

## SYSTEMATICS AND BIOLOGY OF BRACHYMERIA

## BICOLORATA NEW SPECIES

(Chalcididae; Hymenoptera) A Pupal Parasite of *Earias* Spp. in Sind, Pakistan

KULSOOM FATIMA KHOKHAR, M. A. H. QADRI and MANZOOR AHMED

Department of Zoology, University of Karachi, Karachi 32

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*Brachymeria bicolorata*, new species is a primary pupal parasite of cotton boll-worm species *Earias insulana* and *Earias fabia* in southern areas of Sind province. The parasite is one of the commonly found chalcids, and successfully parasitises boll-worm pupae up to 20–30% in field populations. The life history of the parasite depends upon the environmental factors like temperature and humidity as well as on the physiological conditions of the host. The parasite is multifagous, and parasitises a number of the lipidopterous species.

The genus *Brachymeria* is quite widely known, as a number of species of the genus have been recorded parasitising lepidopterous species in America, Europe and India etc. Burks reported<sup>1</sup> the genus to be commonest of all the chalcids in the United States of America, 27 species of the genus were described by him. Among the important hosts listed by Burks there is not included any of the species of *Earias*. Dowden<sup>2</sup> while describing *Brachymeria intermedia*, a pupal parasite of gypsy moth *Porthetria dispar* in Italy, Algeria and Morocco, had discussed the host species of the parasites reared in the laboratory. He has also listed some of the tachinid pupae of which *B. intermedia* is a parasite. Kamal<sup>3</sup> has described the life history, biology and nymphal morphology of *B. femorata* as a primary parasite of cabbage worm *Pieris rapae*, in lower Egypt. Ferriere<sup>4</sup> reported *Brachymeria fijiensis*, *B. obscurata* and *B. olethrius* parasitising pink boll-worm *Platyedra gossypiella* in the Fiji Islands, Hawaii, and Africa respectively. Hussain and Mathur<sup>5</sup> reported three species of *Brachymeria* from cotton boll-worm *Earias insulana* and *Earias fabia* in the Punjab. The present work is a part of our investigation of the parasites of the cotton boll-worms and consists of the description of new species *Brachymeria bicolorata* with its life history and biology on the hosts *Earias* species in Sind province of Pakistan. The species has been reared in the laboratory from parasitised boll-worms collected from Mirpur Khas, Tandojam, Thatta and Karachi. Further studies on the biology and life history were carried out on the larvae collected from the field and bred to pupae in the laboratory. The parasite can be easily collected from the cotton fields in Sind area, throughout the cotton season.

*B. bicolorata* is an important parasite of cotton boll-worm species in Pakistan, particularly due to its selective capability of parasitising the pupal stage of the host. The present workers have studied a number of leg and larval parasites of the

cotton boll-worm species, with which *B. bicolorata* has not to compete in natural populations of the host. The pupae of the host collected from the fields at Mirpur Khas, Tandojam, and Karachi have been observed as parasitised by *Brachymeria bicolorata* up to 20–30%. The parasite is usually active from the month of July to January, and can be easily collected. It is a multifagous parasite and has been reared from a number of other hosts in Sind area. However *B. bicolorata* shows a remarkable preference for the host *Earias* spp. and appears to play an important role in the overall control of boll-worm in nature. It is easily breedable and can be effectively used in large cotton growing areas.

Key to differentiate *B. bicolorata* from allied species

1. Legs more or less reddish, with some parts black. *B. fijiensis* Ferriere
- Legs more or less yellow, with some parts black. 2
2. Antennal pedicel usually as broad as long; mandibles with two teeth 3
- Antennal pedicel twice as long as broad; mandibles with three teeth on the right side, and two teeth on the left
- B. bicolorata*, new sp.
3. Tibiae almost entirely yellow; complete frontal carinae present in both sexes. *B. compsilurae* (Crawford)
- Tibiae black, yellow only at apices; frontal carinae absent or vaguely indicated and short in males: *B. intermedia* (Nees)

*Brachymeria bicolorata*, new sp. (Fig. 1–4)

*Female*.—Length 4.50–5.00 mm; body colour black in general, tegulae, apices of femora and tibiae, claws of fore and middle legs and tarsii of legs all yellowish, claws of middle legs brown;

