Occurrence of blattoid insects in the Gondwana Flora of South America and India

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Insects fauna of the Indian Gondwana is mostly known by hind- and fore-wings of the blattoid group. Discovery of partially preserved body fossil of an insect (Cockroach) from the Mamal Formation of Kashmir Basin indicates the existence of ancient family Archimylacridae in India. In comparison, South American Gondwana sediments contain, apart from blattoids, many types of insect wings referable to families of Protorthoptera, Mecoptera, Neuroptera and Hemiptera.

The comparative occurrence of blattoid insects in South America and India suggests their close association with the early developmental stage of the Glossopteris Flora.

INTRODUCTION

BLATTOID insects have been recorded from the Lower Permian beds of Kashmir Himalaya (Handlirsch, 1906-1908; Bana, 1964; Verma, 1967; Kapoor *et al.*, in press) and the Gondwana of peninsular India (Dutt,1977; Srivastava,1988). They occur in association with early representatives of the Glossopteris Flora, i.e., *Noeggerathiopsis*, *Gangamopteris*, *Euryphyllum* and *Glossopteris*. In South America, too, blattoids are associated with elements of Glossopteris Flora but the age of sediments in which these have been found is controversial. Suero (1958), Archangelsky *et al.* (1980) and Archangelsky (1981) consider them to be of Early Permian age on the basis of plant fossils, whereas Pinto and Purper (1979) and Pinto *et al.* (1980) compare the insect fauna with those from Asia, Europe and North America and favour a Late Carboniferous age.

INDIAN BLATTOID INSECTS

Gondwanoblatta reticulata Handlirsch 1906 (Text-fig. 1)
Handlirsch, 1906-1908, pl. 35, fig. 3.

Occurrence—Risin Spur, Kashmir Basin, Gangamopteris Bed; Permo-Carboniferous.

Prognoblattina columbiana Schudder 1895 (Text-fig. 2)
Bana, 1964, figs 1 & 2.

Occurrence—Risin Spur, about 10.5 km SE of Srinagar, Kashmir Basin; Mamal Formation, Early Permian.

Kashmiroblatta marahomensis Verma 1967 (Text-figs 14,15)
Verma,1967, figs 1-3.

Occurrence—Baliarpatti, near Marahom (Marhoma), Anantnag District, Kashmir Basin; Mamal Formation, Early Permian.

Rajharablatta laskarii Dutt 1977 (Text-fig.3)
Dutt, 1977, pl. 39, figs A.B.

Occurrence—Borehole core sample, Rajhara area, Daltonganj Coalfield, Talchir Formation, Early Permian.

Unnamed Hind wing of the family Archimylacriade (Text-fig. 4)
Srivastava, 1988, figs 1 & 2.

Occurrence—Open Cast Project, Raja Colliery, Seam No. II, West Raniganj Coalfield; Barakar Formation, Early Permian.

Partially preserved body fossil of Cockroach (Text-fig. 5) Kapoor, Bajpai & Maheshwari, in press. pl.1. figs 1-3, (Text-figs 1-5).

Occurrence—Tuffaceous shale, Baliarpatti Spur, Kashmir Basin; Mamal Formation, Early Permian.

Remarks—The size of the wing and the angle of branches of veins subcutis and trend of other veins similar with that of *Kashmiroblatta*.

SOUTH AMERICAN BLATTOID INSECTS

Pinto (1972a,b), Pinto and Purper (1979), and Pinto, Ornellas and Purper (1980) have summarised the information about South American blattoids and following genera and species are known:

Anthracoblattina oliveirai (Carpenter) Schneider 1983 (Text-fig. 6)
Pinto & Purper, 1979, pl.1, fig.1, pl. 2, fig.1.

Occurrence—In a ravine east side of Teixeira Soares site, 45 meters below a yellow sandstone with pebbles, Parana State, Brazil; Teixeira Soares Formation, Lower Itarare Sub-Group, Late Carboniferous

Remarks—The species was earlier described under *Phyloblatta oliveirai* Carpenter 1930 by Pinto and Purper (1979) but Schneider (1983) transferred it under *Anthracoblattina*.

