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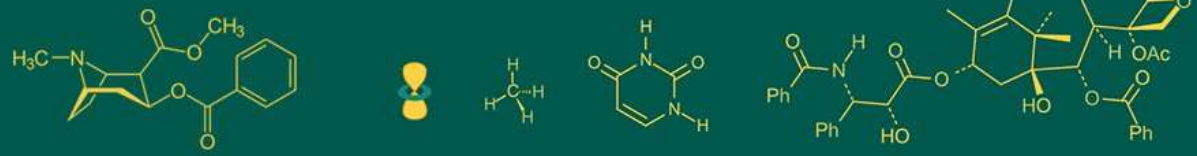

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Studies on mango leaf webber, *Orthaga* spp. with special reference to study the biology of leaf webber, *Orthaga* spp.

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Abstract
"Studies on mango leaf webber, *Orthaga* spp. with special reference to seasonal incidence, biology and management" was conducted during the year 2015-16 and 2016-17at the Horticultural orchard of BTC College of Agriculture and Research Station, Bilaspur (C.G). Data on seasonal incidence indicated that minimum larval population of 21.24 larvae/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 21.83, 23.21, 24.02, 29.43, 30.28, 31.08, 32.19 and 33.16 larvae/tree, respectively. The minimum webbing 12.50 webs/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 16.38, 17.39, 17.89, 18.13, 19.52, 19.84, 20.10 and 21.80 webs/tree, respectively. Biological study of leaf webber, *Orthaga exvinacea* Hampson revealed that female moths lay greenish dull, oval, flattened eggs singly or in groups on the lower surface of leaves near the midrib or vein. The width and length of the eggs were 0.97 and 0.67 mm, respectively. The incubation period was 4.80 days and the hatching rate of eggs was 89.60 percent. The larvae passed through seven instars, the first, second, third, fourth, fifth, sixth, and seventh instar larvae takes for 4.40, 5.20, 3.60, 4.00, 5.00, 5.80, and 3.00 days, respectively. The average larval period was 31.00 day and Pre-pupae period registered for 5.20 day. The pupation occurs inside the web, within the silken cocoon and pupal periods lasts for 18.60 day. Leaf webber adults are brownish grey forewings with wavy lines, male and female life spans completes in 4.40 and 8.40 days, respectively. The pre-oviposition, ovoposition, and post-oviposition periods were recorded as 3.40, 4.60, and 1.60 days respectively and the average fecundity of female was 84.60 eggs. Under laboratory conditions, the male to female ratio was 1: 1.20. and total life cycle completed within 59.20 and 63.20 days, respectively.

Keywords: Insect, leaf webber, larva, pupa and adult

Introduction
The mango, *Mangifera indica* is popularly known as king of fruits. Mangoes are considered as the apples of tropical regions and one among the most favorite fruit worldwide. Mangoes vary in size, shape, and colours (green, yellow, red or purple) from region to region and from varieties to varieties. The flesh is yellow to orange and when ripe has the texture of peach, the flavour also resembles a peach but with a distinct tropical sweetness. It is an important fruit crop grown extensively under tropical and subtropical climate. Mango belongs to the genus *Mangifera* of the family *Anacardiaceae*. There are at least 62 species within the genus and 15 of these bear edible fruits. Even though fruits are harvested at its maturity but in case of mango all stages (mature and immature) of fruits are utilized in preparation of various products. The immature fruits are used in the preparation of chutney, pickles and juice and the ripened fruits are utilized in the preparation of several products like squashes, syrups, nectars, jams and jellies. Even at some places mango seeds are consumed. The bark is utilized in tanning leather, while timber is used for boats, flooring, furniture and other applications. The fruit flesh of a ripe mango is very sweet, with a unique taste. Along with a very good taste it's an excellent source of many nutrients. The mango fruits are rich in vitamin A (21%) and C (60%). It also contains about 10.5-32.5% sugars and up to 1-2% protein (Maldonado-Celis M E *et al*., 2019) [24].

The raw mango consists of about 81.7% water, 17% carbohydrate, 0.5% protein, 0.3% fat and 0.5% ash. A 100 g serving of raw mango has 65 calories and about half the vitamin C found in oranges (Source: https://d1iqctulejj45h.cloudfront). Also the mango kernel contains around 8-10 per cent of fat. The mango consumption helps in fighting against cancer, strengthen the heart, regulates cholesterol, cleanses the skin, mango leaf consumption regulates diabetes.

