

Biology of *Rogas aligarhensis* Quadri (Hym, Braconidae)

A Larval Parasite of *Earias* Spp.*

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ABSTRACT

Rogas aligarhensis Quadri which was reported for the first time by Quadri in 1933 as a larval endo-parasite of *Platyedra gossypiella* Saund. is also a very effective field larval parasite of *Earias* spp. in Anand area of Gujarat State, parasitising upto 90% of the larvae in the field. The parasite lays about 110 eggs during its life. The average egg period is 20.77 hours. The larvae moult five times and pupate in the host larval cadaver. The average developmental period from egg laying to pupation is 5.77 days and the pupal period is 5.54 days. The adult emerges by making a hole at the caudal end of the host cadaver. The average longevity of the female was 16.88 days, while that of the male was 13.12 days. Parthenogenesis is common in this parasite and the progeny from such females is all males.

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INTRODUCTION

Many parasites attack *Earias* larvae in Gujarat of which *Rogas aligarhensis* is most active in all parts of the State. Gohil (1972) reported it parasitising about 10% of *Earias* larvae in Junagadh area. Manjunath (1974) observed that parasitism by this species ranged from 6.3% to 83.3% in 1972-73 and from 20 to 90% in 1973-74. He pointed out some good qualities of the parasite such as (1) its first appearance in the field is synchronous with that of its host, (2) it is active throughout the cotton season, (3) it attacks young *Earias* larvae before they cause any appreciable damage to the plant, (4) it gives high parasitism of *Earias* and (5) it is free from secondary parasites.

R. aligarhensis was reported in 1933 by Quadri from Aligarh (U.P., where it was reared from *Platyedra*

gossypiella Saund. larvae. It is also reported as a larval parasite of *Earias* spp. by Cherian and Kylasam (1941) from Tamil Nadu. Outside India, this parasite is reported by Gomez (1950) from Spain. Although this parasite has been reported since long, its detailed biology has not been studied. This prompted the authors to initiate studies on the biology of this important parasite of *Earias* spp.

MATERIAL AND METHODS

The initial culture of the parasite was started by collecting early instar *Earias* larvae as well as parasitised and dead *Earias* larvae from cotton fields. The larvae were reared on pieces of *bhindi* (okra) pods in round galvanised iron cages measuring 35 cm in diameter and 10 cm in height. The cage was covered with a piece of black cloth held tightly in place by an elas-

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tic string. The food was changed daily. After the parasite larva has completed its development inside the host larva, the latter comes out of the *bhindi* piece and dies.

The parasitised host larvae reared in the laboratory and those obtained from fields were held in glass tubes measuring 10 cm x 2.5 cm and closed with cotton plugs. When the adults emerged, the female could be readily identified by its prominent ovipositor. The parasites were paired in similar glass tubes having cotton swabs soaked with 5% honey. These swabs were changed everyday. The tubes were changed every 3 or 4 days. The culture of the parasite was multiplied by using laboratory reared second instar *Earias* larvae. For this purpose, a larva was picked up on a moist brush and held close to the female in the tube. The female if ready to oviposit immediately stung the larva and laid an egg. Parasitised larvae were further reared on *bhindi* pod pieces.

To study the fecundity of the parasite, a freshly emerged pair was caged in the glass chimney with 10 second instar *Earias* larvae. A cotton swab soaked with 5% honey solution was stuck on inside wall of the chimney and the chimney was covered with a piece of nylon cloth secured in position by a rubber band. After 24 hours, the host larvae were taken out and dissected to count the number of eggs laid by the female. This was continued until the death of the female. The fecundity was studied for both mated and unmated females.

To determine the incubation period of eggs, parasitised host larvae were dissected at different time intervals to record the number of eggs that hatched during different time intervals.

The observations were continued until all the eggs were found to have hatched.

The number of instars and the growth rate of parasite larvae were studied by parasitising host larvae individually and dissecting them daily. The length and breadth of the parasite larvae of different ages were recorded. Size of mandibles was a good criterion to decide the instar. To measure the mandibles, the larvae were treated with 5% iodine solution and then mounted in Berlese's fluid.

