

Jan KOTEJA

Eomatsucoccus gen. n. (Homoptera, Coccinea)
from Siberian Lower Cretaceous deposits

[With 18 text-figures]

Abstract. Alate males of *Eomatsucoccus sukachevae* and *E. popovi* gen. et sp. n. from Siberian Lower Cretaceous (Neocomian) deposits are described on the basis of four impressions. From the relatively well preserved specimens it appears that the *Matsucoccidae* reached their contemporary organization level already 130 mil. years ago. *Eomatsucoccus* is the oldest fossil that can be included to scale insects without any doubt, which indicates that coccids must have radiated into the main groups at least in the Jurassic.

INTRODUCTION

About 200 specimens of fossil scale insects are known, but only 17 species have been established, one from Upper Cretaceous (BEARDSLEY 1969) and the rest from Tertiary (KOTEJA 1984, 1987a, 1987b and records cited herein). Except three forms, all others are amber inclusions. Remarkable, half of them belong to the *Matsucoccidae*. The present paper deals with representatives of this family found in the Lower Cretaceous (Neocomian) deposits in Baisa (Transbaikalia). The occurrence of scale insects that are morphologically very close to the recent ones in such an early time radically changes our idea on the coccid evolution and phylogeny.

Specimens for this study were provided by Dr I. D. SUKACHEVA and Dr Yu. A. POPOV from the Paleontological Institute, Academy of Sciences, Moscow. I am also greatly indebted to Dr V. V. ZHERIKHIN, Dr A. P. RASNITSYN and Dr D. E. SHCHERBAKOV from the above Institute for reading the manuscript and for valuable information.

The study has been supported by the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, Cracow (Res. Program CPBP 04.06.01.3.2).

MATERIAL AND METHODS

The fossils were found in Baisa, at the left bank of the river Vitim, 9 km below the mouth of Baisa Creek, east of the Lake Baikal (Southern Siberia, 53° N, 122° E). The deposits (Zaza Formation) were formed in the early Neocomian (Lower Cretaceous), about 125–115 mill. years ago. These lacustrine sediments are about 80 m thick and contain abundant mollusc and ostracod shells, aquatic and terrestrial insects, fishes and plant remnants. The fine-grained sediments lying on thick conglomerates consist of 12 cyclothemes, each of which comprising sandstones, aleurolitic shales, black paper-shales and marl at the top; insect fossils concentrate in the latter (KRASSILOV, BUGDAEVA 1982). MARTINSON (1961) distinguished 45 beds within these deposits; the matsueocid impressions were found in beds 2, 31 and 35.

Four specimens were available. Three of them are represented by two "halves" (part and counterpart), each; i.e., the specimens have split into "dorsal" and "ventral" parts after the stone had been broken. As a result, the specimens are examined from their "interior". Obviously, the splitting is not perfect, and some ventral parts are attached to the dorsal face, and reversely. Some parts are burrowed in the deposit, thus being invisible; some others are damaged and lost, with, or without, leaving their traces. The body is deformed to various degrees, and the strongly sclerotized and more resistant parts cause deformations of the weaker ones. All cuticle is broken into small polygonal pieces, perhaps as a result of shrinking.

The specimens were examined by means of an ordinary light microscope (70–250 ×) without using any particular methods, except that the impressions were sometimes moistened with a drop of ethyl alcohol to bring into light cuticular parts covered with a relatively thin layer of deposit.

All drawings were made by means of a pentagonal prism. Two kinds of pictures have been produced: the smaller (lower magnification) are outlines based on both cuticular remnants and sculpture of deposit; the larger ones show concrete cuticular pieces, without considering spatial structure, and also irrespective of the fact whether the pieces belong to the given body part or not; for instance, some pieces drawn on mesosternum, actually may belong to scutum. No attempts of reconstruction were made; instead, accuracy of drawing has been preferred. Obscure parts are designated with a broken line. The final figures are combined of several small pieces that were somewhat deformed optically; as a result, the outlines of the "dorsal" and "ventral" halves are not identical.

All dimensions are approximate only. The size of the wing has been calculated from 4 impressions (right and left, dorsal and ventral).

"Cocc" followed by a number refers to numerals of fossils in the "Catalogue of fossil scale insects" which is being prepared by the author. "+" and "-" after the numerals indicate that two parts (part and counterpart) were available for study.

Eomatsucoccus gen. n.

Type species: *Eomatsucoccus sukachevae* sp. n., ♂

The new genus is close to *Matsucoccus* as described by BEARDSLEY (1968) and KOTEJA (1984), but prescutum is about twice as broad as long (subcircular in *Matsucoccus*), scutellum is transversely rectangular (elongate oval in *Matsucoccus*) and the head capsule is strongly sclerotized.

Presumably an extinct genus; known from Lower Cretaceous (Neocomian) deposits in Siberia (Transbaikalia); about 125–115 mil. years old.

Two included species may be identified according to the following key:

1. Wing 1800–2000 μm long, 800–950 μm wide; posterior femur about 400 μm , posterior tibia about 630 μm long; abdomen largely membranous. *E. sukachevae*.
- . Wing 1500 μm long, 700 μm wide; posterior femur about 300 μm , posterior tibia 370 μm long; abdomen sclerotized *E. popovi*.

Eomatsucoccus sukachevae sp. n., ♂

The species is named in honour of Dr I. D. SUKACHEVA, Paleontological Institute, Academy of Sciences, Moscow.

Holotype: Cocc 169 \pm , ♂; Paleontological Institute, Moscow, No. 4210/1100; Baisa, 1983, bed 2; Buryat. ASSR, Eravnenskiy Distr.; Cretaceous, Neocomian; Zaza Formation (For more data see "Material").

Description of holotype

Body 1700 μm long. Head heart-shaped, 210 μm long, 350 μm wide; mid-cranial ridge well developed on dorsum and venter; dorsomedial plate large, very strongly sclerotized; ventromedial plate weak; lateral regions of head obscure; ventral plate rectangular (presumably weakly sclerotized), separated from ventromedial plate. At the neck region there occur 2 subrectangular weak, but distinct, plates that connect posteriorly with a narrow ridge-like transverse strip. If these structures belong to the dorsal face, they could correspond with the posttergites in recent *Matsucoccus* (although ridges are absent in that region



Fig. 1. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 169, holotype; "dorsal" face. Large parts of prescutum, scutum and scutellum are transposed onto the ventral face.

