

ON A FOSSIL COCKROACH FROM THE MAMAL FORMATION, KASHMIR HIMALAYA

HARI MOHAN KAPOOR, USHA BAJPAI and HARI K. MAHESHWARI

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
GPO BOX 106, LUCKNOW 226 001, INDIA

ABSTRACT

A partially preserved cockroach is recorded from the Mamal Formation of the Kashmir Basin. Besides the fore-wings, which are similar to those of *Kashmiroblatta* Verma, the hind-wings, limbs, the head capsule and a part of the prothorax are also preserved.

INTRODUCTION

There are few definite records of fossils insects from Palaeozoic-Mesozoic succession of India. Interestingly all the records are from the plant-bearing horizons. The earliest mention of a fossil cockroach — “covers of Blattidae” — is from the ‘Kota-Maleri’ beds of Maharashtra (Hislop, 1861). Feistmantel (1880) illustrated an “insect-like leaf” from the Talchir Formation. The specimens of fossil cockroaches from Pranhita-Godavari Basin show dorsal impression of the

insect with head, thorax and tegmina, one isolated tegmina and a hind wing (Rao & Shah, 1959). *Rajharablatta laskarii* Dutt recorded from the Talchir Formation of Daltonganj Coalfield (Dutt, 1977), and the unnamed specimen found in the Barakar Formation of Raniganj Coalfield (Srivastava, 1988) represent the hind wings. These three specimens from peninsular Gondwana do not show similarity in characteristics, and possibly belong to different genera.