It's being an important commercial fruit crop of India shows a great potential as an item of export as fresh fruit and processed form. The major mango producing countries in the world are India, China, Pakistan, Mexico, Thailand, Indonesia, Brazil, Philippines, Nigeria and Vietnam. India is the leading producer of mangoes in the world. The area under mango cultivation in India is around 2263 ha, the production is 19687 MT and the productivity is 8.7 MT/ha (2016-17) (Indian horticulture database, 2021). Many states are contributing in the production of mangoes. The leading producers are Uttar Pradesh, Andhra Pradesh and Karnataka of the country. India is the leading exporter of mangoes and the exporting quality of mangoes depends on the freshness and its pulp quality. It's being exported to more than 80 countries with the foreign exchange earning of Rs. 20053.96 million from export of 76460.6 tonnes of fresh fruits and Rs. 7446.1 million from the export of 186197.88 million tones of mango pulp (Anonymous, 2009) [3].

Chhattisgarh is also an important mango growing state which stands 12th in India with the area of 73.99 ha, production of 437.58 MT and the productivity of 5.9 MT/ha (Indian horticulture database, 2021). Bilaspur is a district of Chhattisgarh occupies 10,094 hectares area with production of 35,046 metric tonnes (Anonymous, 2012-13) [4].

Among the several reasons for low production in mango, infestation by pests is major one. The mango tree is attacked by various pests like scale insect, mealy bug, fruit fly, leaf webber, mango hopper etc. Worldwide the mango plants are attacked by 492 species of insects, 17 species of mites and around 26 species of nematodes. Out of these pests around 188 are reported from India (Tandon and Verghese 1985, Srivastava 1998) [46, 45].

Around 260 species of insects and mite pests attack the tree of different stages. The major insect pests of mango are mango hoppers (*Amritodus atkinsoni* Leth, and *Idioscopus* sp.), leaf webber (*Orthaga exvinacea* Saund.), Stem borer (*Batocera rufomaculata* Deg.), mango stone weevil (*Sternochaetus mangiferae* Fab.), defoliator (*Penicillaria jocosatrix* Guenee), blossom webber (*Eublemma versicolor* Walk.), fruitfly (*Bactrocera dorsalis* Hendal), and leaf gall fly (*Procontarinia matteiana* Keifferand Cocconi) cause considerable damage to mango tree.

One among the major pests of mango is leaf webbers, *Orthaga* sp. which damages mostly old mango trees. The damage caused by caterpillar is very typical, on hatching it feeds on tender leaves nearby and feed gregariously on leaf chlorophyll by scrapping the leaf lamina. In young stages, the caterpillars webs two to three leaves together by feeding on internal portion of the leaves from edges towards the midrib leaving behind the network of veins. In grown up stages, the caterpillar feeds voraciously and web the shoots and leaves together. The leaves loose from their stalks, often detach but remain entangled in webs on the tree. Numerous dried bunches of shoots and leaves are clearly visible from a distance on severely attacked mango tree. The webbed leaves give a small tent-like appearance, so it is also popularly called as the Tent caterpillar (Srivastava and Verghese, 1998) [45]. There are many species of leaf webber observed on mango in India of which *Orthaga euadrusalis* (Walker), *Orthaga exuvinaceae* (Hampson) and *Orthaga mangiferae* (Mishra, 2001) are considered as major species. Besides these, *Lamida (Macalla*) *moncusalis* (Walker), *L. carbonifera* and *L.* (*Spectrotrota*) *sordidalis* (Hampson) have also been reported damaging mango tree. Apart from this *O. chilnonalis* and *O. icarusalis* were recorded from Malaysia and Thailand and *Balanotis leucatina* have been reported from Egypt and Srilanka (Srivastava, 1998) [45].

Materials and Methods

To study the biology of leaf webber, *Orthaga* spp.