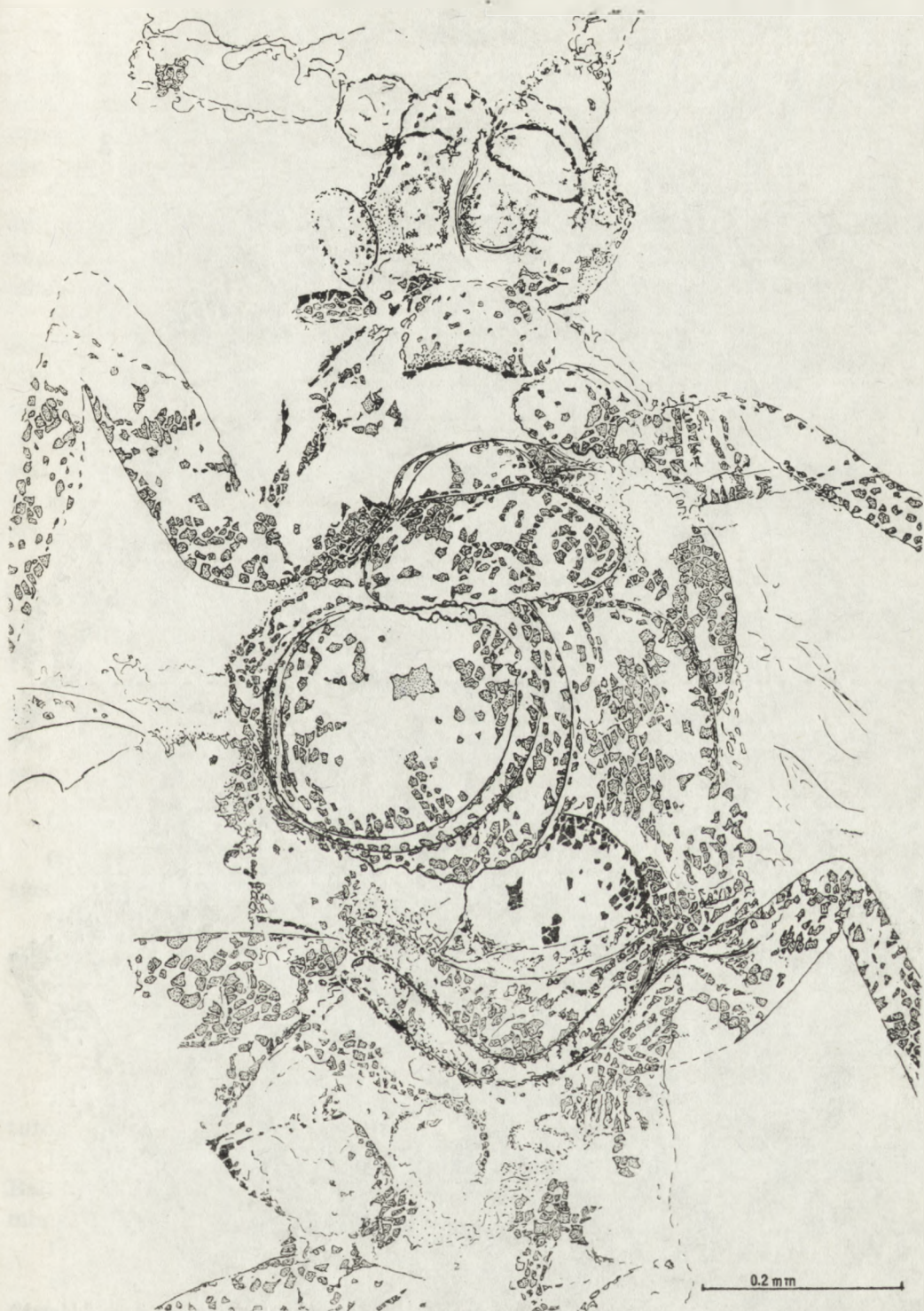


Fig. 2. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 169, holotype; "ventral" face.



Figs 3-4. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 169, holotype; abdomen; 3 - "dorsal" face, 4 - "ventral" face.

in the recent forms), or with pronotum and/or pronotal ridges observed in some archeococcids (see THERON 1958). If they were transferred from the ventral side, they should be interpreted as parts of the ventral plate; in this instance the transverse ridge must be left without any comment.

Only some proximal antennal segments are preserved; scape cylindrical, 60 μm long, 90 μm wide; pedicel cupola-like, 75 μm long, 90 μm wide; first flagellar segment cylindrical, 220 μm long, 60 μm wide; second and third segments of similar shape and size.

Prescutum transversely oval, 150 μm long, 250 μm wide, strongly convex. Scutellum subrectangular, 120 μm long, 150 μm wide, very strongly sclerotized (the cuticle is black) and convex. Prescutum, scutum and scutellum are impressed on both "dorsum" and "venter". Mesopostnotum distinct, strongly sclerotized, adjacent to scutellum (feature characteristic of *Matsucoccus*), in medial line about 90 μm long. Mesosternum large, oval, without medial ridge (as in *Matsucoccus*). Various other thoracic structures can be recognized, but they are greatly deformed and disintegrated.

Wing 1800 μm long, 800 μm wide, of characteristic matsucoccid structure; anal region obscure. Halteres not preserved. Posterior femur 400 μm long, 90 μm wide; posterior tibia 630 μm long, 60 μm wide; tarsus one-segmented, at least 220 μm long.

Abdomen weakly sclerotized, as in recent matsucoccids. Traces of tubular ducts preserved, but nothing definite can be said on their number and structure. The short basal rod of aedeagus (if correctly interpreted) may be seen on the ventral impression. Other structures obscure.

Other material studied

Cocc 170 \pm , ♂, Paleontological Institute, Moscow, No. 4210/1101; Baisa, 1983, bed 2; other data as given for the holotype.

Only some remnants of thorax, abdomen and wings preserved; Latter 1970 μm long, 910 μm wide; i.e., somewhat larger than in holotype.

Eomatsucoccus popovi sp. n., ♂

The species is named in honour of Dr Yu. A. POPOV, Paleontological Institute, Academy of Sciences, Moscow.

Holotype: Cocc 168 \pm , ♂; Paleontological Institute, Moscow, No. 4210/1102; Baisa, 1983, bed 35; Buryat. ASSR, Eravnenskiy Distr.; Cretaceous, Neocomian; Zaza Formation (For more data see "Material").

Description of holotype

Body 1300 μm long. Head and thorax greatly deformed. A strong sclerite present in the neck region (head, thorax ?). Prescutum and scutellum removed.