Phyloblatta roxoi Petri 1945 (Text-fig. 7)
Pinto & Purper, 1979, pl. 1, fig.2, pl. 2, fig.2.

Occurrence—About 1 km from Teixeira Soares railroad in dark grey shales associated with marine brachiopods; Parana State, Brazil; Teixeira Soares Formation, Lower Itarare Sub-Group, Late Carboniferous.

Phyloblatta pauloi Mezzalira 1948 (Text-fig. 8)
Pinto & Purper, 1979, pl.1, fig.3, pl. 2, fig.3.

Occurrence—East side of Teixeira Soares site, 1 km from the railroad station, Parana State, Brazil; Teixerra Soares Formation, Late Carboniferous

Phyloblatta sommeri Pinto & Purper 1979 (Text-fig. 9)
Pinto & Purper, 1979, pl.1, fig. 5, pl. 2, fig.5.

Occurrence—In a ravine east side of Teixeira Soares site, Parana State, Brazil; Teixeira Soares Formation, Lower Itarare Sub-Group, Late Carboniferous.

Phyloblatta langei Pinto & Purper 1979 (Text-fig. 10)
Pinto & Purper, pl.1, fig.4, pl. 2, fig.4.

Occurrence—Teixeira Soares site, Parana State, Brazil; Teixeira Soares Formation, Lower Itarare Sub-Group, Late Carboniferous

Remarks—This species was mentioned by Schneider (1983) as possibly belonging to the genus *Kashmiroblatta* Verma. The general disposition of the veins is similar but it has straight cross-veins while *Kashmiroblatta* has reticulate cross veins.

Aissoblatta ? sp. (Text-fig.16)
Pinto, 1972a, pl.4, fig.11.

Occurrence—Outcrop at 90 km of the road BR 290, Porto Alegre-Uruguaiana, Rio Grande do Sul State, Brazil; Irati Formation, Late Permian.

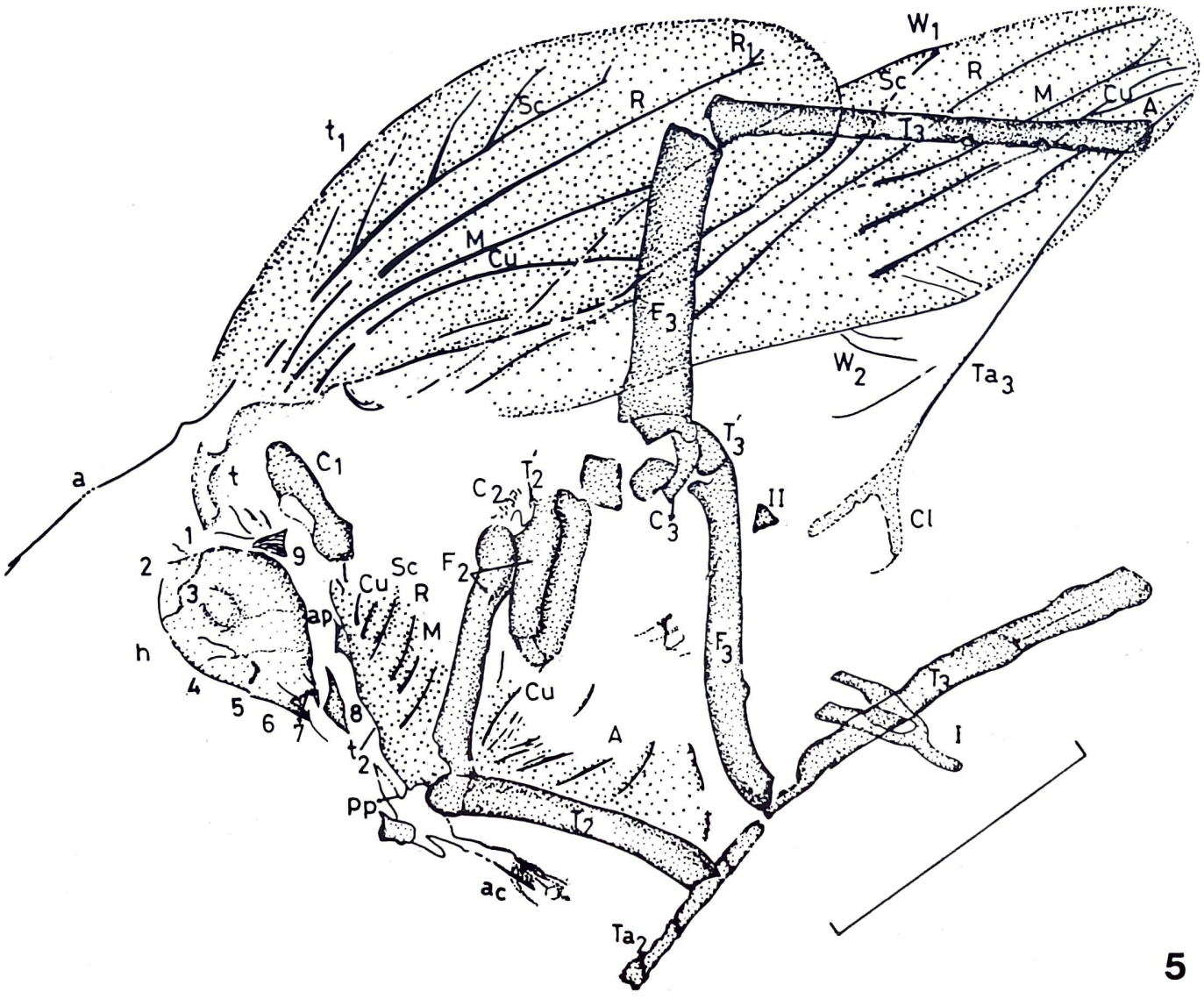
Archangelskyblatta vishniakovae Pinto 1972b (Text-figs 11-13)
Pinto, 1972, figs. 1,2