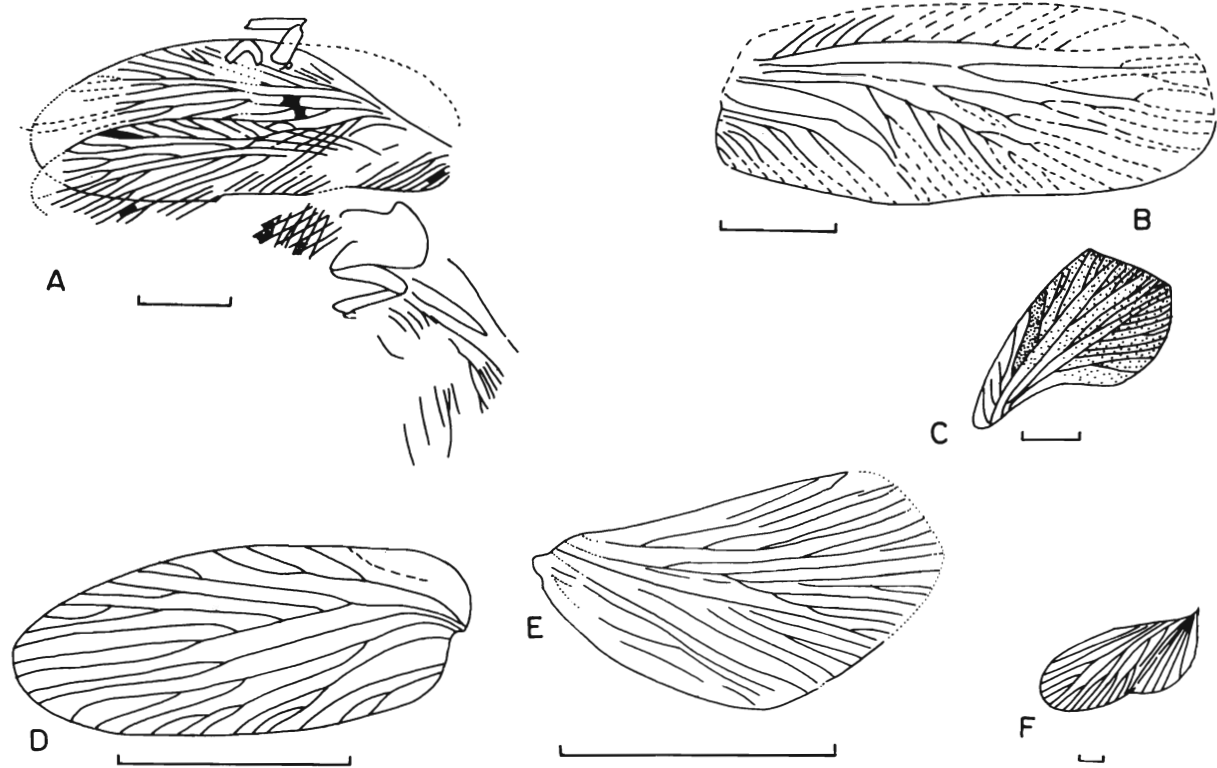


Fig. 1. Reproduction of line drawings of some of the comparable insect wings. A. *Gondwanoblatta reticulata* Handlirsch — forewings; B. *Kashmiroblatta marahomensis* Verma—forewing; C. *Prognoblattina columbina* Scudder—forewing; D. *Rajharablatta laskarii* Dutt - hindwing; E. Unnamed hindwing reported by Srivastava; F. *Eucaenus ovalis* Scudder—hindwing. Bar represents 1 cm length.

From the Perigondwana of the Kashmir Basin, there are three records of cockroach fore-wings from Risin Member of the Mamal Formation, viz., *Gondwanoblatta reticulata* Handlirsch 1906 (fig. 1A), *Prognoblattina columbina* Scudder (Bana, 1964; Text-fig. 1C) from the Risin Spur, and *Kashmiroblatta marahaomensis* Verma from Marohoma (Verma, 1967, 1968, 1970; fig. 1B).

As complete cockroaches are rarely found, the specimen recorded by us is important. The preservation though is not very good, yet the specimen shows appendages (limbs, wings), head capsule, and a part of the prothorax. The meso- and meta-thorax and abdomen are not seen.

The specimen was collected by one of us (HMK) as a drift block of tuffaceous shale lying at Baliarpatti Spur (fig. 2) near the exposure of the Marahom Member (Mamal Formation). Tuffaceous shales are known both from the Risin and the Marahom Members of Lower Permian (Artinskian) Mamal Formation, which are separated by a volcanic flow (Kapoor, Maheshwari and Bajpai, 1992; figures 3, 4). In the Baliarpatti area both the members being exposed, it is difficult to ascertain the origin of the drift block.

DESCRIPTION

Latero-ventrally preserved insect showing faint impression of head capsule, anterior part of prothorax, incompletely preserved fore- and hind-wings, limbs and some unidentifiable appendages (Plate 1; fig. 5).

Head capsule: Hypognathus, triangular in shape, faintly preserved but distinguishable in different parts. A portion of maxilla representing submentum also present. On the anterior side, incomplete elongated thin antenna present, segmentation not seen.

Prothorax: Outline of the dorsal section of prothorax distinguishable, separated by triangular

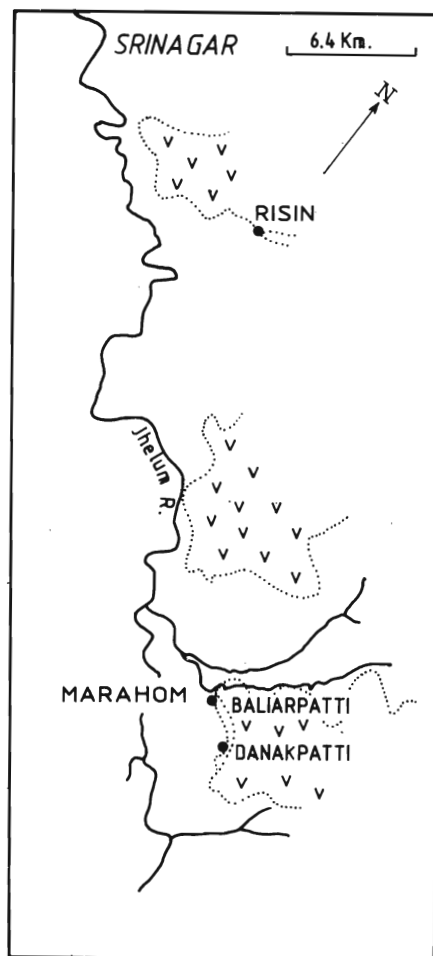


Fig. 2. Sketch map of a part of Kashmir showing localities from where Early Permian insects have been collected.

vertical sclerite, near of which a faint impression, basal attachment of tegmina present.