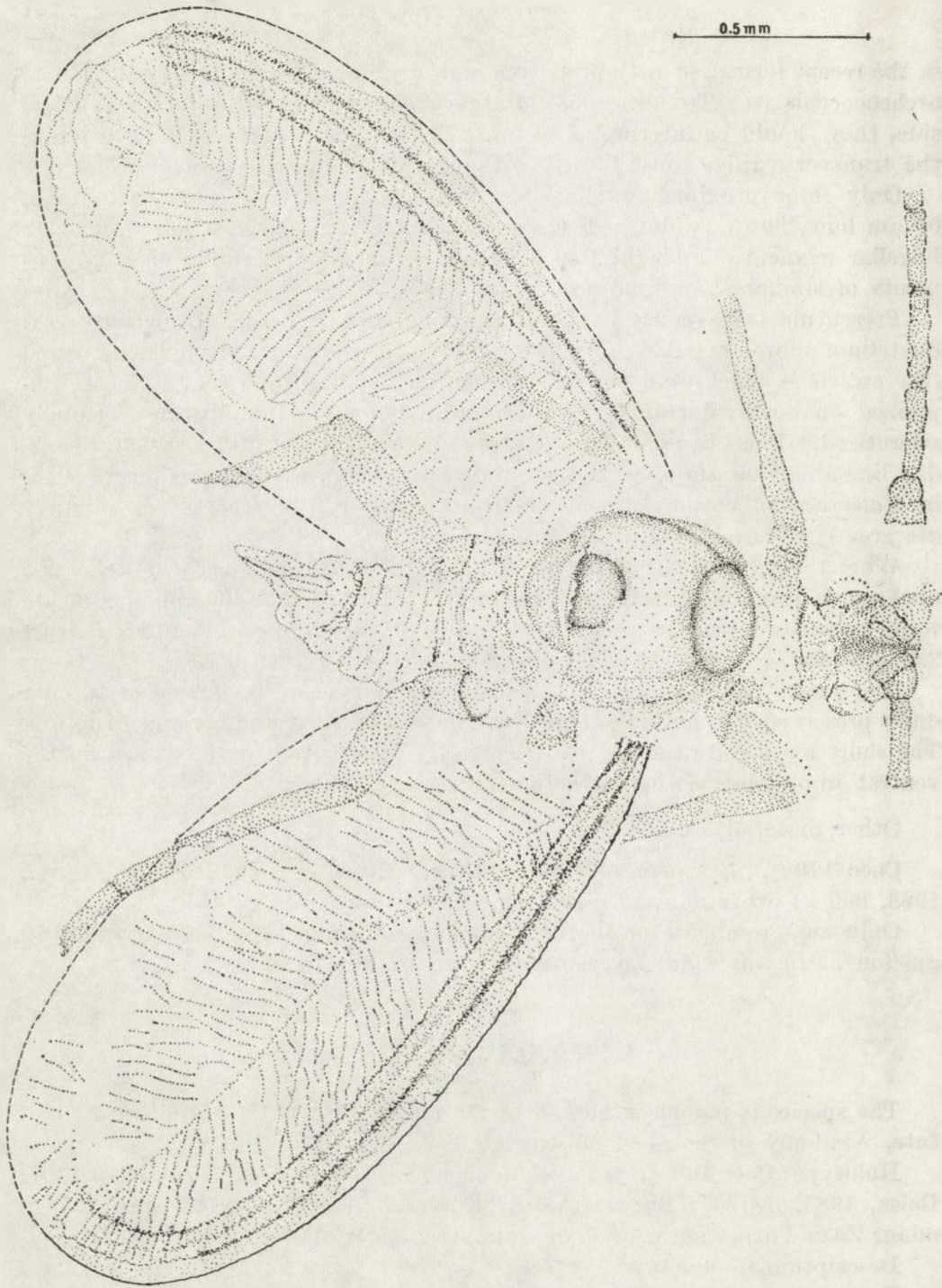


Fig. 5. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 169, holotype; "dorsal" face.

0.5 mm

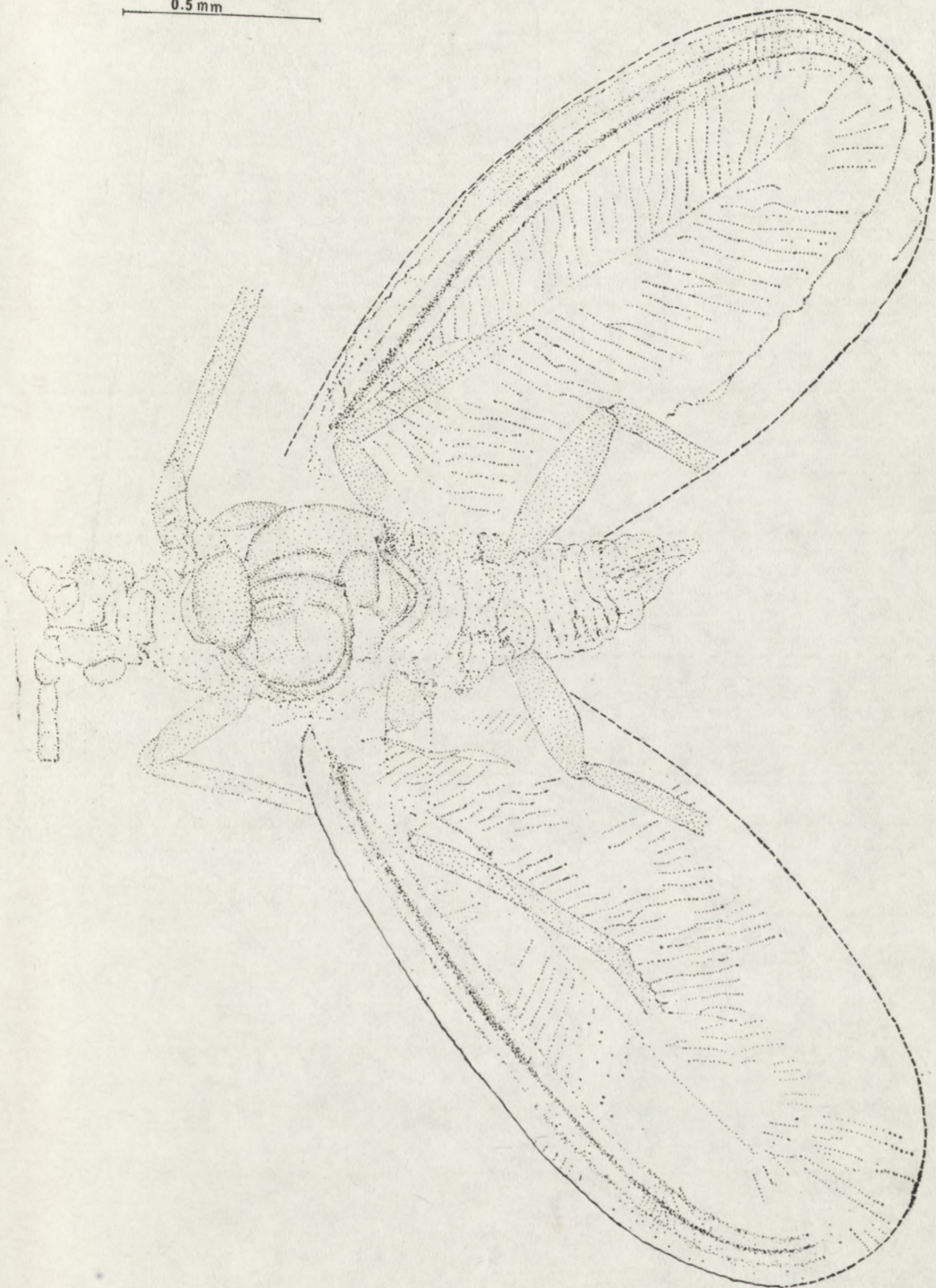


Fig. 6. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 169, holotype; "ventral" face.
The regular square on basisternum is an artefact caused by pressure.

