



E-ISSN: 2278-4136

P-ISSN: 2349-8234

[www.phytojournal.com](http://www.phytojournal.com)

JPP 2020; 9(1): 2086-2089

Received: 10-11-2019

Accepted: 12-12-2019

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## Biology of the common banded awl, *Hasora chromus* Cramer (Lepidoptera: Hesperiiidae) on *Pongamia pinnata* at Bengaluru

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**Abstract**

Studies on the biology of the common banded awl, *Hasora chromus* on *Pongamia pinnata* conducted under laboratory conditions at UAS, GKVK, Bengaluru, revealed that the eggs are laid singly or in small groups of 2-3 on young shoots and staple of the leaves or on the margin of the upper surface of young leaves. The eggs are bun shaped with ridges running from top to base measuring 58.25µm in diameter. Base of the eggs are flattened providing surface for attaching to the substratum. The neonate larvae measured about 1.5 to 2 mm in length and 0.5 to 1 mm in width and after completing five instars, grew to a maximum average size of 32 to 35 mm long and 3 to 4 mm wide. Pre-pupal stage noticed prior to pupation in which the full grown caterpillar stopped feeding and their body shortened, shrunk and decolorized and attached itself to the rolled leaf by a silken thread to seal the pupation shelter. It is pale greenish with yellowish brown coloured head having a number of short setae. Pre-pupal period lasted for 0.64 to 1.76 days. Chrysalis type pupation took place inside the folded leaves. Pupa is naked and attached itself to the leaf surface by silk threads and remained inside the rolled leaf. The average pupal period observed to be of  $1.2 \pm 0.56$  days. The adult female wing expanse ranged between 3.00 to 55.00 mm, with a mean length of  $26.00 \pm 29.00$  mm, the adult male wing expanse ranged between 2.00 to 50.00 mm, with a mean length of  $24.00 \pm 26.00$  mm. The wings of male butterfly are unmarked and female butterfly had two spots on both side of the fore wings and horizontal white band present in both sexes on a lower side of hind wings.

**Keywords:** *Hasora chromus*, life history, instars, univalent, population index, Eastern Ghats, Southern Andhra Pradesh, biology

**Introduction**

*Pongamia pinnata*, commonly known as karanja is a leguminous oil yielding multipurpose tree, it can tolerate a range of different conditions with mean annual rainfall between 500–2500 mm and temperatures of 0-16°C minimum and 27–50°C maximum, mature trees can cope with light frosts, but require a dry period of 2–6 months (Duke, 1983; Daniel, 1997; Orwa *et al.*, 2009) [2, 1, 4]. The tree is known for its insecticidal property (Prakash and Rao, 1997) [5] but attacked by a number of insect pests which deteriorates the overall vigor and oil yielding capacity of the tree. Among the important insect pests, the common banded awl, *Hasora chromus* is one of the major defoliator pests causing heavy losses to the leaves leading to total defoliation in extreme cases. The larva of *H. chromus* is a defoliator and feeds on leaves, particularly on young and tender leaves and its severe infestation causes total defoliation. An attempt was made to study biology of *H. chromus* on *Pongamia* under laboratory conditions during July to December 2018 during which the temperature and RH were 25°C and 69 per cent respectively.

**Materials and Methods**

Eggs of the test insect were collected from the fields and brought to the laboratory and kept in petriplates along with leaves. After emergence of larvae, fresh leaves were provided daily and checked regularly for the head capsule to ensure moulting. A cotton dipped in sugar solution was kept in the petriplate to maintain humidity. Development of different stages of the pest was studied. The *Pongamia* plants (both in nursery and main field) were searched for the activity of *Hasora chromus* infestation. The leaf material along with eggs and different larval stages was brought to the laboratory and further development was observed. Subsequently the egg, larval and pupal development periods were recorded. For this purpose, the field collected *H. chromus* larvae/ pupae were transferred on the *Pongamia* leaves inside the cage (size = 60×30×30) cm for multiplication. Young leaves were supplied daily to the growing larvae. Uniformly hatched adult female moths were collected and transferred on to *Pongamia*

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leaves taken in separate cage. Ten replications were maintained. Observations were made on egg laying. The time period between egg laying and hatching of the eggs was considered as the incubation period. The newly hatched larvae

were observed daily to record larval, pre-pupal and pupal periods. Arithmetic mean and Standard error of all the biological parameters were calculated as per the methodology suggested by Suryanarayana *et al.* (2015) [6].