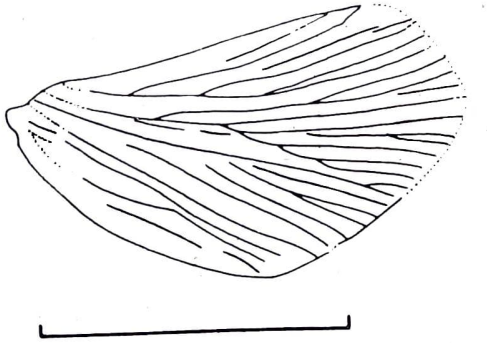
Occurrence—Betancourt, Chubut county at the "Horizonte Plantifero de Ferruglio"; Nueva Lubecka Formation, Late Carboniferous

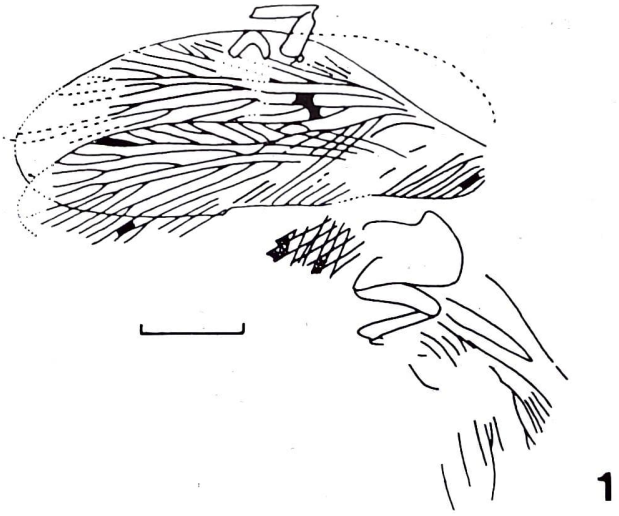
Remarks—Schneider (1983) considers *Archangelskyblatta* as a synonym of *Kashmiroblatta* Verma 1967 but there are several differences between them; the proposition of Schneider (1983) is not accepted. Those differences can be observed in text-figures 11 to 15 of the present paper. They are :