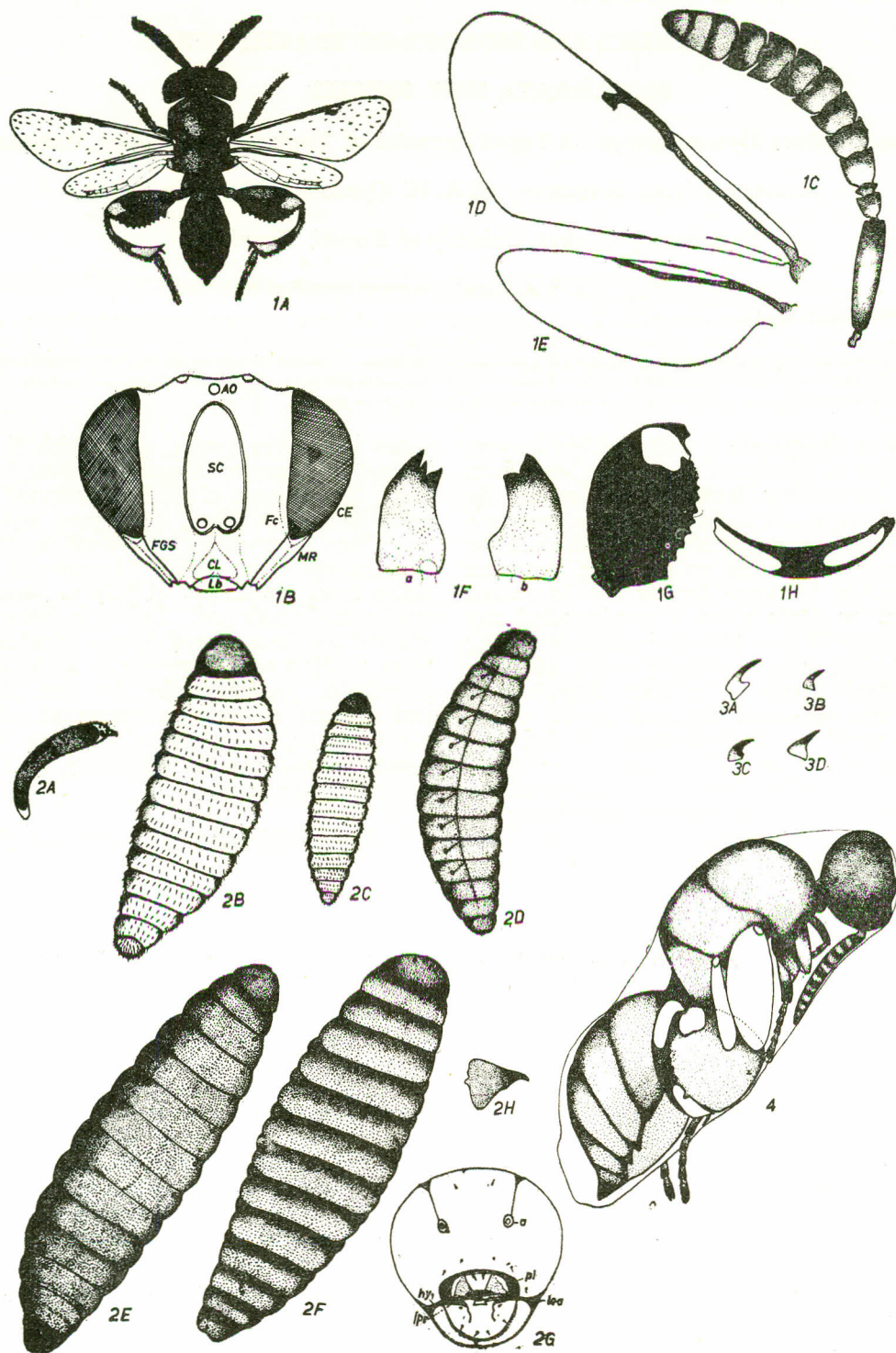


Fig. 1.—(A) Adult female,  $\times 12.5$  (B) Head, Adult female,  $\times 50$  (C) Adult, antenna  $\times 50$  (D) Fore wing  $\times 36$  (E) Hind wing  $\times 36$ ; (F) Mandible, a-right, b-left  $\times 100$  (G) Femur, adult  $\times 36$ ; (H) Tibia, adult  $\times 36$ . Fig. 2.—(A) Egg  $\times 50$  (B) Larva, first instar  $\times 72$  (C) Second instar  $\times 18$  (D) Third instar  $\times 18$  (E) Fourth instar  $\times 36$  (F) Fifth instar  $\times 18$  (G) Head, full grown larva  $\times 72$  (H) Mandible, full grown larva  $\times 144$ . Fig. 3.—Mandibles (A) First instar  $\times 144$  (B) Second instar  $\times 72$  (C) Third instar  $\times 72$  (D) Fourth instar  $\times 72$ . Fig. 4.—Pupa  $\times 72$ .