Examination of the dead parasitised host larvae revealed the parasite in pupal condition. Therefore, the period from parasitisation till the death of the host larva was considered as duration of egg-larval period and the period from the death of the host larva to emergence of adult parasite was considered as pupal period of the parasite.

To study the parthenogenetic behaviour of the parasite, the host larvae were parasitised by unmated females and reared to obtain adults. The adults emerging from these larvae were sexed to determine the sex-ratio. Similarly, the sex-ratio of normal population was determined from the adults obtained from larvae parasitised by mated females and from the adults obtained from field collected host larvae and cadavers.

RESULTS AND DISCUSSION

(i) Life history: Egg (Plate 1-a):

The eggs of *R. aligarhensis* are milky white, shining, elongate, slightly curved with broadly rounded anterior and slightly narrowly rounded caudal end. The freshly laid eggs are 0.440 ± 0.074 mm long and 0.111 mm broad. The parasite eggs began to hatch after 19

hours from parasitisation and continued to hatch until 22.00 hours. Considering the total incubation period of all the eggs that hatched during the period of study, the average incubation period worked out as 20.77 ± 1.12 hours at $26.93 \pm 0.81^\circ \text{C}$.

Larva: First instar larva (Plate 1-b): The first instar larva is smooth, delicate and slightly curved with thirteen segments excluding the head which is

prominent and widest. The breadth of the body gradually reduces towards the caudal end. The mandibles are hook-like, narrow and pointed and are slightly chitinated. The length of the larva ranged from 0.369 to 0.959 mm with an average of 0.580 mm while the width varied from 0.111 to 0.406 mm with an average of 0.241 mm. The average length of mandibles was 0.0179 mm (Plate 1-b-1).

