerably. Hazarika (1952) reported that jute hairy caterpillar reduced the yield by three mounds of fibre per acre. It is reported that 7.3 and 13.2% yield loss by hairy caterpillar assessed of Tossa and Deshi jute respectively.

Besides jute, it also causes severe damage to a large number of cultivated and wild plant species (Tiwari, et al., 1998). For better management of this destructive insect, knowledge on its biology is required. It is a serious pest, which often causes complete devastation of entire fields, wherever it appears in an epidemic form. For profitable cultivation of Jute in Bangladesh, management of Jute hairy caterpillar is urgently needed. The present study was designed to know the bionomics of jute hairy caterpillar which will help the farmers for adopting accurate control measures at right time.

Materials and Methods

The research work was conducted in the laboratory of the Department of Entomology, Bangladesh Jute Research Institute (April to August 2017) to study the bionomics of Jute hairy caterpillar. Field collected larvae of Jute hairy caterpillar, *Spilarctia obliqua* were reared in the rearing insect box. Old leaves and exuviae were cleaned every day and records on moulting maintained regularly. After emergence, the adults were allowed to mate in the potted jute plants which were covered mosquito net (Fig. 1). Adult female lays eggs in clusters on the lower surface of jute leaf. Just after egg hatching, very small larvae were carefully transferred to glass jar or petridishes with the help of a soft camel hair brush. Fresh jute leaves were supplied as food. Data were carefully taken on different larval moulting. When larvae feeding stopped, the larvae were kept undisturbed until pupation. The larval and pupal periods were recorded. Data on morphometric measurements of different growth stages of *S. obliqua* were recorded (Fig. 2). The average temperature and relative humidity were 29.72 ± 0.065 and $66.40 \pm 0.070\%$ respectively during experiment session. The experiment was carried out at Completely Randomized Design (CRD) following twelve replications.

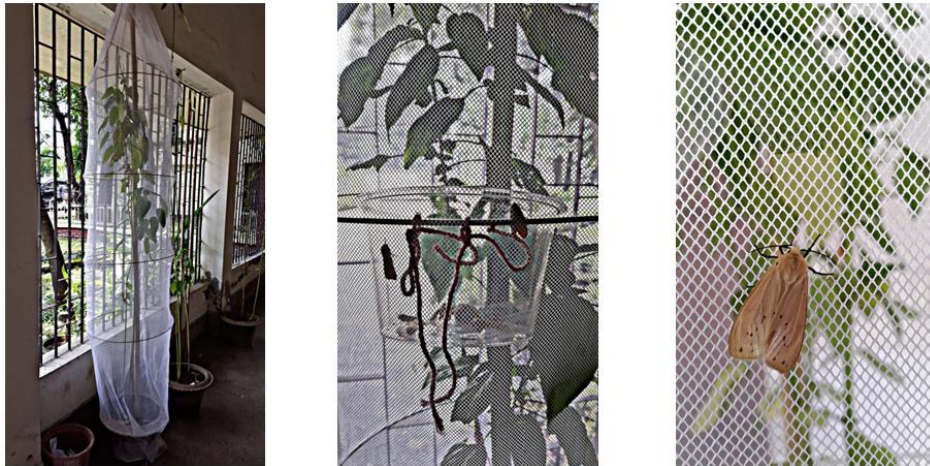


Fig. 1. Insect rearing in earthen pot covering mosquito net.