Initially the larval culture of leaf webber**,** *Orthaga* spp. (*Orthaga exvinacea* Hampson) was collected from the unsprayed mango orchard of Horticultural orchard, BTC College of Agriculture and Research Station, Bilaspur. The larvae were reared in round aluminum tray (35 cm diameter x 10.5 cm depth) providing fresh and tender mango leaves. The tray was covered with fine muslin cloth with the help of rubber band to prevent escape of larvae. Such tray was prepared for mass rearing. The cut aids of a small mango twig with leaves were wrapped with cotton lint soaked in water to keep the leaves fresh and turgid. Mango leaves and tray were changed daily to maintain sanitation. After pupation of the larvae, the pupae were kept in petridishes. The sex of adult moths could be differentiated in the pupal stage by examining the location of genital slit in relation to anal slit with the help of binocular microscope. The male and female pupae were kept in separate acrylic rearing cage (30 x 30 x 30 cm) for emergence of adults. Male and female adults emerging out from pupae were collected with the help of plastic tube (3.5 cm diameter x 4 cm length) and released in separate acrylic rearing cage for mating and egg laying. A small mango twig with four to five tender leaves was provided inside the cage for egg laying purpose. The cut end of mango twig was kept in conical flask (250 ml) filled with water and fixed with a cotton plug to keep the leaves fresh and turgid for longer period. An absorbent cotton dipped in 5% honey solution was served as food to the adults. The leaves with freshly laid eggs were used for further studies (Patel, 2004) [26].

To study the biology of leaf webber, *Orthaga* spp.

Egg

The female moths (*Orthaga exvinacea* Hampson) laid greenish dull, oval and flattened eggs singly or in clusters usually on lower surface of leaves near the midrib or vein. Sometimes the female moths laid eggs on upper surface of leaves and also on tender mango twigs. The length and breadth of eggs was 0.97 and 0.67 mm, respectively (Table 1). The incubation period was 4.80 days. The egg hatching per cent was 89.60 (Table 2).

The above finding are in accordance with Singh, (1993) [38] and Srivastava, (1998) [45] who also reported that leaf webber eggs are greenish dull coloured and oval shaped. Sisodiya *et al.* (2003) [44] from Gujarat noted that the oval in shape as well as somewhat flattened eggs were laid either singly or in clusters by female on upper surface of leaf near the midrib or veins.

In the present study mango shoot webber egg hatching per cent was 89.60. However (Table 1), Patel (2004) [26],

reported that egg hatching per cent varied from 81.58 to 96.92.,which is almost similar to the present findings. The incubation period of the eggs is reported four days on mango leaves (Cherian and Ananthanarayanan, 1943) [11]. Desai *et al.* (1999) [16] reported that incubation period of *O. exvinacea* was 4 to 5 days, whereas it was on an average 4.77±0.43 days in Gujarat (Sisodiya *et al.*, 2003) [44]. These findings are in consonance with present work partially.

Table 1: Duration of different stages of *Orthaga exvinacea* Hampson in laboratory

Life stages	Periods (Days)		
	Min	Max	Mean ± S.D.
Incubation period	4.0	5.0	4.80±0.40
Hatching (%)	85.0	95.0	89.60±3.44
Larva			
I instar	4.0	5.0	4.40±0.49
II instar	3.0	7.0	5.20±1.33
III instar	2.0	5.0	3.60±1.02
IV instar	2.0	6.0	4.0±1.41
V instar	2.0	7.0	5.0±1.67
VI instar	3.0	8.0	5.80±1.94
VII instar	3.0	3.0	3.0±0.00
Total	26.0	35.0	31.0±3.03
Pre-Pupa	2.0	7.0	5.20±1.72
Pupa	12.0	25.0	18.60±4.88
Adult			
Pre-oviposition	2.0	4.0	3.40±0.80
Oviposition	4.0	5.0	4.60±0.49
Post-oviposition	1.0	2.0	1.60±0.49
Longevity			
Male	3.0	5.0	4.40±0.80
Female	7.0	9.0	8.40±0.80
Total life span			
Male	52.0	66.0	59.20±5.71
Female	55.0	69.0	63.20±6.34
Fecundity	55.0	101.0	84.60±19.31
Sex ratio (Male : Female)	1:1.15	1:1.25	1.20±0.03