Wings: One fore-wing and one folded hind-wing detached from the thorax, slightly shifted from the original base, remnant of the attachment of the fore-wing (tegmina) seen near anterior end of

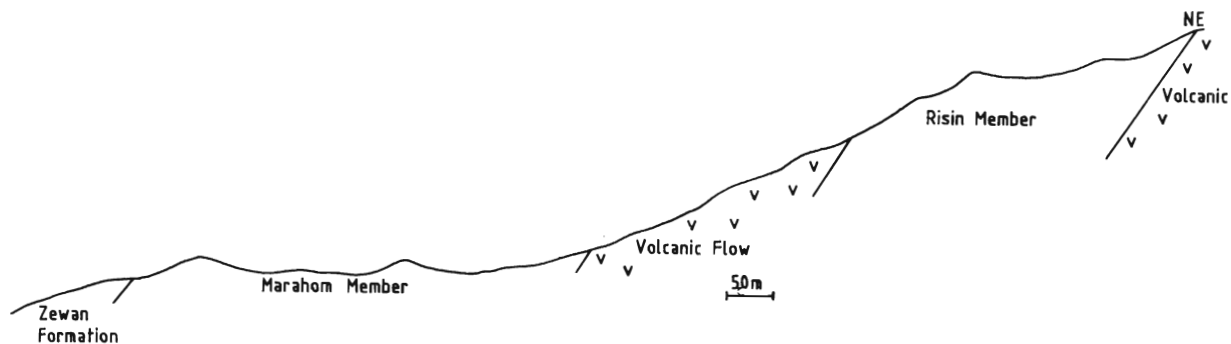


Fig. 3. Cross-section of the Baliarpatti (Marahom) Spur.

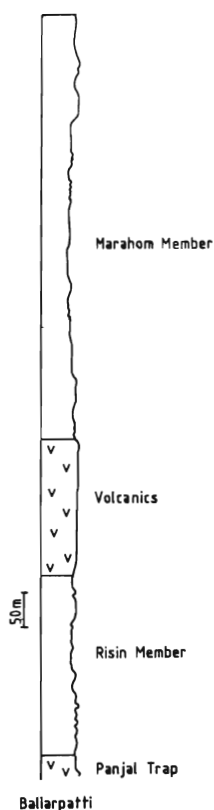


Fig. 4. Columnar Section of the Baliarpatti (Marahom) Spur.

prothorax; nearly 0.5 mm from anterior end of prothorax one detached tegmina, possibly of the other side of the insect, seen down to the head capsule, partially covered by the second limb.¹

Fore-wing (Tegmina I): Well-developed but incomplete, part of the costal (or anterior) and anal (or interior) margins regular and arcuate giving an outline of the wing to be more or less elliptical (fig. 5). Outer and apical margins not seen. The preserved length approximately 2 cm and maximum width about 9 mm. Band like costal area, well-developed costa from which only five pectinate branches (some of which are fully developed) arise at an angle of 30° seen,

and reach up to the anterior margin. Radius prominent, thick and almost parallel toward the basal side and deviates slightly downwards almost near the middle part and furcates towards the outer or apical side. Media strong, convex like radius, also more or less parallel towards basal side and deviate downwards at higher angle from the one-third of the preserved wing. Cubitis strongly developed, smoothly curved downwards and reaching up to inner margin. A faint and incomplete impression of curved anal vein preserved. Branches of radius, median, cubitis and anal veins not preserved.

Tegmina II: Detached, much broken and showing only a portion of basal part. Anterior and posterior natal processes broken, auxillary cord, and tegula (paraptera) however, could be distinguished. Almost all the veins are seen.