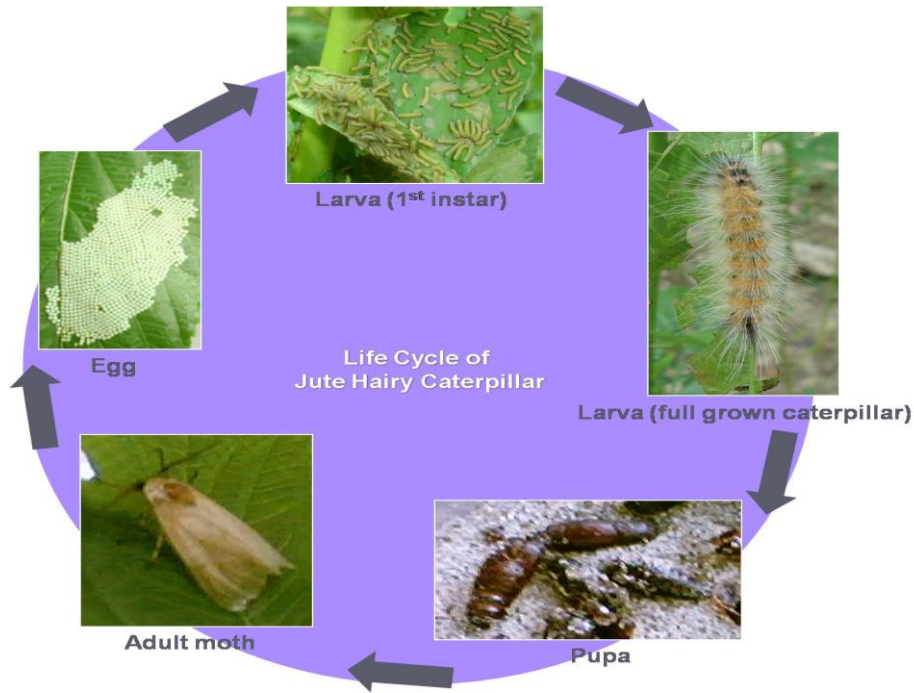


Fig. 2. Life cycle of jute hairy caterpillar.

Results and Discussion

Morphometric description

Eggs: The oviposition generally was occurred at night and site was recorded by observing different parts of the jute plant on which eggs were laid. The female moths laid the eggs in clusters on the lower surface of the jute leaves. A single female generally lay 400-1000 eggs (Fig. 3). The eggs of *S. obliqua* were greenish in colour when it was freshly laid thereafter, it turned to creamish and became dark brownish prior to hatching. The eggs were laid in masses which look like seed of grape from upper side. The eggs are round on upper surface and flattened at base. The diameter of eggs was found 0.520 ± 0.028 mm (Table 1). Similar egg laying pattern of *S. obliqua* was observed by different research workers (Singh and Singh 1990; Ganiger and Sannaveerappanavar 2007).



Fig. 3. Jute hairy caterpillar egg.

Larva: The length of full-grown larva was 42.18 ± 0.055 mm and 7.50 ± 0.015 mm (Table 1) in width with hairy body and orange yellow in color (Fig. 4). The mature larvae stop feeding before pupation and the pre-pupal period lasts from 1 to 3 days. They are characterized by shortened and thickened bodies. The larval period varies from 18 to 20 days in jute season and 28 to 35 days in winter. It was also found that the larvae stopped feeding for few hours before moulting.



Fig. 4. Jute hairy caterpillar larva (3rd instar).

Pupa: The newly formed pupae were soft and pale brown in colour. Later on, the pupa turned brownish in colour (Fig. 5). The pupa which has to develop into male moth has a slit representing the genital opening in the posterior part of 9th abdominal segment while in the case of female it was on the 8th abdominal segments. The lengths of pupae were found in with an average of 17.25 ± 0.217 mm. In case of widths of the pupae, it was found in an average of 5.375 ± 0.164 mm (Table 1).



Fig. 5. Jute hairy caterpillar pupa and its pupation.

Adult: The observations were made on colour and appearance of the *S. obliqua* adults. It was found that the moths were straw in colour with orange and brown streaks over the forewings and white streak along the anterior margin (Fig. 6). The hind wings were found yellowish in color with black markings. The observations were made on size of the *S. obliqua* adults and it was found that the lengths of male moths were an average of 15.33 ± 0.224 mm (Table 1), while the lengths of the female moths were with an average of 15.83 ± 0.205 mm (Fig. 7).