Table 2: Measurement of different stages of *Orthaga exvinacea* Hampson

Stage	Particulars	Measurement (mm)		
		Min	Max	Mean ± S.D.
Egg	Length	0.95	0.99	0.97±0.02
	Breadth	0.60	0.70	0.67±0.04
I instar	Length	1.15	1.90	1.52±0.31
	Breadth	0.25	0.35	0.30±0.03
II instar	Length	3.50	5.53	4.76±0.75
	Breadth	0.40	0.55	0.48±0.05
III instar	Length	6.00	7.25	6.86±0.45
	Breadth	0.75	1.25	0.99±0.18
IV instar	Length	9.00	12.35	11.02±1.29
	Breadth	1.45	1.80	1.65±0.14
V instar	Length	15.50	18.25	16.75±1.15
	Breadth	2.15	2.55	2.33±0.16
VI instar	Length	20.00	22.50	21.65±0.86
	Breadth	2.50	2.80	2.68±0.13
VII instar	Length	25.00	30.00	27.97±1.69
	Breadth	3.00	4.00	3.55±0.40
Pre-Pupa	Length	19.75	22.50	21.36±1.15
	Breadth	3.00	4.25	3.54±0.49
Pupa	Length	12.25	15.28	13.91±1.15
	Breadth	3.25	4.28	3.85±0.46
Adult				
Male	Length	24.25	13.25	12.05±1.24
	Breadth (wing expanded)	12.25	27.55	25.52±0.90
Female	Length	12.25	14.50	13.41±0.90
	Breadth (wing expanded)	26.50	30.58	29.02±1.54

Larva

The newly emerged caterpillars reached to tender leaves and fed gregariously on leaf chlorophyll by scraping the leaf surface. In young stages, the caterpillars webbed two to three leaves together and fed on them by cutting the leaves from edges towards the midrib behind the network of veins. In grown up stages, the larvae were found feeding voraciously and webbing the shoots and leaves together. Vanderlan (1981), Singh, 1989 [37], Srivastava (1998) [45], Verghese and Kamalajayanthi (2001) [48], and Patel (2004) [26] have also reported the similar nature of damage by this pest on mango.

Larvae of leaf webber passed through seven instars in the present finding (Table 1). Similar numbers of larval instars were reported by Kasar *et al*., 2017 [18], Kavitha *et al*. (2005) [20-21], Patel (2004) [26], Masarrat *et al*. (2000), Singh (1988) [39], findings of the previous worker strongly support the present finding. Cherian and Ananthanarayanan (1943) [11] investigated the caterpillars *O. exvinacea* moulted 5–7 times before entering the pupal stage.

1. Eggs of Mango leaf webber

2. Larvae of Mango leaf webber

3. Pupae of Mango leaf webber

4. Adult of Mango leaf webber

Fig 1: Different stages of Mango leaf webber, *Orthaga exvinacea* Hampson

1. Early instar of mango leaf webber

2. Late instar of mango leaf webber

3. Pupae and cocoon of mango leaf webber

4. Composite web

Fig 2: Mango leaf webber *Orthaga exvinacea* Hampson

The newly hatched larvae were pale green to light yellow in colour with shining brownish white head. The larvae in second and third instar increased in size only but showed no remarkable change. It was light yellow with brown head having dark brown spots and black to brown thoracic shield. Lateral side of the third instar larvae having single light green longitudinal line appeared in place of the brownish streaks on either side running from mesothorax to caudal segment. A distinct pink transverse band on first abdominal segment was evident. The larvae of fourth instar also did not show any remarkable changes except the pink coloured transverse band on first abdominal segment as found in earlier instars but disappeared completely in this instar. The larvae were light yellow in colour with light green longitudinal stripes and scattered hairs on the body. The fifth instar larvae were dark greenish black in colour. It has a brown head with dark mottling and brown to black pro-thoracic shield. In sixth instar larvae, the colour of longitudinal stripes changed to green. A thin, white, fairly long seta arising from each black wart on dorsal region. The full grown larvae were pale greenish to black in colour with dark brown head having dark mottling. The prolegs were found on 3rd to 6th and 10th abdominal segments. More or less similar observation on morphological characters of full grown caterpillars have been reported by Ayyar (1932) [7], Butani (1979) [10], Singh (1988) [39], Singh (1989, 1993) [37, 38], Patel (2004) [26], Beria *et al*. (2008) [8] and Kasar *et al*. (2017) [18]. These reports are in agreement with the present findings.