pubescence silvery white all over; antennae inserted slightly dorsad to ventral margins of compound eyes; scrobe cavity reaching anterior ocellus;  $\frac{1}{2}$  of lateral margin carinate; ventral carina minutely interrupted on menson; antennal scape not exceeding apex of scrobe cavity; pedicel twice as long as wide; first funicle  $\frac{1}{2}$  as long as wide; second funicle shorter than first; 3rd to 9th funicles becoming progressively wider; club formed of three funicles, broad at base, narrow and rounded at apex; labrum twice as broad as long; clypeus bearing three bristles, set in pits on either side of menson; mandibles dark-brown, left mandible with two, blunt, subequal teeth, right mandible with three subequal pointed teeth; anterior tooth longer and pointed, posterior tooth rather blunt, and the middle one is smaller than both; pronotum with median  $\frac{1}{2}$  of anterior margin ecarinate; forewing with marginal vein twice as long as postmarginal vein, stigma  $\frac{1}{2}$  as long as postmarginal vein; scutellum convex in lateral aspect; hind coxae without median tooth; hairs present at the junction of the coxa and femur; anterior surface of the hind femur smooth and shining; hind femur with twelve teeth, of which outer ventral tooth four times as large as any other tooth; dorsal surface of the first, second, third and the fourth gasteral tergites sculptured; fifth and sixth tergites with dense setigerous punctures; apex of gaster subtruncate.

*Male*.—Length 4.00–5.00 mm; colour as in female; pubescence slightly less dense; basal tooth of hind femur smaller than that of female.

The species *Brachymeria bicolorata* appears close to *B. intermedia* and *B. fjiensis* in characters of face of adult female, in the dentation of femur, and in general body colour. It however differs in outer tooth of hind femur being four times larger than the following teeth and in the apex of antennal scape reaching the apex of scrobe cavity.

*Type and Other Material*.—Holotype female, Karachi, Sind, 20 IX 69 (K.F. Khokhar), allotype male, and thirty paratypes, same data in the Zoological Museum, University of Karachi, Karachi Pakistan.

### Biology and Life History

The female usually selects newly formed pupae to lay eggs which hatch in about 48–72 hr depending upon the temperature. The freshly hatched larva starts feeding very soon. The larva is morphologically similar to those of the ectoparasitic chalcidoid larvae. Normally the female lays only one egg per host, but in cases where more than one egg happens to be laid in one host, only one parasite can complete its development in one host pupa. The parasite larva remains in the middle of the body of the host pupa and feeds on the contents until it becomes full grown, when it

casts its meconium immediately and passes through prepupal and pupal development stages. The adults emerge from the middle of the pupal case. In a few cases the emergence hole has been found on the posterior end of the pupal case.

*Brachymeria bicolorata* has two generations in a year. The maximum number of eggs laid by a single female in her life time was 40 in our laboratory at the rate of 5–6 eggs per day. The life history takes 24–32 days in completion. Mating takes place just after emergence of adults and mated females start laying eggs after 2–3 days. Virgin females also oviposited, but the progeny was males. The female when about to lay eggs crawls to a host pupa and walks over it for a few minutes, then it takes a firm grasp of pupa with her hind legs and inserts her ovipositor in the anterior part of the pupa. Oviposition lasts for about 1–4 min. It then withdraws her ovipositor and the host becomes motionless for some time. A small drop of fluid exudes from the hole.

*Egg* (Fig. 2A).—The female lays eggs usually in newly formed pupae, but other stages like full grown larvae and pupae in advanced stages of development are also parasitised. The eggs are elongate, broad at their anterior end, narrow at posterior end. They are curved in middle, 0.87 mm long, 0.20 mm wide at the anterior end, 0.07 mm wide at posterior end. The colour of the egg is yellowish-white or creamy.