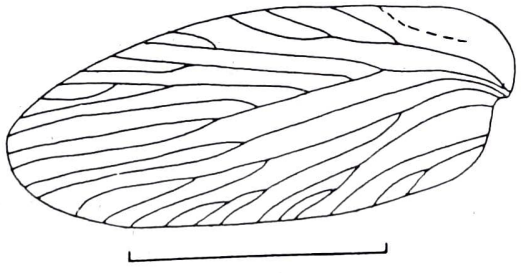
(K = *Kashmiroblatta*, A = *Archangelskyblatta*)
K— Sc vein almost straight reaching near the apex
A— Sc sigmoid curving strongly to Costa much before the apex
K— R with Rs forking several times as Ri

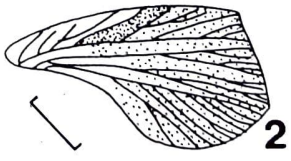
Text-figures 1-5. 1. *Gondwanoblatta reticulata* Handlirsch; 2. *Prognoblattina columbiana* Schudder; 3. *Rajharablatta laskarii* Dutt. 4. Unnamed wing, Srivastava; 5. Line drawing of the fossil cockroach from the Mamal Formation, Marahom, Kashmir. (A anal vein, a. antenna; ac.axillary cord of tegmina; 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 veint. 1 thorax; t1, t2. fore. wings; T2, T3.tibia of 2nd and 3rd limbs; T2, T3. trochanter of 2nd and 3rd limbs; Ta2, Ta3, 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.cervial sclerite 1.11. unidentifiable appendages. Bar represents 1cm length (after Kapoor *et al.*)











Text-figures 1-5

A— R without Rs or if with, it will be considered that the first bifurcation of R produces Rs and Ri. Ri is single vein.
K— Cui strongly curved to the posterior margin and ending in it.
A— Cui almost straight inclined nicely to the posterior border and ending practically at the apex
K— Cross-veins as a close network narrow, thin, rectangular veins.
A— Cross-veins as a close-set series of almost straight, rugose parallel veins.

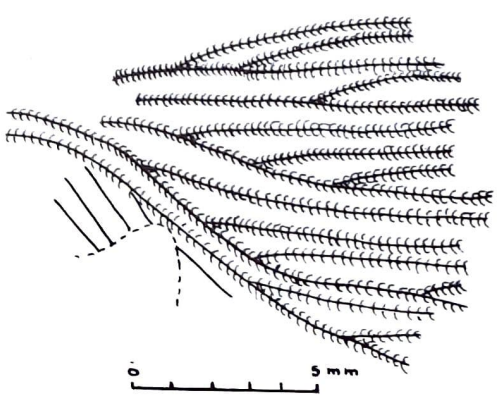
Another great difference is the double size of A in comparison to K.

DISCUSSION

The distribution of blattoid insects in the Indian Gondwana, though meagerly known, suggests their occurrence in association with the flora of Lower Permian sequence, i.e., Talchir and Barakar Formations of peninsular India, and Mamal Formation of Kashmir Basin.

In South America, the blattoids are distributed in Teixeira Soares Formation, Itarare Sub-Group of Brazil, and Nueva Lubecka Formation of Argentina. Floristically these two formations contain species of *Botrychiopsis, Asterotheca, Gangamopteris, Glossopteris, Cordaites, Noeggerathiopsis, Paranocladus, Ginkgophyllum*, and on the basis have been attributed an Early Permian age (Archangelsky, 1984, 1986; Archangelsky & Cuneo, 1991). However, the comparison of the insect fauna with those of Kuznetsk Basin, Commentry (Allier) Stephanian, France and Upper Alleghney, Pennsylvania, USA supports a Late Carboniferous age (Pinto, 1972a; Schlutter, 1990). Daemon and Quadros (1970) have also assigned a Late Carboniferous age on the basis of palynological studies.