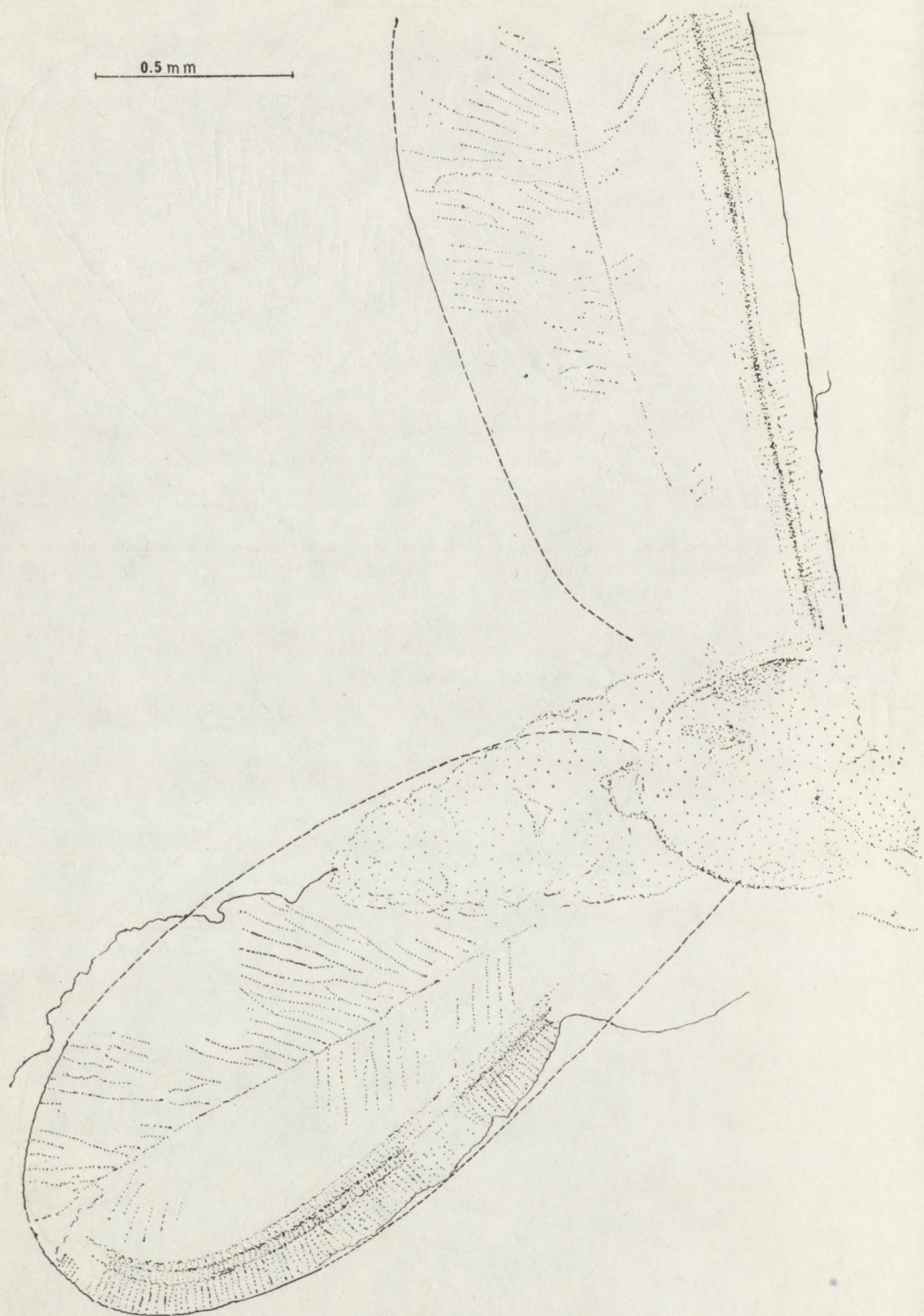


Fig. 7. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 170; "ventral" face.



0.5 mm

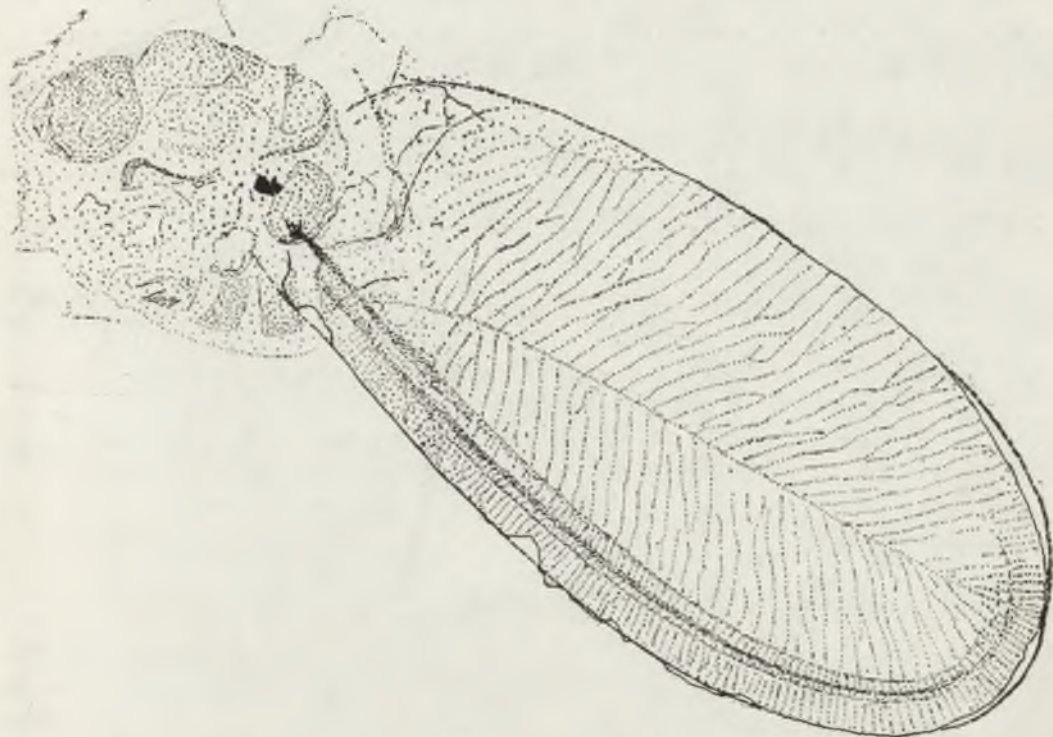


Fig. 8. *Eomatsucoccus sukachevae* sp. n., ♂, Cocc 170; "dorsal" face.

Scutum very strongly sclerotized; detached from the deposit. Wing 1500 μm long, 670 μm wide, of characteristic matsucoccid structure; cuticular strips stronger than in *E. sukachevae*. Apex of right wing and anal region of left wing folded. At the base of left mid-femur there is a plate which presumably represents the haltere; if actually so, it bears 5 setae (only sockets are visible, Fig. 13) Mid-femur 300 μm long, 75 μm wide; mid-tibia 375 μm long, 45 μm wide; hind-femur 300 μm long, hind-tibia 405 μm long.

Abdomen, presumably ventrally, strongly sclerotized; 8th sternite almost completely preserved; although the tubular-pore bearing tergite is removed, the waxy rods, presumably 7 in number, are very well preserved.

Other material studied

Cocc 167, ♂, Paleontological Institute, Moscow, No. 3064/4602; Baisa, 1979, bed 31; other data as given for the holotype.