Hind-wing: One partially preserved, possibly folded hind-wing shows a curved partial anterior margin. Folding of the part of the inner margin has left some oblique faint impressions cutting across the main vein and blurring at places. Preserved length

approximately 2.6 cm. Subcosta prominent, irregular and concave. Radius faint and partial. Median well-developed and strong. Cubitis strong and curved downwards with several pectinate branches, branching towards apical side; branches further bifurcating. One of the strong anal veins also seen.

Limbs: The first limb is represented by only a faint impression of the coxa, about 0.4 cm long. The second pair of legs includes a coxa, trochanter two femurs, one tarsus, and one tibia. Segmentation is not seen in any of the parts. Faint setae are present on the tarsus. The length of the femur is about 1.2 cm, width 1.0 mm, length of the tibia about 1.4 cm, width 1.1 mm; the tarsus is incomplete. The hind pairs relatively well-developed and stout, consist of two pairs of coxae, one trochanter, two femur, two tibia, and one tarsus. Segmentation is not seen in any of the parts. On the tibia at places bases of spines are seen. The posterior of the tarsus is developed into flattened claw. The length of the femur is about 1.2 cm, width 1.9 mm; length of the tibia about 2 cm, width 1 mm; tarsus 2 cm long and less than 0.25 mm in width.

Other appendages: There are several isolated impressions of appendages which can not be identified. Of interest are two which are marked as I and II on the figure and may possibly represent appendages of the mouth parts (fig. 5).

COMPARISON

The specimen of the insect recorded by us differs considerably from almost all the groups of extant insects, except for showing a certain resemblance in the head capsule, prothorax, preserved shape of wings and limbs with the group of cockroaches; Order Blattoidea Handlirsch, or Order Dictyoptera Imms (von Zittel, 1937; Imms, 1977). Among the fossils, however, a comparison is possible only on the basis of wings, as mostly only these parts are preserved and have been used for identification.

The venation pattern of the tegmina in general is of primitive Archimylacrid type (Family Archimylacridae) characterised by the long subcosta, which sends off a large number of branches to the costal margin (von Zittel, 1937, p. 80, fig. 1548B). The tegmina is comparable with that of *Aphtoroblattina shottonii* Laurentiaux from the Early Westphalian of South Staffordshire (Laurentiaux, 1953, p. 459, fig. 54) of the Family Archimylacridae but is distinguishable in the angle of branches arising from subcosta and in furcation of branches, presence of cross veins (intercalary veins) between media and costa. In our specimen the