The stratigraphic dispense of blattoid insects in the Gondwana Flora of India and South America suggests that on the Gondwana Supercontinent, this group appeared almost simultaneously with the Glossopteris Flora, if not earlier. The similarity of northern hemispheric and southern hemispheric blattoid forms apparently is a case similar to the occurrence of "mixed flora". Recent investigation suggests that the ancestry and affiliation of glossopterid forms with that of Carboniferous forms of Northern Hemisphere (Srivastava, 1992). The possibility that the Permian insects fauna of the Gondwana Supercontinent evolved from that of the Carboniferous Period alongwith the diversification of Glossopteris Flora needs to be examined in detail.



Text-figure 16. *Aissoblatta* ? sp. Pinto. **16**

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REFERENCES

Archangelsky, S. 1981. Studies fitopaleocologicos en el Paleozoico Superior del Oeste de Chubut, Argentina. *Ann. II Cong. Lat-amer. Paleont. Porto Alegre* **1**: 141-156.

Archangelsky, S. 1984. Floras Neopaleozoicas de Gondwana Y suzonacion estratigraphica, aspects paleogeograficos Conexus. *Comun. Serv. Geol. Portugal* **70**: 135-150.

Archangelsky, S. 1986. Late Paleozoic floras of the Southern Hemisphere. Distribution, Composition. Paleoecology. *Notes for short course on land plants. Ed* Broadhead, T.W. : 128-142.

Archangelsky, S., Acuzy, C.L., Pinto, I.D., Gonzalez, C.R., Margues T.M., Rosler, O. & Wagner, R.H. 1980. The Carboniferous and Early Permian of South American Gondwana area. A summary of biostratigraphic information. *Actas II Cong. argent. Paleont. Bioestrat.* **4**: 257-269.

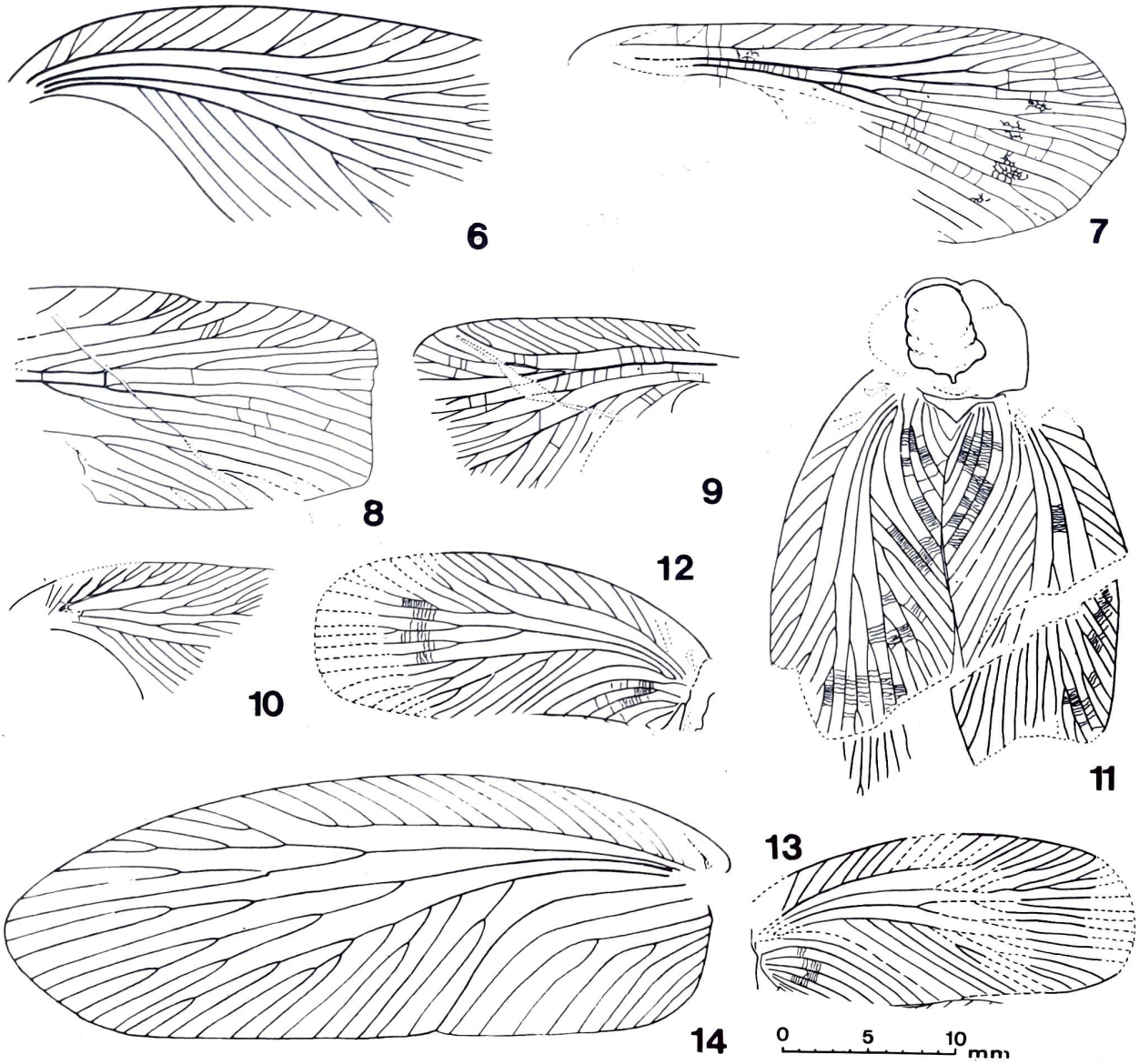
Archangelsky, S. & Cuneo, R. 1991. The Neopalaeozoic floristic succession from North Western Argentina. A new perspective. *In:* Ulbrich, H. & Rocha Campos, A.C. (eds)— *Gondwana Seven Proceedings* : 469-481, Instituto de Geociencias, Universidade de São Paulo.