Plate - 1

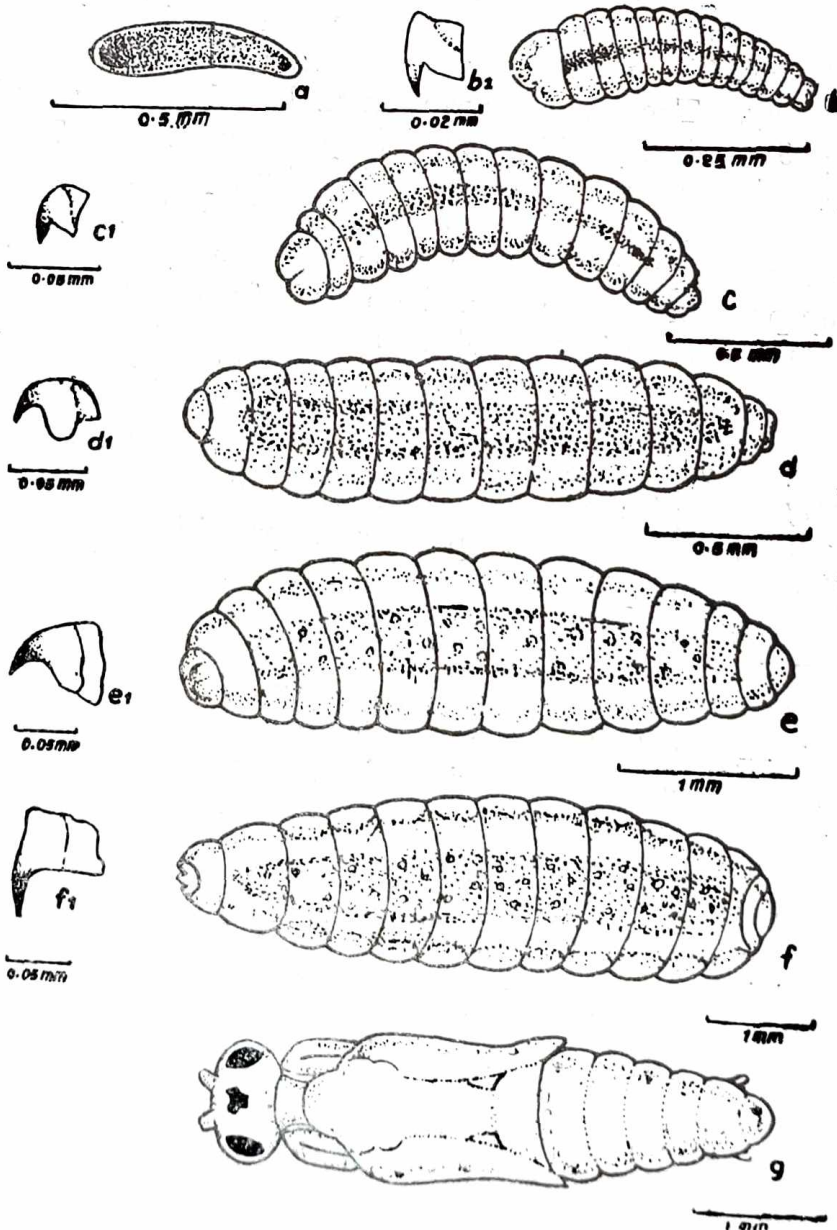


Plate 1. Egg. Different larval instars and pupa of *Rogas aligarhensis*

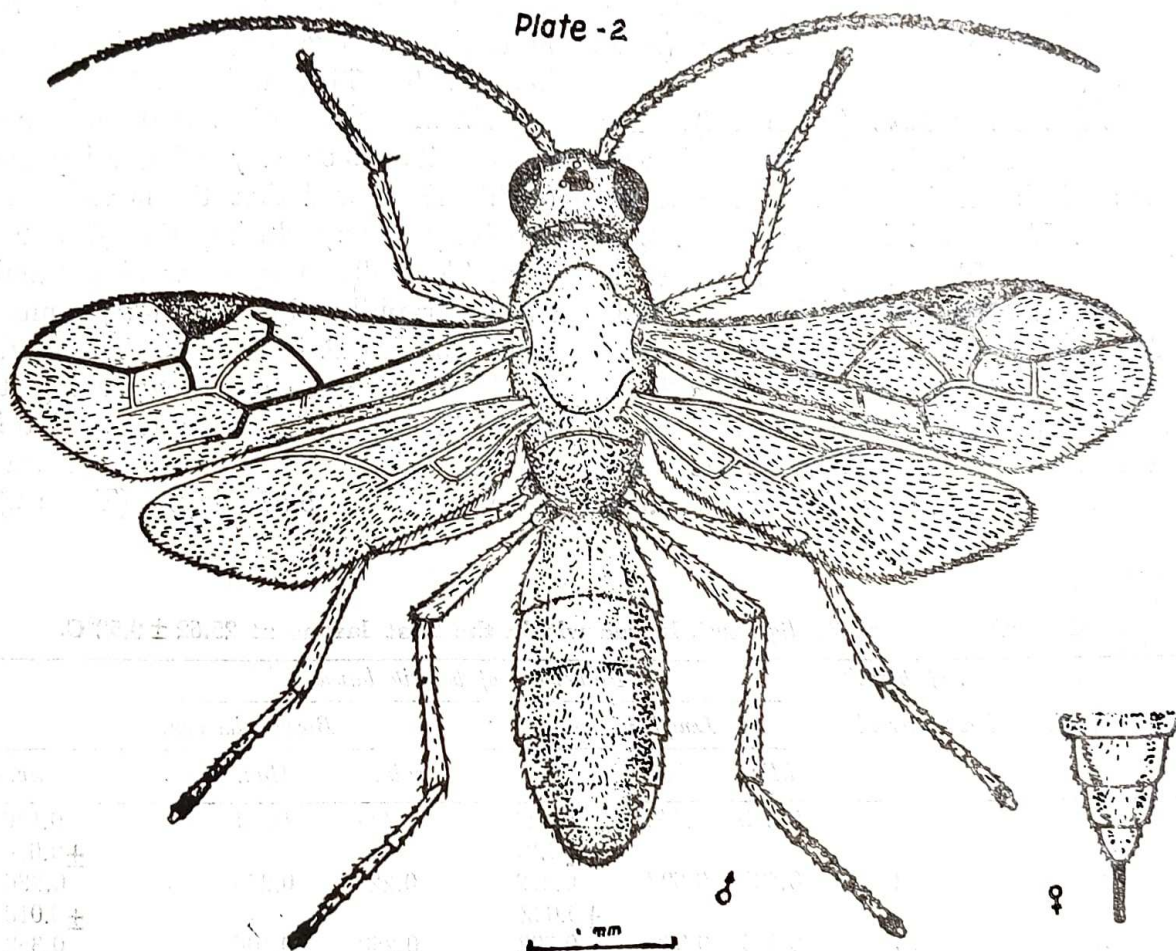


Plate 2. Adult *Rogas aligarhensis* male and tip of abdomen of female

Second instar larva (Plate 1-c): The larva in this instar is readily differentiated from that of the first by the presence of tracheae. They are creamy white, cylindrical and with slightly curved body. The length varied from 0.923 to 1.661 mm with an average of 1.442 mm while the breadth varied from 0.406 to 0.701 mm with an average of 0.535 mm. The average length of the mandibles was 0.0364 mm. (Plate 1-c-1).

Third instar larva (Plate 1-d): The larva in this instar is smooth, creamy white, cylindrical and with rounded ends. The alimentary canal appears slightly green in colour. The tracheal

system is well developed. All the body segments are more or less equal in size. The length of the larvae in this instar varied from 1.476 to 2.841 mm with an average of 2.139 mm while the breadth varied from 0.590 to 0.923 mm with an average of 0.773 mm. The average length of the mandibles was 0.0476 mm (Plate 1-d-1).

Fourth instar larva: (Plate 1-e): There is very little difference between the third and the fourth instar larvae. The body colour in this instar is pale green. The length varied from 2.694 to 3.850 mm. with an average of 3.426 mm. while the breadth varied from 0.886 to 1.450 mm. with an ave-

rage of 1.191 mm. The average length of the mandibles was 0.0650 mm. (Plate 1-e-1).