*First Instar* (Fig. 2B).—The larva measures 1.25 mm in length and 0.30 mm in width. It is hymenopteriform, somewhat elongated, with a large sclerotized head. The body possesses 13 distinct segments of approximately equal length, except the last segment which is shorter and slightly invaginated posteriorly. The head is very distinct and its size is about double the first thoracic segment. It bears a pair of short truncate antennae. The mandibles (Fig. 3) are well sclerotized sickle shaped. Tracheal system consists of a pair of lateral longitudinal trunks united posteriorly in the eleventh abdominal segment, and anteriorly in the first thoracic segment. There are four pairs of open spiracles present on the second thoracic and first three abdominal segments. There are two pairs of sensory setae present on the dorsal side of all the body segments except the last abdominal segment. One of the two pairs is dorsolateral in position and the other is ventrolateral. The body of the larva is covered with spines. They are arranged transversely in equidistant bands on each segment. In the ninth and tenth abdominal segments the arrangement of the spines is different and are present all over the dorsal and ventral surfaces.

*Second Instar* (Fig. 2C).—It measures 2.42 mm in length and 0.57 mm in width. The body segments are equal in length dorsally, except the last abdominal segment, which is about  $\frac{1}{2}$  the size of

other segments. The mandibles (Fig. 3) are slightly bigger than the mandibles of the first instar larva, and measure about 0.065 mm in length. Spiracular system at this stage is also slightly different. The stumps of rudimentary spiracular branches are more prominent than in the first instar. Head sutures are clearly defined. Cuticular spines are present on all the body segments on the dorsal as well as ventral side. These spines are also much more developed than in the first instar. Two pairs of sensory setae are present on each thoracic and abdominal segment.

*Third Instar* (Fig. 2D).—It is dirty white and measures about 3.98 mm in length and 0.95 mm in width. The larva is very much similar to that of second instar, but differs in size and shape of head. It has nine pairs of open spiracles. The head is similar to that of a full grown larva, but is less chitinized. The mandibles are larger in size and resemble those of second instar. The spiracles are distributed on second and third thoracic segments and first seven abdominal segments. The eighth abdominal segment has no spiracle.

*Fourth Instar* (Fig. 2E).—It is greyish, measuring about 4.76 mm in length and 1.66 mm in width. The mandibles have the same shape, but are slightly larger. The arrangement and number of the sensory setae is the same. The cuticular spines are absent on the first body segment, but are present on the last four segments. The cuticular spines are straight with a single point, unlike *Brachymeria intermedia* where many of the spines on the last abdominal segment have several points.

*Fifth Instar* (Fig. 2F).—The full grown larva has the general shape similar to that of fourth instar. It measures about 6.25 mm in length and 1.90 mm in width. The thoracic spiracles and lateral lobes on the thorax are distinctly lower than the line of spiracles and the lateral lobes on the abdominal segments. Cuticular spines are absent in this instar. The number of sensory setae varies. The head is well differentiated at this stage. The mandibles are 0.20 mm long and 0.17 mm broad. Their tips are brownish and they are strongly sclerotized. In the head, the pharyngeal bracon and tentorial arms are strongly developed. There are two distinct tentorial maculae present on the head. The antennae are small fleshy protuberances surrounded by large rounded foramina. The histoblasts (or imaginal buds) can be easily distinguished in fifth instar. The tracheal system is as in the previous instars but the branches are longer and more ramified. The fat body is

conspicuous. It consists of many rows of large oval cells, placed between the skin and integumentary muscles of each segment.

*Pupa* (Fig. 4).—When the larva is full fed, it voids its meconium. The prepupa is dirty white. The head and thorax can be distinguished first and then the abdomen and appendages are differentiated. The pupa measures about 4.29 mm in length and 1.80 mm in width. It is first yellowish-white, but as the development proceeds it becomes black. The adult *Brachymeria* emerges from the host pupa by cutting an irregular hole at the anterolateral end or in the middle.

*Duration of Life History Stages in November and December*

Egg stage	2-3 days
First instar	2 days
Second instar	2-3 days
Third instar	2 days
Fourth instar	2 days
Fifth instar	4-5 days
Pupa	12-15 days
Total = 26-32 days	

*Duration of Life History Stages in September and October*

Egg	1-2 days
First instar	2 days
Second instar	2 days
Third instar	2 days
Fourth instar	2 days
Fifth instar	4-6 days
Pupa	10-12 days
Total = 24-28 days	

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