CHARACTERISATION OF SEXES IN THE PUPAL STAGE OF THE SUNFLOWER CATERPILLAR, *DIACRISIA CASIGNETUM* KOLLAR (LEPIDOPTERA:ARCTIIDAE)

T. C. BANERJEE AND N. HAQUE
Department of Zoology, Burdwan University, Burdwan 713 104, India.

THE hairy caterpillars of *Diacrisia casignetum* are major defoliators of sunflower[1], a promising oilseed plant in India. All known studies involving pupal sex determination of different insect species have stressed the importance of the positions of genital and anal openings, spiracles, size, colour and weight[2-6]. Recent interest in its pest potentiality and management, studied through mass-rearing, has led to the examination of certain outstanding features, aiming at its outright characterisation of sexes in the pupal stage. No account was available before, and so this paper attempts to describe the outstanding features of sexes in the pupal stage of *Diacrisia casignetum*.

The records were kept on 50 male and 50 female pupae of the same age obtained from the laboratory mass-culture of the caterpillars reared on sunflower leaves (*Helianthus annus* L.; EC 68414) in 1-litre glass jars placed in a BOD incubator ('SD' BOD incubator) at 27 ± 1° C, 70 ± 10% moisture and 12 hr photoperiod. The characters for separation of sexes were examined under a binocular microscope, and the morphometric features individually scaled by an oculometer. Each pupa, kept separately in a 250 ml covered glass jar, was weighed daily throughout the pupal period and any change in biomass, was accounted for. The sex was finally confirmed by checking the emergence from the jars containing individual pupa.

The 9th abdominal segment of the female pupa is smaller than that of the male which shows posteriorly tapering abdomen (figure 1). In the male pupa, the genital opening is situated ventrally on the 9th abdominal segment which is devoid of spiracles whereas in the female pupa it is on the 8th abdominal segment that bears a pair of spiracles. The anal opening is on the 10th abdominal segment for the sexes, but is larger in the female pupa (0.46 ± 0.01 mm) than in the male (0.42 ± 0.01 mm).

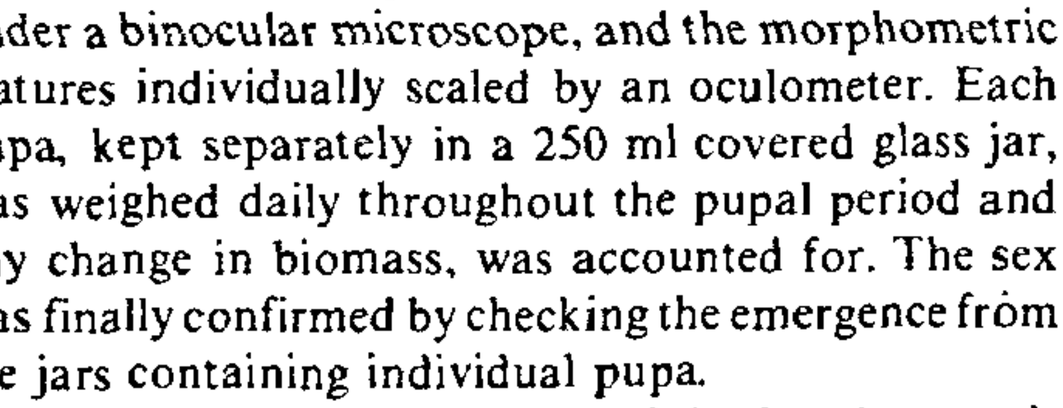

Figure 1. Abdominal portion of *D. casignetum* showing differences in characters of male and female pupae.

Table 1 presents a comparative account regarding various morphometric features considered for determining pupal sexes of *Diacrisia casignetum*. The female pupa is usually larger than the male and the respective abdominal lenghts are 4.9 ± 0.13 and 5.53 ± 0.1 mm. A male pupa weighs 195.2 mg (±9.4); and a female pupa, 277.4 mg(±11.4). The mean distance between genital and anal openings in the female pupa is 3 times that of the male pupa. The body length varies from 13.9 ± 0.3 mm in the male pupa to 15.3 ± 0.2 mm in the female pupa. The number of cremasters at the 10th abdominal segment of the pupa used for attachment to the cocoon varies from 10 ± 0 in the male to 14 ± 0.5 in the female.