**Table 1:** Duration of different life stages of *H. chromus*

Sl. No.	Stage	Mean duration (Days)	Range
1.	Egg stage	2.53 ± 0.52	2.01-3.05
2.	I Instar	1.67 ± 0.49	1.18-2.16
	II Instar	3.13 ± 0.74	2.39-3.87
	III Instar	3.00 ± 1.00	2.00-4.00
	IV Instar	2.53 ± 0.92	1.61-3.45
	V Instar	3.93 ± 1.22	2.71-5.15
3.	Pre-pupation	1.2 ± 0.56	0.64-1.76
4.	Pupa stage	6.8 ± 3.55	3.25-10.35
5.	Adult longevity	3.33 ± 1.50	1.83-4.83
Total life cycle		28.12 ± 10.5	17.62-38.62

**Table 2:** Morphometric observations on different life stages of *H. chromus*

Stage	Length (mm)	Range	Width (mm)	Range	Head capsule width	Range
I Instar	1.50 ± 2.00	0.50-3.50	0.50 ± 1.00	0.50-1.50	0.47 ± 0.52	0.05-1.04
II Instar	5.90 ± 11.10	5.20-17.00	0.80 ± 1.30	0.50-2.10	0.71 ± 0.79	0.08-1.50
III Instar	15.8 ± 22.90	7.10-38.70	1.49 ± 2.00	0.51-3.50	1.11 ± 1.36	0.25-2.47
IV Instar	17.60 ± 26.10	8.50-43.70	1.88 ± 2.41	0.53-4.55	1.65 ± 1.87	0.22-3.52
V Instar	24.98 ± 35.00	10.02-59.98	2.45 ± 3.14	0.69-5.59	2.29 ± 2.78	0.49-5.07
Male pupae	8.90 ± 11.40	2.50-20.30	2.90 ± 3.45	0.55-6.35		
Female pupae	9.90 ± 13.85	3.95-23.75	3.40 ± 4.00	0.60-7.40		

### Eggs

Eggs were laid singly or in small groups of 2-3 on young shoots or on the margin of upper surface of young leaves. Eggs were bun shaped with ridges running from top to base and eggs measured 58.25 µm in diameter. The eggs were flattened at the base which helped to attach firmly onto the substratum. The freshly laid eggs were whitish in colour, but later turned pinkish and finally turned into silvery white colour just before hatching. Black coloured head of the larvae could be easily seen on the upper part of the eggs from where they fed on the upper portion of the chorion and cut a hole to emerge out of it. After emergence larvae did not feed on the entire shell but fed only partly on it. The incubation period was ranging between 2.01 to 3.05 days, with a mean of 2.53 ± 0.52 days (Table 1).

### Larvae

The neonate larvae measured about 1.5 to 2 mm. in length and 0.5 to 1.0 mm in width and after completing five instars, grew to an average size of 32 to 35 mm. in length and 3 to 4 mm. in width (Table 1).

### Instar I

The first instar larva was typically cylindrical in shape with yellowish brown body, which later turned pinkish brown, having a number of short setae with three pairs of thoracic legs (true legs) and five pairs of abdominal legs (prolegs). The head was large, black and hairy with four white stripes on the dorsal side towards the prothorax upto last abdominal segment. Moulting was confirmed by the presence of head capsule. The feeding rates increased with their age. The larva folded the leaves of young plants and fed within. In grown up plants, leaf was folded longitudinally bringing together the margins with the help of silken threads and by living inside the tubes thus formed, which helped them to feed on leaves from tip to base. The first instar duration ranged between 1.18 to 2.16 days, with a mean duration of 1.67 ± 0.49 (Table 2). The first instar larval length ranged between 0.50 to 3.50 mm,

with a mean length of 1.50 ± 2.00 mm, width ranged between 0.50 to 1.50 mm, with a mean width of 0.50 ± 1.00 mm. Its head capsule width ranged between 0.05 to 1.04 mm, with a mean width of 0.47 ± 0.52 mm days (Table 2).