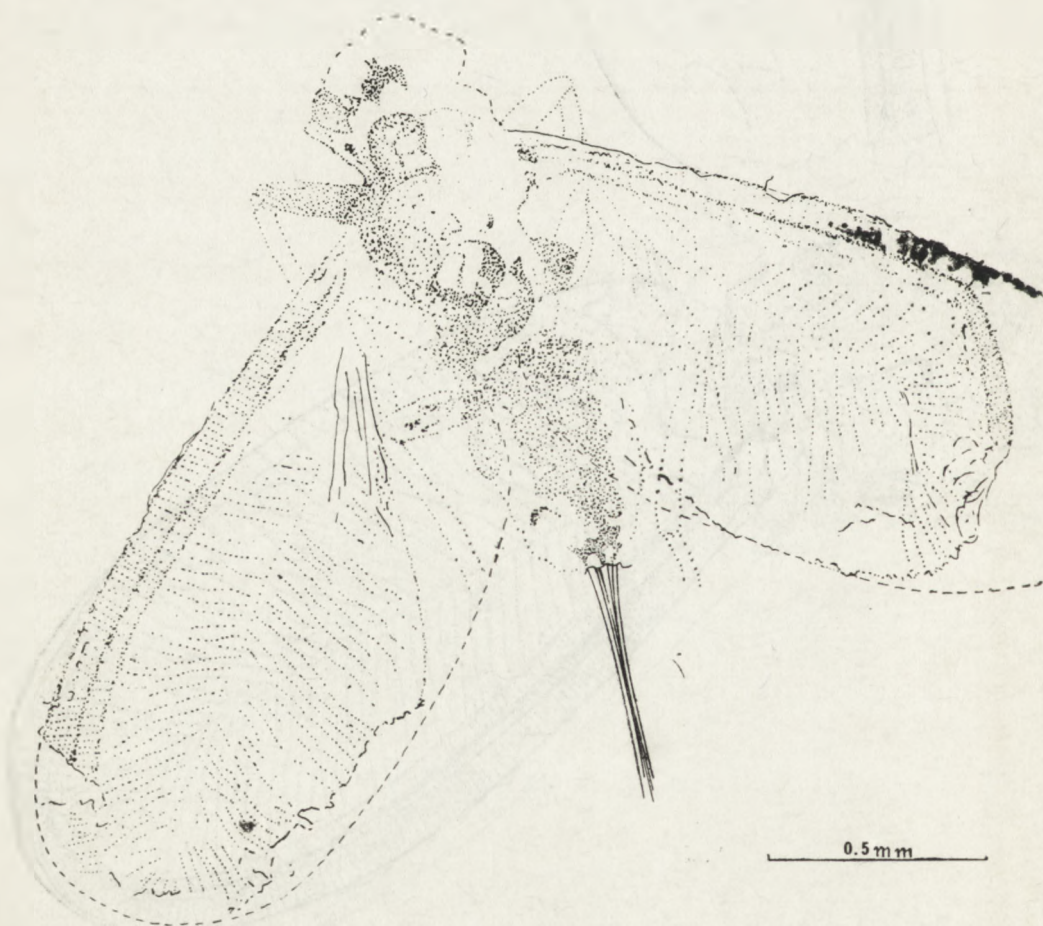
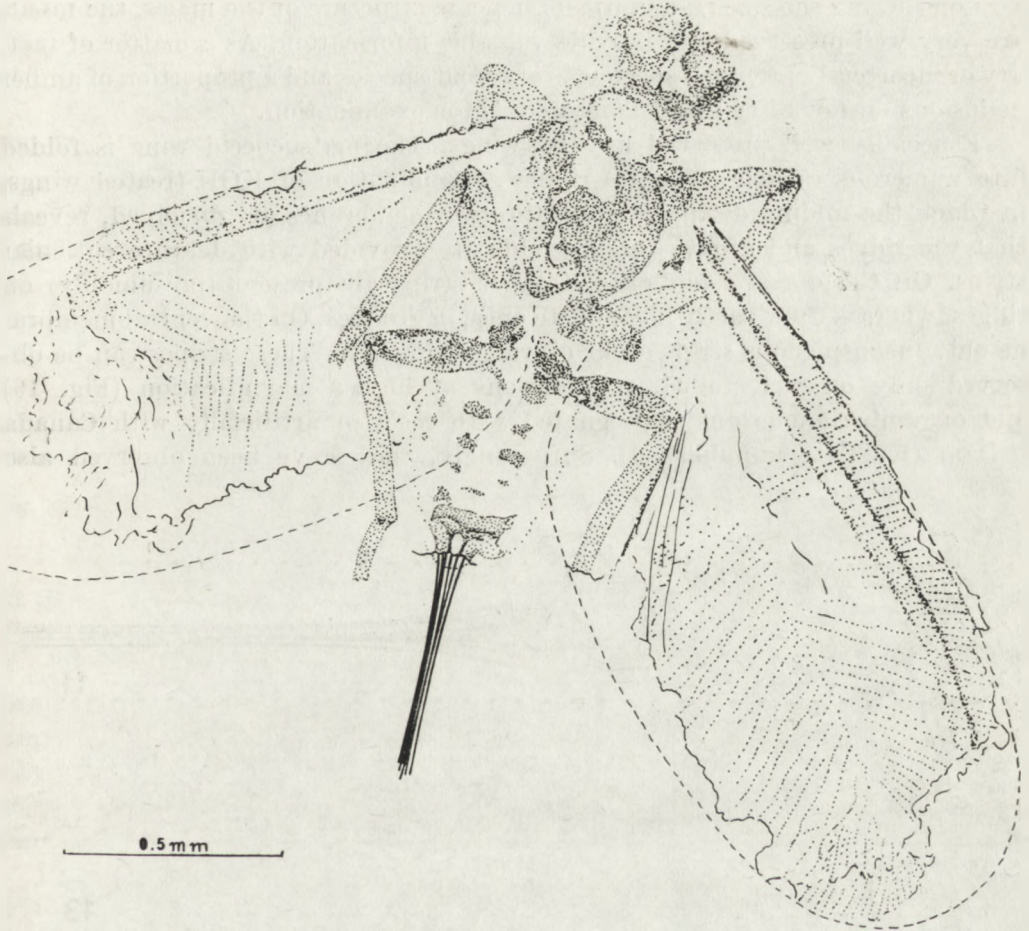


Fig. 9. *Eomatsucoccus popovi* sp. n., ♂, Cocc 168, holotype; "dorsal" face (apex of right wing and anal region of left wing folded).



0.5 mm

Fig. 10. *Eomatsucoccus popovi* sp. n., ♂, Cocc 168, holotype; "ventral" face. At a given angle of light only part of the ripples are visible, and these are drawn; alternation of the angle brings into light further ripples not shown here.

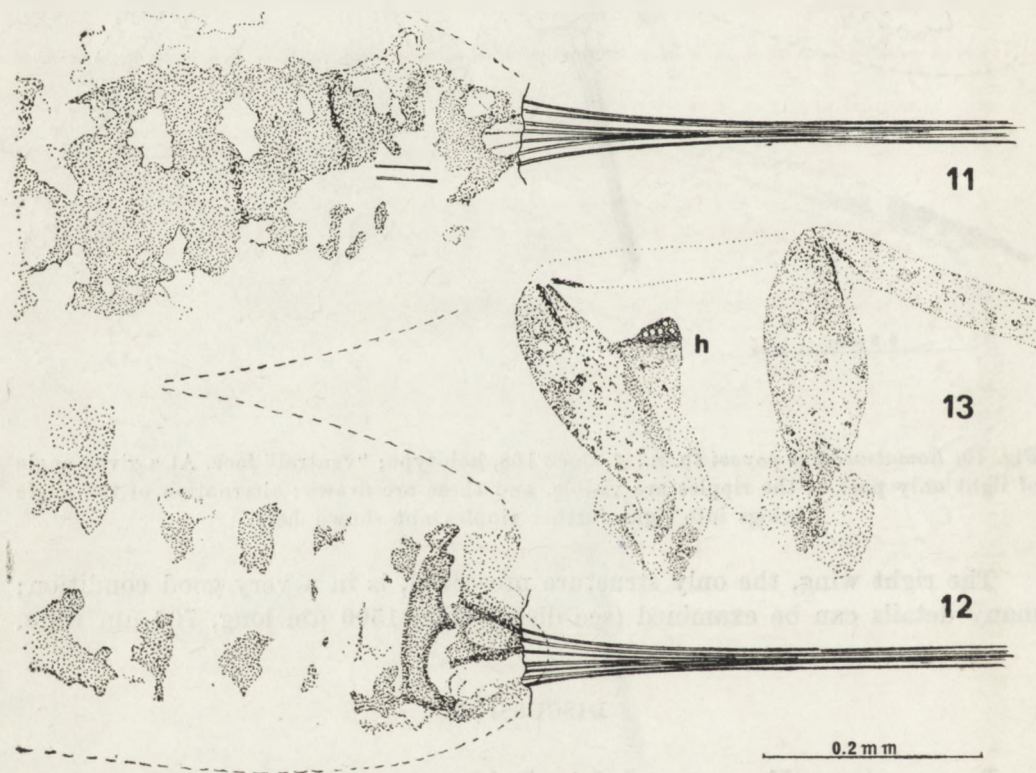
The right wing, the only structure preserved, is in a very good condition; many details can be examined (see discussion); 1500 μ m long, 700 μ m wide.

DISCUSSION

Impressions. If, as suggested by BEARDSLEY (1969), SCHLEE (in HENNIG 1981) and others, the Upper Triassic *Mesococcus asiatica* BEKKER-MIGDISOVA is not a coccid, the fossils of *Eomatsucoccus* are the oldest (Neocomian, 125–115 mil. years) known scale insect impressions. A few other impression-fossils mentioned by SCUDDER (1890), PAMPALONI (1903) and ZUENER (1938) are of a much younger origin (Oligocene, Miocene).

Considering the size (1–2 mm) and delicate structure of the males, the fossils are very well preserved and provide valuable information. As a matter of fact, dry or incorrectly prepared specimens of recent species and a proportion of amber inclusions do not offer many more details for examination.