TABLE 1

Variations in the biomass and morphometric characters of male and female pupae of Diacrisia casignetum Kollar

Characters	Male pupae*	Female pupae*
**Biomass (mg)/pupa	195.2 ±9.44	277.45 ± 11.4
Distance between anal and genital openings (mm)	0.3 ±0.01	0.9 ± 0.01
Length of genital opening (mm)	0.25 ± 0.01	0.28 ± 0.01
Length of anal opening (mm)	0.42 ± 0.01	0.46 ± 0.01
Body length (mm)	13.9 ±0.3	15.35 ± 0.2
Abdominal width (mm)	4.9 ±0.13	5.53 ± 0.1
Abdominal length (posterior to wing pads, mm)	5.2 ±0.2	5.48± 0.1
Cremasters/individual	10 ± 0	14 ± 0:5

*Mean of 50 observations ± S.D. **Average of the weights throughout the pupal period.

A preliminary analysis of the data showed that variabilities in the characters mentioned above for determining pupal sexes in *Diacrisia casignetum* are tenable. Apart from showing the female pupa to be usually larger than the male one, the present study spotlights certain distinguishing features, such as the position of the female genital opening in the 8th abdominal segment with spiracles, differences in the size of the 9th abdominal segment, the pupal biomass, distance between genital and anal opening and the number of the cremasters for characterising the pupal sexes in this insect.

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MIDDLE CAMBRIAN TRILOBITES FROM KARIHUL, LIDDAR VALLEY, ANANTNAG DISTRICT, KASHMIR AND ITS SIGNIFICANCE

GOPENDRA KUMAR AND GOPAL SINGH*

Himalayan Geology Division, Geological Survey of India, B-11/H-Road, Mahanagar Extension. Lucknow 226 006.
* Palaeontology Division, Geological Survey of India, Lucknow 226 007

THE authors, while imparting training to the Officer Trainees, Geological Survey of India, recovered five genera of Middle Cambrian trilobites from a limonitised zone of shale exposed at Karihul (75°22′: 33°50′30″) in the Liddar Valley in the southeastern part of the Kashmir Basin (figure 1). The assemblage is in the form of head-shields, thoracic fragments, pygidia and some ill-preserved unidentifiable complete articulated forms.

The earlier record of the Cambrian trilobites from the Kashmir Basin were confined to the northwestern part[1-8].

The classification of palaeozoic sequence of the southeastern part of the Kashmir basin has earlier been attempted[9-11]. Detailed lithological classification of the Lower Palaeozoic sequence (pre-Margan Shale Formation) of this area[12] is given below:

Karihul Formation:

Greenish grey sandy shale with lenticular limestone bands.