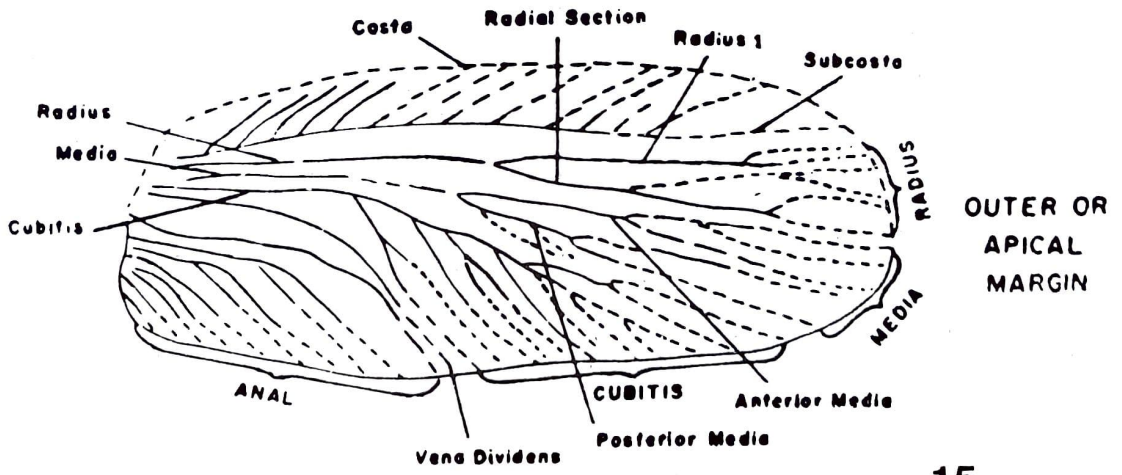
Bana, H.R. 1964. *Prognoblattina columbiana* Schudder from Permo-Carboniferous beds, near Srinagar, Kashmir, India. *Report 22nd Int. geol. Cong. New Delhi*, Part VIII: 274-281.

Carpenter, F.M. 1930. A Permian Blattoid from Brazil. *Bol. Serv. Geol. Min. Brazil, Rio de Janeiro* **50**: 4-10.