Especially well preserved are the wings. The matsucocoid wing is folded into numerous regular (pinnate) ripples. Examination of KOH-treated wings, in which the folding disappears and the two membranes are disjoined, reveals that the ridges and grooves of the folds are provided with delicate cuticular strips. On the dorsal membrane stronger strips are present (presumably) on ridges, whereas thin, partly incomplete ones, in grooves. On the ventral membrane only inconspicuous strips occur on ridges (Fig. 17). These stripes can be observed only on well-stained preparations at higher magnification (Fig. 16) and on amber inclusions impregnated with resin or artificially with Canada balsam (KOTEJA, unpublished). Surprisingly, they have been observed also



Figs 11–13. *Eomatsucoccus popovi* sp. n., ♂, Cocc 168, holotype; 11 – abdomen with waxy tail from dorsum (Note pieces of two waxy rods in the region of 8th tergite); 12 – abdomen from venter with almost complete 8th sternite; note that the pieces of sclerites are those lacking from the “dorsal” face (remnants of membranous abdominal cuticle are not drawn); in fact, presumably the ventral derm is sclerotized; 13 – meso- and metathoracic legs and supposed remnants of haltere with 5 setal sockets.

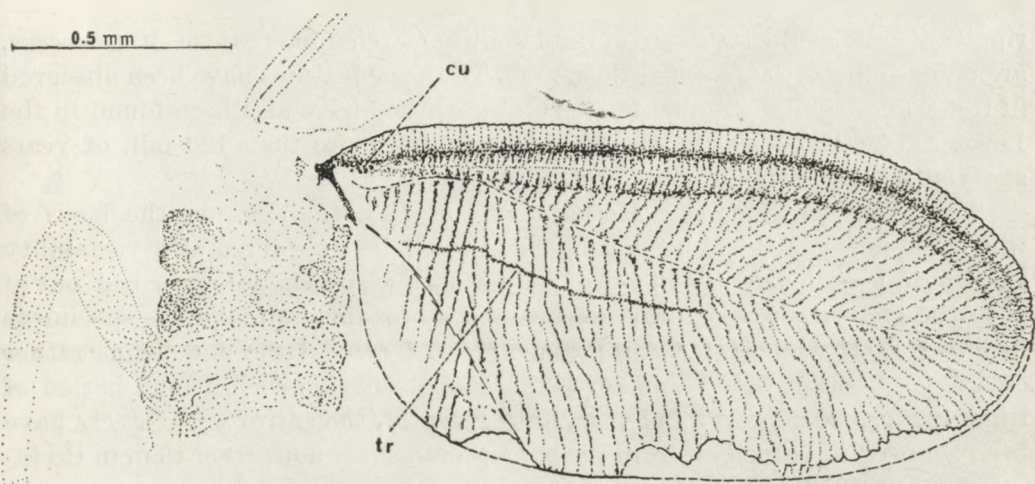


Fig. 14. *Eomatsucoccus popovi* sp. n., ♂, Cocc 167; right wing; cu — presumably campaniform sensilla, tr — presumably a trachea.

on the impressions (Fig. 15). In addition, a trachea could be seen on Cocc 167 (Fig. 14), which are accessible for examination in recent species only by means of special techniques (KOTEJA 1986b). Hard dorsal sclerites of thorax are well preserved in Cocc 168 (Fig. 1); but also delicate (endophalus, haltere) and minute dermal structures (e.g., tubular ducts producing the waxy tail rods) may be preserved (KOTEJA, unpublished); however, most surprising is the preservation of wax products, for instance, the characteristic male tail (Figs 11 and 12).

From the folding of wings (Figs 9 and 10) and even hard parts (e.g., legs) it is clear that as a result of putrefaction the cuticle became soft before embedding, thus particular body parts were translocated and their shape was deformed. Later, as a consequence of pressure, shrinking and petrification, the cuticle was broken into small polygonal pieces (Figs 1–3), and eventually, during splitting of the stone, some of the pieces were disjoined from the deposit and lost; e.g., the scutum in Cocc 168 (Fig. 10) is attached to the deposit only at its left (on drawing right) side; and the scutellum is entirely absent. It is thus obvious that numerous specimens (of the same species!) are needed to reconstruct the actual structure.

Some problems arise with minute setae. Since the outer surface of the cuticle adheres to the deposit, and the setae are buried within the deposit, they cannot be seen; however, the basal sockets are visible. In *Matsucoccus* the setae are small and sparse, and even in recent specimens they are difficult to study. In the impressions already examined the setae have not been found, except perhaps the sockets of hamuli of the haltere (Fig. 13).

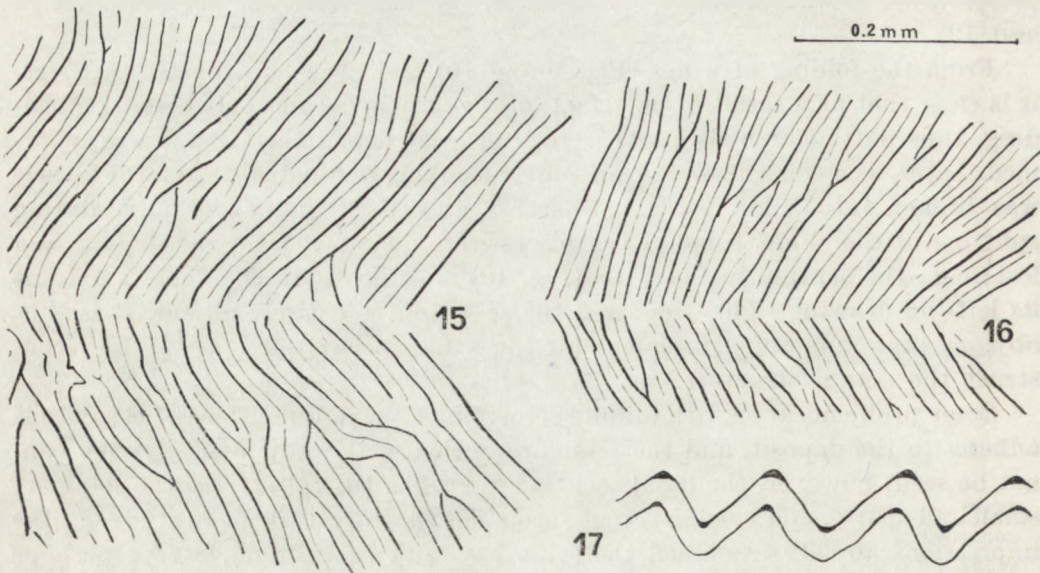
Stability at family and generic levels. The marginal thickening of wing, subcostal ridge, cubital and anal folds, and particularly the pinnate

ripples, as well as the structure of head and thorax characteristic of *Matsucoccus*, are unique among the recent scale insects. The same features have been observed in the Eocene-Miocene amber fossils, and now they have also been found in the Lower Cretaceous deposits, thus they originated more than 120 mil. of years ago and have remained unchanged up to now.

The differences between *Matsucoccus* and *Eomatsucoccus* on the basis of which the new genus has been established could be considered as a variability at generic level (currently males of only very few species are described out of about 30 known), or as deformations caused by fossilization, and the specimens included to *Matsucoccus*. As a matter of fact, I erected the new genus rather on the assumption that a generic taxon cannot survive such a long period of time. It must be kept in mind that, until recently, the entire scale insects have been believed to branch off from the homopteran stock not earlier than in Cretaceous (HOY 1962).

No matter whether *Eomatsucoccus* is distinct or synonymous with *Matsucoccus*, the homogeneous *Matsucoccidae* represent real "living fossils". In addition, they must be considered morphologically and biologically as highly specialized (KOTEJA 1974, 1984).

It should be emphasized, by the way, that the pinnate sculpture of the matsucoccid wing has nothing to do with the primitive reticulated wing venation. First, actual veins are entirely absent in scale insects; second, the ancestral form of the pinnate wing sculpture, now known in the *Ortheziidae*, is repre-



Figs. 15-17. Structure of wing disc. 15 - *Eomatsucoccus popovi*, Coec 167, piece of wing on cubital region; 16 - the same in a KOH-treated specimen of *Matsucoccus pini*; 17 - schematic section through a wing disc showing the distribution of cuticular strips (see text).