Table 1. Comparative length, breath of different stages of jute hairy caterpillar.

Developmental Stages	Average Length (mm) (Mean \pm SE)	Average Breath (mm)
Egg	0.52 ± 0.028	0.38 ± 0.015
Larvae(full grown)	42.17 ± 0.055	7.50 ± 0.015
Pupa	17.25 ± 0.217	5.38 ± 0.164
Adult male	15.33 ± 0.224	4.42 ± 0.140
Adult female	15.83 ± 0.205	5.38 ± 0.103

The breath of male moths was an average of 4.42 ± 0.140 mm, while the width of the female moths were with an average of 5.38 ± 0.103 mm (Table 1).



Fig. 6. Jute hairy caterpillar adult moth.

There is no relevant literature is available on this aspect to support the present study. Gotyal et al., (2013) studied the comparative biology of *S. obliqua* on jute. They reported effect of cultivated and wild species of jute on the larval survivability, larval weight, pupal weight and adult emergence of *S. obliqua* at different days after feeding. Ganiger and Sannaveerappanavar (2007) have studied the field biology of Red headed hairy caterpillar *Amasacta albistriga* (Walker) under groundnut ecosystem in Karnataka.

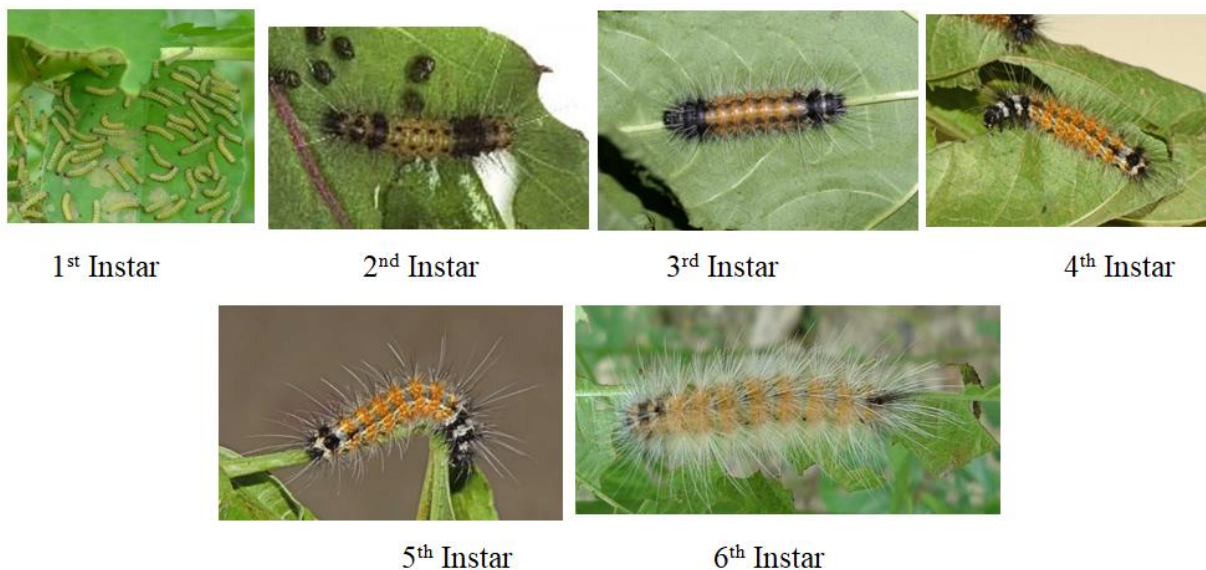


Fig. 7. Different larval instars of *Spilarctia obliqua*.

Different larval instars of *S. obliqua*

The observations were made on duration and morphometry of (length, width) different instars of *S. obliqua* with the help of stereoscopic binocular microscope. It was found that the larvae passed through sixth instars on jute plant leaves under the laboratory condition. The results on larval periods as well as morphometries are presented here under.