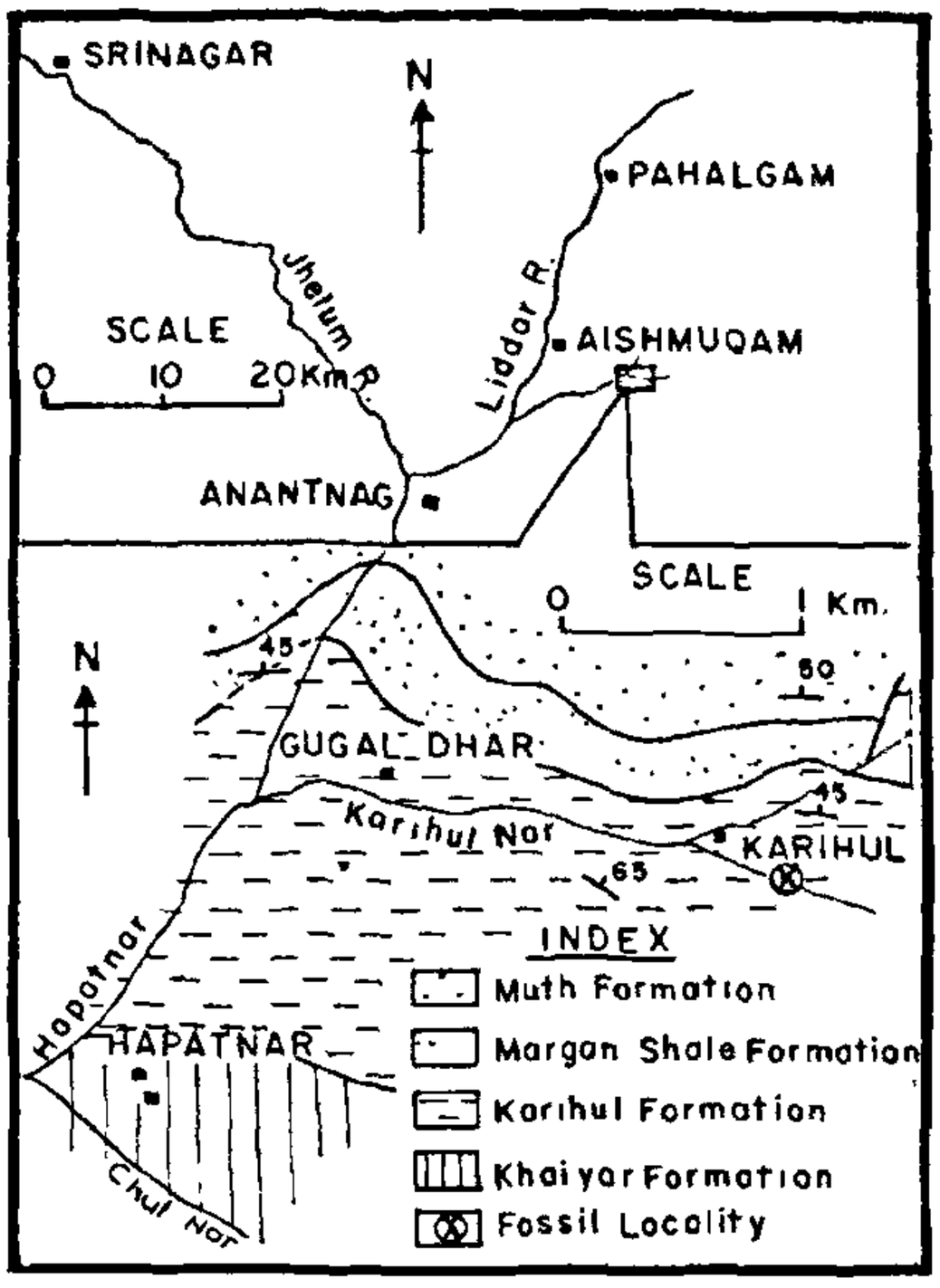

Figure 1. *Fossil locality and geological map.*

Greenish grey micaceous sandstone, siltstone, shale with lenticular grey to white crystalline limestone/dolomite, occasionally oolitic or pisolitic. Trilobite fauna in upper part.

Khaiyar Formation:

Vel Member—Alternate sequence of grey to black laminated shale and greenish grey micaceous siltstone, shale with large worm-tubes and trail markings.

Razdain Member—Rhythmic alternation of grey quartzite and shale with abundant worm-tubes on ripple-marked surfaces.

Lithologically, the Karihul Formation is comparable to the similar rocks of northwestern Kashmir, and also of Spiti Valley[13,14], Himachal Pradesh, where they also contain Cambrian trilobites.

Check list of trilobites:

1. *Ptychoparia* sp.
2. *Ptychoparella* sp.
3. ? *Anomocare* sp.
4. ? *Asaphiscus* sp.
5. ? *Caborcella* spp.
6. Gen indet.