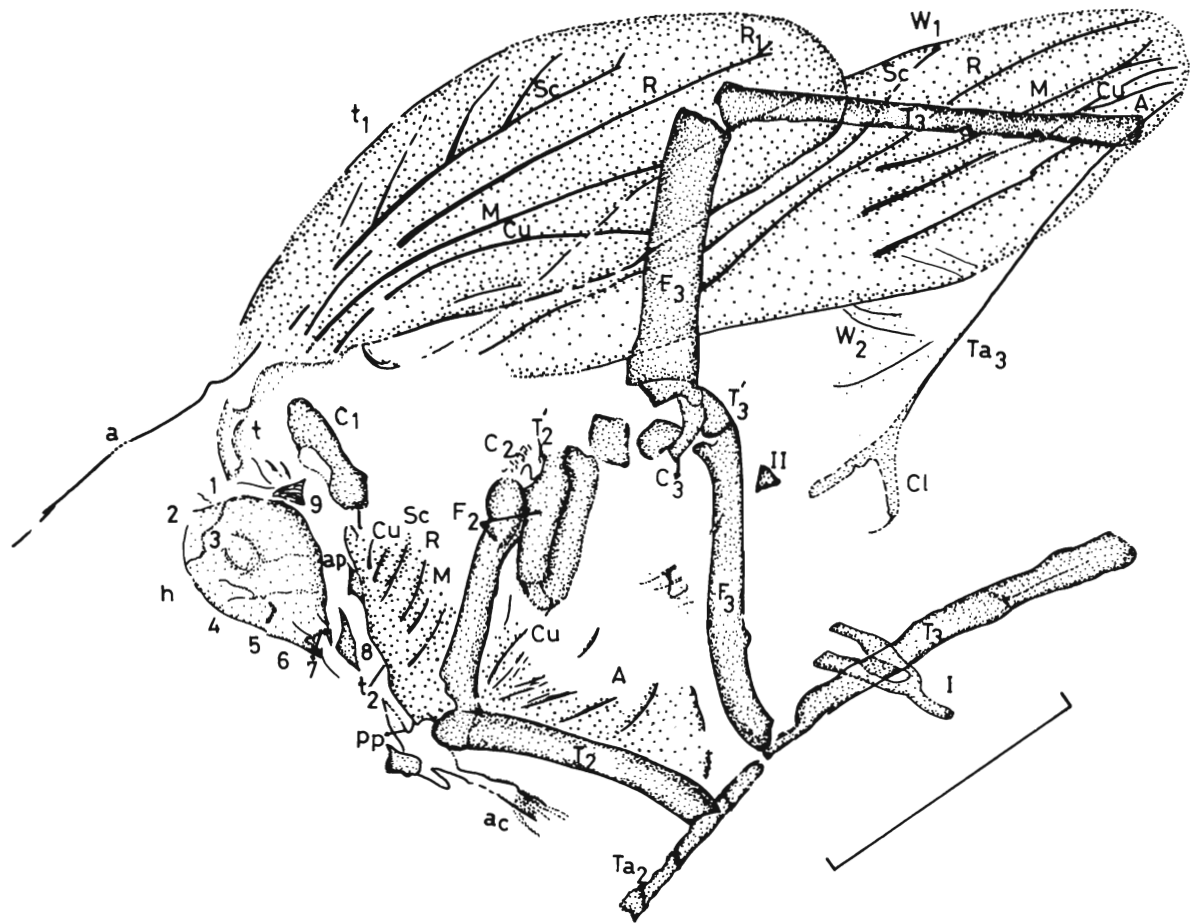


Fig. 5. Linedrawing of the fossil cockroach from the Mamal Formation, Marahom, Kashmir. Bar represents 1 cm length.

[A. anal vein; a. antenna; ac. axillary cord of tegmina; ap. anterior natal process of tegmina; C₁, C₂, C₃. coxae of three limbs; Cl. claw; Cu. cubitis vein; F₂, F₃. femur of 2nd and 3rd limbs; h. head capsule; l. ligula of tegmina; M. median vein; pp. posterior natal process of tegmina; r. radius vein; Sc. subcostatus vein; t. I thorax; t₁, t₂. fore-wings; T₂, T₃. tibia of 2nd and 3rd limbs; T'₂, T'₃. trochanter of 2nd and 3rd limbs; T_{a2}, T_{a3}. tarsus of 2nd and 3rd limbs; 1. occiput; 2. vertex; 3. circum ocular circus; 4. frons; 5. clypeus; 6. labrium; 7. mandible; 8. submantum; 9. cervical sclerite; I, II. unidentifiable appendages.]

veins though strong, yet are not completely preserved and the branching is also not seen. The size of the wing and the angle of branches of veins subcutis and trend of other veins is almost similar with that of *Kashmiroblatta* and quite distinct from *Gondwanoblatta*; therefore the tegmina possibly represents *Kashmiroblatta marahomensis* (fig. 1B). Incidentally, both the specimens originate from the same locality.

The hind-wing differs considerably in the venation pattern from *Rajharablatta laskarii* Datta (1977, fig. 1D), and unnamed wing reported by Srivastava (1988; fig. 1E). With the latter, however, pattern of subcostatus and trend of median and pectinate branching of cubitis have some similarity conforming with the hind-wing of Blattoids. The wing is rather more close with the hind-wing of *Encaneus ovalis*

Scudder (von Zittel, 1937, p.801, fig. 1546; fig. 1F) referred to the Family Encaenidae of Order Protoblatta-toidea.