The duration of first, second, third, fourth, fifth, sixth and seventh instar larvae was 4.40, 5.20, 3.60, 4.00, 5.00, 5.80 and 3.00 days respectively. The total larval duration was 31.00 days (Table 1). The larval duration similar or slightly differed in present finding reported by Patel (2004) [26] the duration of the first, second, third, fourth, fifth, sixth and seventh instar larvae was 4.16±0.68, 4.68±1.13, 3.48±0.74, 3.58±1.21, 3.86±1.40, 4.18±1.19 and 5.76±1.70 days, respectively. The average larval duration was 29.70±3.77 days. The total larval period varied from 25 to 33 days in Uttar Pradesh (Singh, 1989 and Tandon, 1994) [37]. Sisodiya

et al. (2003) [44] have noted that the total larval period was 19.62±4.24 days in Gujarat. Accourding to Reddy *et al*. (2001) [32] mango leaf webber *O. exvinacea* the larval stages last for 34 days on an average. Beria *et al*. (2008) [8] investigated the total larval period lasted for 31.57±2.08 days,

The length of the first, second, third, fourth, fifth, sixth and seventh instar larvae were measured 1.52, 4.76, 6.86, 11.02, 16.75, 21.65 and 27.97 mm, whereas in case of breadth it was 0.30, 0.48, 0.99, 1.65, 2.33, 2.68, 3.55 mm, respectively (Table 1). Patel (2004) [26] reported the length of the first, second, third, fourth, fifth, sixth and seventh instar larvae was 1.34±0.18, 4.55±0.78, 6.67±0.44, 10.98±1.13, 16.84±1.14, 20.80±1.26 and 27.12±1.94 mm, whereas it was 0.29±0.02, 0.46±0.04, 0.95±0.21, 1.64±0.12, 2.26±0.13, 2.65±0.12 and 3.55±0.33 mm in case of breadth. This reports are in accordance with the present findings.

Pre-pupal stage

The pre-pupae were pale greenish to dark black in colour. The duration of pre-pupae was 5.20 days (table 2). The length and breadth was 21.36 and 3.54 mm, respectively (Table 1). As per findings of Patel (2004) [26] the pre pupae is dark black and pale greenish in colour . The duration of pre-pupa was 3.84±1.25 days and also the length and breadth was 21.08±1.36 and 3.50±0.40 mm, which arein accordance with the present finding. *O.exvinacea* infesting mango was studied by Rawat and Saxena (1969), who found that the pre-pupal periods, lasted 3-5 days. Beria *et al*. (2008) [8] investigated the pre-pupal period 3.78±0.4 days which is almost similar to the present findings.

Pupa

The pupation takes place within the web, inside the silken cocoon. The pupae were dark brown in colour. The length of pupae was measured 13.91 mm, whereas breadth was 3.85 mm (Table 1), the duration of pupae was 18.60 days (Table 1).

Similar finding were reported by Cherian and Ananthanarayanan, (1943) [11], they stated that pupation took place within a silken cocoon in the webbed up clusters of leaves. The pupae were brown in colour and measuring 13mm in length. Leaf webber pupa was dark brown in colour. According to Patel *et al.* (2007) [26] male pupae measured 13.04 mm in length and 3.76 mm in width, while female 13 pupae measured 13.80 mm in length and 3.88 mm in width. Male and female pupal durations were last for 15.80 and 17.16 days respectively. The pupation took place within the web, inside the silken cocoon.

Adult

Adults of *O. exvinacea* Hampson were brownish grey with wavy lines on fore wings. Hind wings were ash grey with fringes on apical margin. Similar identification marks were reported by Cherian and Ananthanarayanan (1943) [11], Butani (1979) [10], they reported that *O.exvinacea* moth are grey in colour with dark patches on wing. Reddy *et al*., (2001) [32] reported that the *O.exvinacea* as a medium sized grey coloured moth with dark wavy patches on the blackish forewings. Hind wings were light greyish in colour with less scales and the boarder of hind wings possess brownish scales.

The longevity of male and female were recorded 4.40 and 8.40 days, respectively (Table 1). More or less similar findings were reported by Beria *et al*. (2008) [8] who investigated the mango leaf webber *O. exvinacea* in Junagadh (Gujarat), longevity of male and female were 3.53±0.62 days and 4.40±0.95 days, respectively. According to Cherian and Ananthanarayanan (1943) [11] the adult survived for 4-5 days, Reddy (2000) [33], reported the adult longevity greater for females (3.59±0.40 days) as compared to that of males (2.52±040 days) under lab conditions. There is different statement was published by Kavitha *et al*., (2005) [20-21] who reported that female lived for 5.3 days and the male for 7.6 days, respectively.

The length of male and female was measured 12.05 and 13.41 mm, while the breadth with expanded wings was 25.52 and 29.02 mm, respectively (Table 1). Reddy (2000) [33] reported that the *O. exvinacea* female moths were measuring 12 mm and male 10 mm in body length. The female moths wing expanse measured 2.9 cm and 2.4 cm in the males. Patel (2004) [26], reported that the length of male and female was 12.12±0.67 and 13.0±0.82 mm, the breadth with wing expanded was 25.36±1.08 and 27.76±1.33 mm, which is accordance to present finding.