### Instar II

The head capsule and body were covered with short fine setae, with four faint whitish narrow dorsal bands and one lateral band. The second instar duration ranged between 2.39 to 3.87 days, with a mean duration of 3.13 ± 0.74 days (Table 2). The second instar larval length ranged between 5.20 to 17.00 mm, with a mean length of 5.90 ± 11.10 mm, its width ranged between 0.50 to 2.10 mm, with a mean width of 0.80 ± 1.30 mm, its head capsule width ranged between 0.08 to 1.50 mm, with a mean width of 0.71 ± 0.79 mm (Table 2).

### Instar III

More prominent dorsal and lateral whitish bands were seen. Numerous tiny light coloured patches were found dotting the dark brown surface with a narrow anal plate, which was dark brown to black in colour and could be seen on posterior end. The third instar lasted for 2.00 to 4.00 days, with a mean duration of 3.00 ± 1.00 days (Table 2). The third instar length ranged between 7.10 to 38.70 mm, with a mean length of 15.8 ± 22.90 mm, while its width ranged between 0.51 to 3.50 mm, with a mean width of 1.49 ± 2.00 mm, head capsule width ranged between 0.25 to 2.47 mm, with a mean width of 1.11 ± 1.36 mm (Table 2).

### Instar IV

The body turned to purple brown during this instar. The whitish setae on the head capsule were proportionately much longer than in the earlier instars. The fourth instar period ranged between 1.61 to 3.45 days, with a mean duration of 2.53 ± 0.92 days (Table 2). The fourth instar length ranged between 8.50 to 43.70 mm, with a mean length of 17.60 ± 26.10 mm and its width ranged between 0.53-4.55 mm, with a mean width of 1.88 ± 2.41 mm, its head capsule width ranged

between 0.22 to 3.52 mm, with a mean width of  $1.65 \pm 1.87$  mm (Table 2).

### Instar V

The body colour changed to dark shades of black, with greenish colour. Several large dorso-lateral spots were also present here. A narrow lateral band could be seen. The head capsule turned to pale orange brown. The fifth instar duration lasted for 2.71 to 5.15 days, with a mean duration of  $3.93 \pm 1.22$  days (Table 2). The fifth instar length ranged between 10.02 to 59.98 mm, with a mean length of  $24.98 \pm 35.00$  mm and the width ranged between 0.69 to 5.59 mm, with a mean width of  $2.45 \pm 3.14$  mm. The head capsule width during IV instar ranged between 0.49 to 5.07 mm, with a mean width of  $2.29 \pm 2.78$  mm (Table 2).

### Pre-pupa

Towards the end of the V instar, the larvae stopped feeding and their body shrunkened and decolourized just before pupation. The pre-pupa attached itself to the rolled leaf by silk threads to sealed the pupation shelter. It was pale greenish with yellowish brown head, having a number of short setae. Pre-pupal period ranged between 0.64 to 1.76 days, with a mean duration of  $1.2 \pm 0.56$  days (Table 1).

### Pupa

Chrysalis type pupation occurred inside the folded leaves. It was naked and attached itself to the leaf surface by a silken thread and remained concealed within the rolled leaf. Pupa became greenish in colour, with white powder over the body surface being blunt at the posterior end and broad anteriorly. The pupal period ranged between 3.25 to 10.35 days, with a mean duration of  $6.8 \pm 3.55$  days (Table 2). The male pupal length ranged between 2.50 to 20.30 mm, with a mean length of  $8.90 \pm 11.40$  mm, width ranged between 0.55 to 6.35 mm, with a mean width of  $2.90 \pm 3.45$  mm, the female pupal

length ranged between 3.95 to 23.75 mm, with a mean length of  $9.90 \pm 13.85$  mm, its width ranged between 0.60 to 7.40 mm, with a mean width of  $3.40 \pm 4.00$  mm (Table 1)