The importance of the present specimen lies in the presence of appendages and the head capsule which possibly may be helpful in reconstructing the shape of the insect, which had close affinities with *Kashmiroblatta*.

ACKNOWLEDGEMENTS

We thank the Director, Birbal Sahni Institute of Palaeobotany, Lucknow and the Director-General, Geological Survey of India, Calcutta for supporting our project on the late Palaeozoic biota from the Kashmir Basin. Thanks are due to Dr A.C. Mathur of Regional Research Laboratory, Jammu, Dr U.D. Sharma and Dr Meenakshi Srivastava of Zoology Depart-

ment, Lucknow University and Mr. K.K. Verma, formerly of the Geological Survey of India for helpful suggestions and discussions.

REFERENCES

- Bana, H.R.** 1964. *Prognoblattina columbiana* Schudder from Permo-Carboniferous beds, near Srinagar, Kashmir, India. *Report 22 int. geol. Congr. New Delhi, VIII*: 274-281.
- Dutt, A.B.**, 1977. *Rajharablatta laskarii*, a new Lower Gondwana fossil insect from Daltonganj Coalfield, Bihar. *Rec. geol. Surv. India* 108(2) : 167-169.
- Feistmantel, Ottokar**, 1880. The fossil flora of the Gondwana System: Flora of the Damuda-Panchet divisions. *Mem. geol. Surv. India Palaeont. indica*, ser. 12, 3(2): 1-77.
- Handlirsch, A.** 1906-1908. Die Fossilien Insecten. 2: 351-352.
- Hislop, S.** 1861. On the age of the fossiliferous thin bedded sandstone and coal of the Province of Nagpur, India. *Q. Jl. geol. Soc. London*, 17: 354.
- Kapoor, H.M., Maheshwari, H.K. and Bajpai, Usha** 1992. Mamal Formation of the Perigondwana - redefined. *Geophytology*, 22: 89-96.
- Laurentiaux, D.** 1953. Class des Insectes (Insecta Linne 1758). In: Piveteau J. ed. *Traite de Palaeontologie*, 3: 397-527, Masson et Cie, Paris.
- Rao, C.N. and Shah, S.C.**, 1959. Fossil insects from the Gondwanas of India. *Indian Minerals*, 13(1): 3-5.
- Richard, O.W. and Davis, R.G.**, 1977. Imms General Text Book of Entomology, 2(3): 421-454, 10th edn, Chapman & Hall, London.
- Scudder, S.H.** 1895. Revision of American fossil cockroaches. *Bull. U.S. geol. Surv.*, 124: 131-132.
- Srivastava, A.K.** 1988. An insect wing from the Lower Gondwana of India. *J. Paleont.*, 62: 827-828.
- Verma, K.K.** 1967. A new fossil insect from the Lower Gondwanas of Kashmir. *Curr. Sci.*, 36: 338-340.
- Verma, K.K.** 1968. Permo-Carboniferous formations of Marahom, Anantnag District, Kashmir. *Jl Indian Sci. Assocn.* 8: 114-116.
- Verma, K.K.** 1970. A new fossil insect from the Lower Gondwanas of Kashmir. *Indian Minerals*, 22: 93-97.
- Verma, K.K.** 1972. Stratigraphical and palaeontological features of the Permo-Carboniferous formations occurring near Marahom, Anantnag District, Kashmir. *Geol. Surv. India Misc. Publ.*, 15: 121-126.
- Von Zittel, K.A.**, 1937. *Text Book of Palaeontology*, 2nd Edn. (ed. C.R. Eastman). Macmillan & Co., London.

EXPLANATION OF PLATE

Plate I

- 1-3. Fossil cockroach from Mamal Formation, Marahom, Kashmir. Specimen no. 20401, Geological Survey of India, Calcutta. 1. dry specimen under incident light, x 1; 2. dry specimen under incident light, x 3; 3. same photographed under liquid paraffin, x 3.