Fifth instar larva (Plate 1-f): The shape of larva in this instar is very much different from that of the earlier instars. The head is narrow and bent downwards. The body is broadest in the middle region which is greenish. The mandibles are highly chitinized and sharply pointed. The length of the larvae varied from 4.669 to 6.337 mm with an average of 5.225 mm while the breadth varied from 1.668

to 2.201 mm with an average of 1.756 mm. The average length of the mandibles was 0.0866 mm. (Plate 1-f-1)

Examination of larval measurements after each day of development (Table 1) showed that the larvae grow relatively slowly during the first two days. Thereafter they grow almost uniformly rapidly but attaining much larger size on the last day. The study of the duration from egg-laying to death of host larva showed that this period varied from 4 to 8 days with an average of 5.57 days (Table 2).

TABLE 1

Rate of development of *R. aligarhensis* larvae within the host larvae at $25.62 \pm 0.52^\circ\text{C}$.

Days after parasitisation	No. of parasite larva observed	Measurement of parasite larvae					
		Length in mm.			Breadth in mm.		
		Min.	Max.	Av.	Min.	Max.	Av.
1.	14	0.369	0.443	0.424 ± 0.27	0.111	0.148	0.130 ± 0.016
2.	18	0.480	0.627	0.512 ± 0.032	0.221	0.293	0.236 ± 0.018
3.	16	0.535	0.959	0.792 ± 0.141	0.258	0.406	0.352 ± 0.054
4.	25	0.923	1.845	1.451 ± 0.225	0.406	0.775	0.555 ± 0.086
5.	23	1.845	2.952	2.373 ± 0.356	0.664	1.107	0.821 ± 0.102
6.	37	2.952	6.337	4.270 ± 0.875	0.996	2.201	1.468 ± 0.278

TABLE 2

Duration from parasitisation of *Earias* larva until its death caused by *R. aligarhensis* at $27.36 \pm 0.94^\circ\text{C}$.

Duration from parasitisation till the death of host larvae in days	No. of individuals	Total duration in days
t	n	t x n
4	7	28
5	45	225
6	61	366
7	4	38
8	2	16
Total	119	663
Average,	$\frac{tn}{n} = \frac{663}{119} = 5.57 \pm 0.72$ days.	