Daemon, R.F. & Quadros, L.P. 1970. Bioestratigrafia de Neopaleozoico da Bacia do Parana. In : *Congress Brazileiro de*

Text-figures 6-15. 6. *Anthracoblattina oliveirai* (Carpenter) Schneider; 7. *Phyloblatta roxoi* Petri; 8. *Phyloblatta pauloi* Mezzalira; 9. *Phyloblatta sommeri* Pinto & Purper; 10. *Phyloblatta langei* Pinto & Purper; 11. *Archangelskyblatta vishniakovae* Pinto; 12-13. Reconstructed wing of *Archangelskyblatta vishniakovae*; 14. *Kashmiroblatta mahrahomensis* Verma; 15. Reconstruction of *Kashmiroblatta marahomensis* Verma by Schneider.





Text-figures 6-15

Geologica. 24, *Brasilia Anais*. *Brasila*, *Soc. Bras. de Geol*: 359-412.

Dutt, A.B. 1977. *Rajharablatta laskarii*, a new Lower Gondwana fossil insect from Daltonganj Coalfield, Bihar. *Rec. geol. Surv. India* **108**: 167-169.

Handlirsch, A. 1906-1908. *Die Fossilen insecten*. **2**: 351-352, pl. 35, fig.3, Leipzig.

Kapoor, H.M., Bajpai, U. & Maheshwari, H.K. in Press. On a fossil Cockroach from the Mamal Formation, Kashmir Himalaya. *J. palaeont. Soc. India*.

Mezzalira, S. 1948. *Phyloblatta pauloi*, sp. nov. *Inst Geogr. Geol. Sao Paulo* **4**(2): 1-3.

Petri, S. 1945. *Phyloblatta roxoi* sp. nov. *Bol. Fac Fil. Gin. Let., Giologia, Sao Paulo* **2**: 129-131.

Pinto, I.D. 1972a. Late Paleozoic Insects and Crustaceans from Parana Basin and their bearing on chronology and continental drift. *An. Acad. Brasil Cienc. Rio de Janeiro* **44** (suppl): 247-254.

Pinto, I.D. 1972b. A new Insecta *Archangelskyblatta vishniakovae* Pinto, gen. nov., sp. nov. A Permian Blattoid from Patagonia, Argentina. *Ameghiniana* **9**(1): 79-89.

Pinto, I.D. & Purper, I. 1979. Brazilian Paleozoic Blattoids. Revision and new species. *I.G., UFRGS, Pesquisas, Porto Alegre* **12**: 9-23.

Pinto, I.D., Ornellas, L.P. & Purper, I. 1980. Fossil insects and the problem of Permo-Carboniferous boundaries. *Acta II Congr Argentina Paleont. Bioestrat. I Congr. Latin-amer. Paleont. Buenos Aires* **4**: 207-212.

Schluter, T. 1990. Fossil insects localities in Gondwanaland. *Entomol. Gener. Stuttgart*. **15**(1): 061-076.

Schneider, J. 1983. Die Blattodea (Insecta) des Paläozoikums. Teil 1 : Systematik, Ökologia und Biostratigraphie. *Freib. Forsch. C 282 Deuts. Verl. f Grund.* Leipzig : 106-145.

Schudder, S.H. 1895. Revision of American fossil Cockroaches. *U.S. geol. Surv. Bull.* (124): 131-132.

Srivastava, A.K. 1988. An insect wing from the Lower Gondwana of India. *J. Paleont.* **62**: 827-828.

Srivastava, A.K. 1992. Alien elements in the Gondwana flora of India. *In* : Venkatachala, B.S. & Singh, H.P. (eds) - *Four Decades of Indian Palaeobotany. Palaeobotanist* **40:** 147-156.

Suero, T. 1958. Datos geologicos sobre el Paleozoico Superior de la zona de Nueva Lubecka y alrededores (Chubut Extra-Andino, Provincia Chubut). *Revta Mus. La Plata, n.s. Sec. Geol.* **5**: 1-28.

Verma, K.K. 1967. A new fossil insect from the Lower Gondwana of Kashmir. *Curr. Sci.* **36**(13): 338-40.