First instar: The newly hatched larva was creamy whitish with shining brown head and having brown spots over entire body from which white hair arises which later turn black. The integument was transparent, abdominal segments were distinct with three pairs of prolegs. Larvae turned pale yellow colour within a few hours after hatching. The data (Table 2) on first instar larvae of *S. obliqua* revealed that the duration of first instar was found to be 2 to 4 days with an average of 2.83 ± 0.67 days. Further, it was also found that the length and width of first instar larvae with an average of 5.17 ± 0.24 mm and with an average of 1.04 ± 0.045 mm, respectively (Table 2).

Table 2. Different larval instars, their duration and size of jute hairy caterpillar in jute season.

Instars	Duration (in days)	Length (mm) \pm SE	Breath (mm) \pm SE
1 st	2.83 ± 0.65	5.17 ± 0.24	1.04 ± 0.045
2 nd	5.25 ± 0.278	9.92 ± 0.287	2.46 ± 0.156
3 rd	7.92 ± 0.228	14.83 ± 0.321	3.71 ± 0.170
4 th	10.83 ± 0.321	23.75 ± 0.217	5.29 ± 0.143
5 th	16.42 ± 0.312	35.67 ± 0.284	6.64 ± 0.132
6 th	19.85 ± 0.304	42.50 ± 0.415	7.33 ± 0.016

Second instar: The larva in second instar slightly increased in size having light yellow color body with brown markings on thoracic and last abdominal segment, more hairs on the body compared to first instar and thoracic legs were black with brown abdominal legs. The duration of second instar was with an average of 5.25 ± 0.278 days. Further, it was found that the lengths and widths of second instar larvae were with an average of 9.92 ± 0.287 mm and with an average of 2.46 ± 0.156 mm respectively (Table 2).

Third instar: Third instar larvae were similar to second instar but the coloration of head and body segments were little darker compared to the second instar. The third instar larvae were more active than the first and second instar larvae. The duration of third instar were found with an average of 7.92 ± 0.228 days. Further, it was also found that the lengths and widths of third instar larvae were with an average of 14.83 ± 0.321 mm and with an average of 3.71 ± 0.17 mm respectively (Table 2).

Fourth instar: The larva in fourth instar were uniformly yellowish in color as the segments were brown and tuft of brownish white hairs arose from reddish brown and when the larvae approached late fourth instar stage, the head turned dark brownish black. The duration of fourth instar larvae were with an average of 10.83 ± 0.33 days. Further, it was also found that the lengths and widths of fourth instar larvae were with an average of 23.75 ± 0.217 mm and with an average of 5.29 ± 0.143 mm respectively (Table 2).

Fifth instar: The fifth instar larvae were dark yellow with reddish tinge in color and the heads and thoracic shields were dark brown in color while the legs were found to be reddish brown. Spiracles were inconspicuous and visible only under magnification as circular patches. The duration was with an average of 16.42 ± 0.312 days. Further, it was also found that the lengths and widths of fifth instar larvae were with an average of 35.67 ± 0.284 mm with an average of 6.17 ± 0.181 mm, respectively (Table 2).

Sixth instar: The fully grown sixth instar larva had dark black head with brownish legs and uniformly reddish-brown body with brownish black verrucae on which there were whitish hairs. The duration was with an average of 19.75 ± 0.304 days. Further, it was also found that the lengths and widths of sixth instar larva were with an average of 42.50 ± 0.417 mm and with an average of 7.33 ± 0.166 mm respectively (Table 2).

Developmental duration of immature stages and egg-adult of Jute hairy caterpillar, *Spilosoma obliqua* under laboratory condition

The incubation period of *S. obliqua* was started immediately after the egg laying and continued up to hatching. The incubation period varied from 4 to 7 days with an average of 5.17 ± 0.24 days (Table 3). Nath and Singh (1996) and Debaraj and Singh (2010) reported that the incubation periods of eggs in the range of 4-6 days, 3-12 days 5.6 days) and 6.5 to 10.5 days which were similar to the present studies. The total larval period of *S. obliqua* was ranged from 17 to 22 days with an average of 19.75 ± 0.304 days (Fig. 7). Earlier workers also reported larval period of 17.22 days, 24.72 days (Nath and Singh,1996) and 24 days (Debaraj and Singh 2010).