During the earlier phases of larval development, the location of the parasite larvae is not fixed. But by the time of death of the host, the head of the parasite larva remains towards the head of host larva. At this time practically all the internal organs are consumed by the parasite larva leaving only a small quantity of body fluid. The parasite larva then reverses its direction perhaps to consume the fluid in the posterior region and finally it moults throwing out the exuviae on one side of its caudal end and then it pupates in the cadaver.

Pupa (Plate 1-g): The dissections of

dead host larvae showed that the pupa is exarate. The colour of the freshly formed pupa is light yellow which gradually turns to light brown. The sex can be easily differentiated by the presence or absence of ovipositor.

The average length and breadth of male pupa were 4.637 mm and 1.269 mm respectively while those of female were 5.453 mm and 1.374 mm respectively. The duration (in days) from the death of the parasitised host larvae until the emergence of adults was 4 to 9 days with an average of 5.54 days. The data are presented in Table 3.

TABLE 3

Duration in days from the death of parasitised host larva until the emergence of *R. aligarhensis* at $27.35 \pm 0.94^{\circ}\text{C}$.

Duration in days <i>t</i>	No. of individual that emerged <i>n</i>	Total duration in day <i>t x n</i>
4	4	16
5	56	280
6	52	312
7	5	35
8	1	8
9	1	9
Total	119	660

$$\text{Average, } \frac{tn}{n} = \frac{660}{119} = 5.54 \pm 0.74 \text{ days.}$$

Adult: The head of the adult is prominent and is sparsely hairy. The eyes are black. Three prominent ocelli arranged in a triangular manner are located on the vertex enclosing a black area. The antennae are light brown, filiform having 29 to 31 segments in male and 31 to 33 segments in female. The thorax is moderately pubescent and rather humped. The prothoracic legs are shorter than meso- and meta-thoracic legs. The tarsus consists of five tarsomeres. The fifth tarsal segment bears a pair of black claws with pulvillus between them. The

wings are hyaline and pubescent. There is a prominent stigma about mid-way along the costal margin. The abdomen is composed of seven segments of which the first two are proportionately larger in size than the remaining segments.

(ii) Behaviour of adult:

(a) *During mating*: The adults mate soon after emergence. The males exhibit distinct mating excitement. During mating, the male rubs its antennae vigorously with those of the female. Mating lasts for 5 to 15 seconds. If the female is not interested in mating, it bends her abdomen downward and

keeps walking away quickly. If the female is interested in mating, she touches the male with her antennae and pushes him about.

(b) *During oviposition:* The gravid female moves towards the host larva keeping the antennae in front of the head and the tip of the abdomen downwards. It holds the host larva with front and middle legs, brings the ovipositor in front from beneath the body and inserts an egg in 15 to 80 seconds with an average of 45 seconds. The parasite lays eggs in any part of the body except the head region and the extreme caudal end of the host.

(c) *During emergence:* The parasite pupates inside the host cadaver. For emerging from the cadaver, the parasite cuts a hole of about 1.22 mm in diameter on the dorsal side of the 8th and 9th segments of the cadaver.

(iii) Sex-ratio:

The sex ratio of the adults emerging from field collected material varied from 1.60 to 2.10 females for every male while the same in the laboratory bred culture varied from 1.62 to 3.18 females for every male.

(iv) Fecundity and Longevity:

Mated females laid on an average 111 eggs while unmated females laid on an average 100 eggs, with a maximum of 37 eggs in a single day. There were no pre-oviposition and post-oviposition periods. On an average, the male survived for 13.12 days while the female survived for 16.88 days. The progeny of unmated females was all males.

Summary:

Rogas aligarhensis Quadri is a larval parasite of cotton bollworm, *Earias*, spp. It has been reported from almost all the cotton-growing areas in India and is reasonably effective in Gujarat.

Minute elongate slightly curved eggs are laid inside the host body. The

egg stage lasted on an average for 20.77 hours. The larval development is completed in five instars. The duration from egg laying to death of the host larva is 5.57 days. The parasite pupates in the larval cadaver and the pupal period is 5.54 days. The mated females laid on an average 111 eggs —while unmated females laid 100 eggs with a maximum of 37 eggs in a single day. The average life of males was 13.12 days while that of females was 16.88 days. The progeny of unmated females is all males.

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