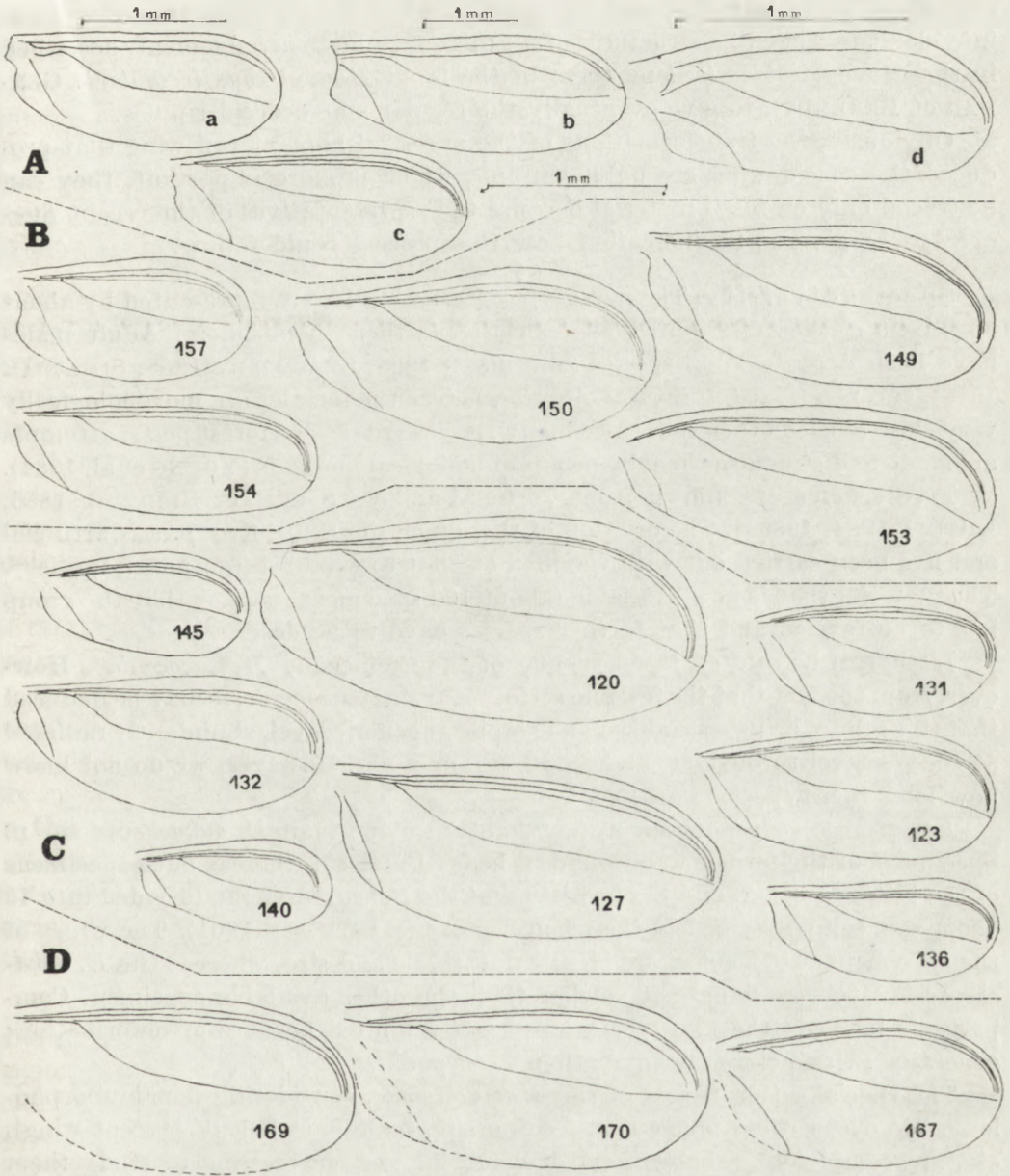


Fig. 18. Shape and size of matsuoccid wing; A recent forms; B — Miocene (Saxonian amber); C — Eocene (Baltic amber); D — Neocomian (Lower Cretaceous, Transbaikalia); a — *Matsucoccus bisetosus* (redrawn from BEARDSLEY 1968); b — *M. matsumurae* (redrawn from MORRISON 1928); c — *M. pini* (from author's collection); d — *M. pini* (redrawn from SIEWNIAK 1976; with artefacts caused by treatment with KOH). Numbers at other drawings refer to the catalogue of scale insect fossils (in preparation).

sented by polygonal tubercles (KOTEJA 1986b, 1987a). These tubercles unite into elongate ridge-like structures of a radial or pinnate arrangement, described in the *Monophlebidae* (among them in the fossil *Monophlebus irregularis* GERMAR et BERENDT), to give eventually the regular matsucoccid ripples.

Obviously, the transformations of the ancestral homopteran wing that produced the coccid wing are unknown and, which is more important, they can be traced only on fossil material because the representatives of the recent *Sternorrhyncha* give us no indication how this process could follow.

Species diversity. The monotypic *Matsucoccidae* are represented by about 30 recent species distributed all over the northern hemisphere. Adult males have been described in 3 species (MORRISON 1928, BEARDSLEY 1968, SIEWNIAK 1976), and mentioned in several others, whereas the females are morphologically very close to each other and, since many species are serious forest pests, attempts are made to distinguish them by means of biological methods (YOUNG et al. 1984).

Five species are known from Tertiary ambers (GERMAR, BERENDT 1856, KOTEJA 1984, 1986a). The division of these inclusions into five taxa is artificial and has been carried out with the idea of "not to establish too many species". The material that is now available (about 100 specimens) reveals that the group has to be revised and that further species have to be described.

Little can be said on the diversity of the Cretaceous *Matsucoccidae*. However, from the fact that the few known fossils are matsucoccids, it may be deduced that this group, being specialized and stable at generic level, abundantly radiated at species level throughout about 120 mil. of years. However, we do not know how long these species had lived.

Eomatsucoccus popovi sp. n. is "slightly" older than *E. sukachevae* sp. n. Specimens of the former were found in beds 31 and 35, whereas both specimens of the latter in bed 2, and the formation of the Baisa sediments (divided into 45 beds) was completed in less than 1 mil. years (MARTINSON 1961). The wings of the specimens of *E. popovi* are identical in shape and size, whereas the *E. sukachevae* holotype is somewhat smaller than the other available specimen. Comparisons between the two species are greatly limited because of deformation; generally *E. sukachevae* is larger than *E. popovi*.

The specialization trends of the *Matsucoccidae*, considering female morphology, life cycles, host preference, feeding site, male morphology (except wing), etc. are completely unknown, and it would be very interesting to study them taking into account the longevity of this group. Discussing the status of *Matsucoccus saxonicus*, Koteja (1986a) suggested that it must have been primitive because of the broad wings. However, since this species lived in the Miocene time, that suggestion is of little value.

Fig. 13 shows the size and shape diversity of the wing in *Matsucoccidae*. As pointed out above, descriptions of only 3 recent species are available, thus it is difficult to comment upon the differences between the wings of the Baltic

amber material, of which only a small proportion is presented on the drawing. However, it seems likely that the *Matsucoccidae* could have reached their greatest diversity and abundance in the Eocene Baltic amber time. On the other hand, it is clear from the material studied that the size-decrease, a suggested general evolutionary trend in scale insects, must be ruled out in this family. The available oldest forms are medium-sized; among the Tertiary material there are specimens much larger and much smaller than the ancestors; in all likelihood similar conditions occur also in the recent fauna.