### Adult

Adult butterfly was brownish black in colour and the wings were completely covered with scales. The wings of male butterfly were unmarked, whereas that of the female butterfly had two spots on both side of the fore wings and a horizontal white band was present in both sexes, on the lower side of hind wings. The adult butterfly was a very active. Antenna was lengthy, which enlarged gradually towards the tip with hook like projection on the terminal segment. The total life cycle was completed in 17.62 to 38.62 days, with a mean duration of  $3.33 \pm 1.50$  days (Table 2). The adult female wing expanse ranged between 3.00 to 55.00 mm, with a mean length of  $26.00 \pm 29.00$  mm, the adult male wing expanse ranged between 2.00 to 50.00 mm, with a mean length of  $24.00 \pm 26.00$  mm (Table 1).

### Longevity of adults of *H. chromus*

It was clear from the study that longevity of *H. chromus* adult when fed with food and also when starved showed significant differences (Table 4). The longevity of starved male and female was  $3.00 \pm 1.05$  days and  $3.70 \pm 1.16$  days ranging from 1.95 to 4.05 and 2.54 to 4.86 days, respectively. However, in case of adults fed with food, the average longevity of male and female was  $16.90 \pm 1.96$  and  $17.50 \pm 2.42$  days ranging from 14.94 to 18.86 and 15.08 to 19.92 days, respectively.

**Table 3:** Wing expanse of *H. chromus*

	Wing Expanse (mm)	Range
Adult female	$26.00 \pm 29.00$	3.00-55.00
Adult male	$24.00 \pm 26.00$	2.00-50.00

**Table 4:** Longevity of adults of *H. chromus*

Pair number after emergence	Longevity in (Days)			
	With 10% honey solution as food		Without food	
	Male	Female	Male	Female
1.	14.00	13.00	5.00	6.00
2.	15.00	16.00	3.00	4.00
3.	20.00	21.00	4.00	4.00
4.	17.00	18.00	4.00	5.00
5.	16.00	17.00	3.00	4.00
6.	18.00	19.00	2.00	3.00
7.	20.00	21.00	2.00	3.00
8.	16.00	17.00	3.00	3.00
9.	16.00	17.00	2.00	2.00
10.	17.00	16.00	2.00	3.00
Total	169.00	175.00	30.00	37.00
Mean	$16.90 \pm 1.96$	$17.50 \pm 2.42$	$3.00 \pm 1.05$	$3.70 \pm 1.16$
Range	14.94-18.86	15.08-19.92	1.95-4.05	2.54-4.86

**Table 5:** Fecundity of *H. chromus*

Number of days after emergence	Pair number										Total
	1	2	3	4	5	6	7	8	9	10	
1.	23	26	16	15	23	18	16	17	19	22	
2.	27	31	25	23	29	19	21	19	22	19	
3.	30	28	32	21	25	22	19	21	24	21	
4.	24	24	18	19	21	23	16	25	21	18	
5.	22	21	14	15	18	17	18	13	21	11	
6.	15	18	-	13	-	15	19	-	17	-	
Eggs	141	148	105	106	116	114	99	95	124	91	1131.00

( $\bar{x}$ ) = 113.90 Eggs/ Female

**Table 6:** Sex ratio of *H. chromus*

Adult emergence			Percentage		Sex ratio
Total No. of replications	Female	Male	Female	Male	Male to Female
125.00	66.00	59.00	52.80	47.20	1.00 : 1.12

**Cramer**

Total number of eggs laid by ten pairs of common banded awl was 1139 with a mean fecundity per female bring 113.90 (Table 33).

**Sex ratio of *H. chromus***

Sex ratio from male to female male was 1.00 to 1.12. Out of 125 larvae 66.00 was emerged as female and 59.00 was emerged as male and percentage varies from male to female male was 47.20 and 52.80 per cent, respectively (Table 35).

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