The duration of male pupae was varied from 8 to 12 days with an average of 9.33 ± 0.309 days, (Table 3). The present findings are in close conformity with the report of Singh and Singh (1990), Nath and Singh (1996) in which they reported pupal period of 10.25 and 11.46 days, respectively. Total developmental period of female *S. obliqua* from egg-adult (egg+larva+pupa+longevity) was with an average of 41.41 ± 0.49 days. At the same time, total developmental period of male *S. obliqua* from egg-adult (egg+larva+pupa+longevity) was with an average of 37.99 ± 0.55 days (Table 3).

Table 3. The developmental duration of immature stages and egg-adult of *Spilosoma obliqua* under laboratory condition.

Developmental Stages	Days \pm SE
Egg	5.17 ± 0.24
Larva	19.75 ± 0.304
Pupa	9.33 ± 0.309
Egg-adult(female)	41.41 ± 0.49
Egg-adult(male)	37.99 ± 0.55
Room Temp($^{\circ}$ C)	29.72 ± 0.065
%RH	66.40 ± 0.070

Pre-oviposition, oviposition periods: The pre-oviposition period of *S. obliqua* varied from 1 to 2 days with an average of 1.29 ± 0.129 days (Table 4) while oviposition period was ranged from 3 to 4 days with an average of 3.33 ± 0.188 days (Table 4). According to Singh and Singh (1990) and Nath and Singh (1996), pre-oviposition, oviposition periods were 2.14 to 2.40; 2.44 to 2.88 days, respectively.

Table 4. Pre-oviposition, oviposition and longevity of jute hairy caterpillar moth under laboratory condition.

Parameters	Days \pm SE
Pre-Oviposition	1.29 \pm 0.129
Oviposition	3.33 \pm 0.188
Female longevity	7.17 \pm 0.270
Male longevity	3.75 \pm 0.217
Room temp ($^{\circ}$ C)	29.72 \pm 0.065
%RH	66.40 \pm 0.070

Longevity: The longevity of female moths *S. obliqua* was found in the range of 6 to 9 days with an average of 7.17 ± 0.270 days, while in case of male moths it was found to be of 3 to 5 days with an average of 3.75 ± 0.217 days (Table 4).

Total life span: The total life span of male *S. obliqua* was found 37.99 ± 0.55 days, while in case of female, it was found 41.41 ± 0.49 days. The present findings are in close conformity with the report of Singh and Singh (1990); Nath and Singh (1996) and Debaraj and Singh (2010) as they reported that the total life span was found to be 37.50; 53.06 and 39.60 days, respectively.

Conclusion

This study revealed that a single female generally lay 400-1000 eggs. The incubation period varied from 4 to 7 days with an average of 5.17 ± 0.270 days. The duration of first, second, third, fourth, fifth and sixth instar was found with an average of 2.83 ± 0.67 , 5.25 ± 0.278 , 7.92 ± 0.228 , 10.83 ± 0.33 , 16.42 ± 0.312 and 19.75 ± 0.304 days respectively. The total larval period was ranged from 17 to 22 days with an average of 19.91 ± 0.47 days. The total life span of male and female was found 37.99 ± 0.55 and 41.41 ± 0.49 days respectively.

Conflict of Interest

The authors have no conflict of interest to report.

Author's Contribution

All authors equally contributed to conduct this experiment.

Acknowledgement

The author takes an opportunity to express his gratefulness to Bangladesh Jute Research Institute, Ministry of Agriculture, The People's Republic of Bangladesh for providing financial contribution on the successful completion of this research work.