The pre-oviposition, ovoposition and post-oviposition period noted as 3.40, 4.60 and 1.60 days, respectively (Table 1). Similar observations were made by Sisodiya *et al.*, (2003) [44] from Gujarat, the pre-oviposition, oviposition and post-oviposition periods of *O. euadrusalis* were reported as 3.0±0.71,4.0±0.71 and 1.4±0.55 days, Kavitha *et al*., (2005) reported that the pre-oviposition, oviposition and post-oviposition periods were 1.7, 4.8, 1.6 days.

In the present studies, fecundity of leaf webber female was recorded 84.60 eggs (Table 1). More and less similar fecundity has been reported by Sisodiya *et al.* (2003) [44], the fecundity was 56.2±13.26 eggs in Gujarat. The total number of eggs laid by each female was 63.00. (Patel *et al*., 2007) [27]. Desai *et al.* (1999) [16] and Reddy (2000) [33] observed that the *O. exvinacea* laid on an average 55.80 and 44.2 eggs on the mango leaves.

The sex ratio (male : female) under laboratory was 1:1.20 (Table 2). The male to female sex ratio of *O. euadrusalis* was 1:1.2 in Gujarat (Sisodiya *et al.* 2003) [44]. Under field conditions, the sex ratio (male: female) was 1:1.18, while in the lab, it was 1:1.14. Male and female (Patel *et al*., 2007) [27]. This reports tallies with the present findings.

The total life span of male and female was 59.20 and 63.20 days, respectively (Table 1). More or less similar results were reported by Sisodiya *et al.* (2003) [44], the total life cycle of male was 43.2±7.32 days and 55.4±9.50 days of female. Desai *et al.* (1999) [16] investigated that *O. exvinacea* males takes 43-53 and females takes 44-54 days to complete their life cycles. Reddy *et al*. (2001) [32] analysed the mango leaf webber life cycle took 53.36 to 62.7 days.

Conclusion

Female moths (*Orthaga exvinacea* Hampson) laid greenish dull, oval, flattened eggs singly or in clusters, typically near the midrib or vein, on the lower surface of leaves. The eggs measured 0.97 mm in length and 0.67 mm in width. The time of incubation was 4.80 days. The hatching rate of the eggs was 89.60 percent.

When the caterpillars hatched, they went straight to tender leaves and scraped the leaf surface for chlorophyll. The caterpillars webbed two or three leaves together in the early stages and fed on them by cutting the leaves from the sides to the midrib, leaving a network of veins behind. The larvae

passed through seven instars. The prolegs were found on 3rd to 6th and 10th abdominal segments. The first, second, third, fourth, fifth, sixth, and seventh instar larvae each lasted 4.40, 5.20, 3.60, 4.00, 5.00, 5.80, and 3.00 days. The average time spent as a larva was 31.00 days (See Table 1) The length of the first, second, third, fourth, fifth, sixth and seventh instar larvae was 1.52, 4.76, 6.86, 11.02, 16.75, 21.65 and 27.97 mm, whereas in case of breadth it was 0.30, 0.48, 0.99, 1.65, 2.33, 2.68, 3.55 mm, respectively.

The pre-pupae ranged in colour from pale greenish to dark black. The pre-pupae stage lasted for 5.20 days. The dimensions were 21.36 mm in length and 3.54 mm in width. The pupation takes place within the silken cocoon, within the web. The pupae had a rich brown colour to them. Pupae measured 13.91 mm in length and 3.85 mm in width. Pupae lived for an average of 18.60 days.

O. exvinacea Hampson adults had brownish grey forewings with wavy lines. The ash grey hind wings had fringes on the apical margin. Male and female life spans were 4.40 and 8.40 days, respectively. Males and females measured 12.05 and 13.41 mm in length, with 25.52 and 29.02 mm in width with extended wings, respectively. Pre-oviposition, oviposition, and post-oviposition periods were calculated to be 3,40, 4.60, and 1.60 days, respectively. The female's fecundity was 84.60 eggs. Under laboratory conditions, the sex ratio (male: female) was 1:1.20. The male and female life spans were 59.20 and 63.20 days, respectively

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