References

- Bandyopadhyay, S., Gotyal, B.S., Satpathy, S., Selvaraj, K., Tripathi, A.N., Ali, N. (2014). Synergistic effect of azadirachtin and *Bacillus thuringiensis* against Bihar hairy caterpillar, *Spilarctia obliqua* Walker. *Biopest International*, 10:71-76.
- Debaraj, Y., Singh, R. (2010). Seasonal biology of Bihar hairy caterpillar, *Spilarctia obliqua* Walker on castor, a primary food plant of eri silkworm. *Uttar Pradesh Journal of Zoology*, 30:17-20.
- Ganiger, P.C., Sannaveerappanavar, V.T. (2007). Field biology of red headed hairy caterpillar, *Amasacta albistriga* (Walker) on groundnut. *International Journal of Tropical Agriculture*, 25:271-278.
- Gotyal, B.S., Satpathy, S., Selvaraj, K., Ramesh Babu, V. (2013). Comparative biology of Bihar hairy caterpillar, *Spilosoma obliqua* on wild and cultivated species of jute. *Indian Journal of Entomology*, 41:219-221.
- Gupta, G., Bhattacharya, A.K. (2008). Assessing toxicity of post-emergence herbicides to the *Spilarctia obliqua* Walker (Lepidoptera: Arctiidae). *Journal of Pest Science*, 81:9-15.
- Hazarika, S.H. (1952). Destructive insects of eastern Pakistan and their control. East Bengal Govt. Printing Press, Dacca, pp:98.
- Islam, M.N., Islam, K.S., Jahan, M., Rahman, M.S. (2020). Investigation on the natural enemies of jute yellow mite and their performances and seasonal incidence. *Agricultural Science*, 2:56.
- Nath, P., Singh, A.K. (1996). Biology and insecticidal management of Bihar hairy caterpillar, *Spilosoma obliqua* infesting groundnut. *Annals of Plant Protection Science*, 4:42-46.
- Rahman, M.S., Islam, M.N., Talukder, F.U., Sultan, M.T. (2020). Evaluation of insecticides for the management of jute hairy caterpillar, *Spilosoma obliqua* walk. (Lepidoptera: Arctiidae) in jute (*Corchorus Olitorius*). *International Journal of Entomology Research*, 5:71-77.
- Selvaraj, K., Gotyal, B.S., Satpathy, S., Ramasubramanian, T. (2015). First record of *protapanteles obliquae* (Wilkinson) (Braconidae: Hymenoptera) on *Spilosoma obliqua* Walker on jute crop. *Journal of Biological Control*, 29:169-170.
- Singh, K.J., Singh, O.P. (1990). Biology of red hairy caterpillar, *Amsacta moorei* on soybean (*Glycine max*) in Madhya Pradesh. *Indian Journal of Entomology*, 60:192-194.

- Tiwari, S.N., Rathore, Y.S., Bhattacharya, A.K., Sachan, G.C. (1998). Susceptibility of several varieties of groundnut to *Spilosoma oblique* Walker (Lepidoptera: Arctiidae). *Indian Journal of Entomology*, 50:179-184.
- Varatharajan, R., Amar Singh, S., James Keisa, T., Singh, O.D., Selvasundaram, R. (1998). Life table of *Spilosoma obliqua* (Lepidoptera: Arctiidae) on sunflower. *Insect Science and Application*, 18:383-385.
- Warad, M., Kaleshwaraswamy, C.M. (2017). Biology of Bihar hairy caterpillar, *Spilarctia obliqua* (Walker) (Erebidae: Lepidoptera) on field bean. *Agriculture Update*, 12:1256-1260.
-

Citation:

Islam, Md.N., Polan, Md.S., Ahmmed, S., Rahman, Md.S. (2022). Bionomics of the jute hairy caterpillar, *Spilarctia oblique* (order: *Lepidoptera*, family: *Arctiidae*; walker) of *Corchorus olerarius* jute. *Ukrainian Journal of Ecology*. 12:21-27.



This work is licensed under a Creative Commons Attribution 4.0 License