Ecology. The recent *Matsucoccidae* are associated exclusively with *Pinus*. Their abundance in ambers (about half of the inclusions) strongly favours the hypothesis that also the Tertiary matsucoccids lived on pines: *Pinus* (or *Pinites succinifera* in the Baltic amber area and *Cupressospermum saxonicum* in the Saxonian amber area (both these plants are in fact hypothetical taxa):

With the Lower Cretaceous matsucoccids the matter is somewhat more complicated. The genus *Pinus* did not exist yet, but several other conifers were found in the Baisa deposits; among them *Podozamites*, *Elatides*, *Schizolepis* and *Pseudolarix* (a recent genus) constituted a dominant group (KRASSILOV, BUGDAEVA 1982). Some of them must have been the host plant, or host plants, of the matsucoccids. The question why these insects are now confined to *Pinus* cannot be answered yet.

The large proportion of matsucoccids in the amber inclusions can be explained by the circumstance that they lived intimately on the plant that produced resin. However, among the five known Lower Cretaceous impressions, four are matsucoccids again; it means that they generally must have been abundant in the past.

As mentioned above, the matsucoccids were found in beds 2, 31 and 35. Both plant and some insect remnants indicate that these deposits were formed during a colder period in comparison with the interlying (15–27) beds (SUKACHIEVA 1969, ZHERIKHIN 1978, KRASSILOV, BUGDAEVA 1982).

The age of coccids. Most entomologists believe the scale insects to be a young group, the origin of which has not “appreciably antedated that of the angiosperms, which is generally considered to be mid Cretaceous” (HOY 1962), and “even if they actually existed before the appearance of angiosperms, then these archaic forms did not survive” (DANZIG 1980). Only BORCHSENIUS (1958) dated the origin of coccids as Carboniferous. Commenting upon this opinion HENNIG (1981) says ironically: “BORCHSENIUS’ suggestion that from the Carboniferous to the Permian the *Coccina* separated into no fewer than 11 groups is not based on any facts!”. The lack of paleontological evidence for the existence of scale insects before late Cretaceous has also been emphasized by DANZIG (1980). In fact, various Paleozoic and Mesozoic fossils that had been affiliated with scale insects appeared to belong to other branches, except the Upper Cretaceous *Electrococcus* from Canadian amber (BEARDSLEY 1969).

The beginning of the Cretaceous age is estimated at about 140 mil. years, and the sediments at Baisa (Zaza Formation) are supposed to be deposited 125–115 mil. years ago. In addition to matsuccocids, another coccid fossil (perhaps related to *Xylococcus*) has been found in this locality (KOTEJA, unpublished). Thus there is now no doubt that further, well defined, coccids will be discovered in the Lower Cretaceous deposits.

Another argument for rejecting the early origin of scale insects were the host-parasite relationships. HOY (1962) reasoned: "If the *Coccoidea* did originate earlier than the angiosperms, there is, today, no evidence of exclusive association with gymnosperm host at family level in the *Coccoidea*, and exclusive association even at generic level occurs in relatively few genera". In addition, these "few" associations were considered as secondary adaptations (DANZIG 1980). The above conclusions have been based on absolute number of taxa; however, a comparison of relative numbers revealed that the associations of coccids with gymnosperms were much more intimate than with the angiosperms, i.e., almost all gymnosperms are infested with scale insects, whereas only a small proportion of angiosperms serves as hosts for the coccids (KOTEJA 1985). The suggestion that scale insects existed before the origin of angiosperms is supported by the present findings: angiosperm macrofossils are extremely rare in comparison with those of gymnosperms in the Baisa sediments (KRASSILOV, BUGDAEVA 1982).

HOY (l.c.) also rejected the idea of the early origin of the scale insects because it would "involve a very long period of stability at family level". The instance of *Matsuccocidae*, already discussed, demonstrates that coccids may be stable at family level at least 120 mil. years.

Matsuccoccus has been affiliated with *Xylococcus*, *Neosteingelia*, *Kuwania*, *Stomacoccus*, *Steingelia* and the *Margarodidae* s. str. in various combinations and at various taxonomic levels (MORRISON 1928, BEARDSLEY 1968, KOTEJA 1974, MILLER 1984). The *Margarodidae* live exclusively on underground parts of herbs (mainly on grasses) being specialized diggers (including the male); the remaining genera live on deciduous trees, and all are morphologically and biologically specialized to a high degree, but in diverse ways. Although *Matsuccoccus* shares this or that character with any of the mentioned genera, it is very unlikely, or even impossible, to assume that any of them derived from the matsuccocids in Cretaceous or later. Thus, either we must believe that these coccids are unrelated and derived from another unknown group, or that the radiation had taken place long before the Cretaceous time. Available information indicates that the main groups of archeococcids (= *Orthezioidea*) must have existed already in the Lower Cretaceous, being represented by numerous genera and species, of which only relict survived, except such genera as *Orthezia*, *Icerya*, *Porphyrophora* and a few others which have been flourishing until now.

What about neococcids (= *Coccoidea*)? The Eocene ambers contain inclusions of at least five groups (families). Most of them belong to *Putoidae*, *Pseudococcidae*

and *Eriococcidae*, and the level of their organization corresponds with that of today. Obviously, they must have radiated earlier, i.e. in the Cretaceous time. The question when they originated, in Cretaceous or earlier, may be answered after new paleontological finds.

REFERENCES

- BEARDSLEY J. W. 1968. External morphology of the adult male of *Matsucoccus bisetosus*. Ann. ent. Soc. America, Columbia, **61**: 1449-1459.
- BEARDSLEY J. W. 1969. A new fossil scale insect (*Homoptera: Coccoidea*) from Canadian amber. Psyche, Cambridge, **76**: 270-279.
- BORCHSENIUS N. S. 1958. Ob evolucii i filogenetičeskikh svjazjah *Coccoidea* (*Insecta, Homoptera*). Zool. Ž., Moskva, **37**: 765-780.
- DANZIG E. M. 1980. Kokeidy Dal'nego Vostoka SSSR (*Homoptera, Coccinea*). Leningrad, 367 pp.
- GERMAR E. F., BERENDT G. C. 1856. Die im Bernstein befindlichen Hemipteren und Orthopteren der Vorwelt. Organische Reste im Bernstein, **2**. Königsberg, pp. 3-4.
- HENNIG W. 1981. Insect Phylogeny. Chichester ... Torono 514 pp.
- HOY J. M. 1962. *Eriococcidae* (*Homoptera, Coccoidea*) of New Zealand. N. Z. Dept. Sci. Industr., Res. Bull., Wellington, **146**: 1-219.
- KOTEJA J. 1974. On the phylogeny and classification of the scale insects (*Homoptera, Coccinea*). Acta zool. cracov., Kraków, **19**: 267-325.
- KOTEJA J. 1984. The Baltic amber *Matsucoccidae* (*Homoptera, Coccinea*). Ann. zool., Warszawa, **37**: 437-496.
- KOTEJA J. 1985. Essay on the prehistory of the scale insects (*Homoptera, Coccinea*). Ann. zool., Warszawa, **38**: 461-503.
- KOTEJA J. 1986a. *Matsucoccus saxonicus* sp. n. from Saxonian amber (*Homoptera, Coccinea*). Dtsch. ent. Z., Berlin, N. F., **33**: 55-63.
- KOTEJA J. 1986b. Morphology and taxonomy of male *Ortheziidae* (*Homoptera, Coccinea*). Pol. ent., Wrocław, **56**: 323-374.
- KOTEJA J. 1987a. *Protorthezia aurea* gen. et sp. n. (*Homoptera, Coccinea*). Pol. Pismo ent., Wrocław, **57**: 241-249.
- KOTEJA J. 1987b. Current state of coccid paleontology. Proc. Int. Symposium of Scale Insect Studies, Portici, 24-29 VI 1986.
- KRASSILOV V. A., BUGDAEVA E. V. 1982. Achene-like fossils from the Lower Cretaceous of the Lake Baikal area. Rev. Paleobot. Palynol., Amsterdam, **36**: 279-295.
- MARTINSON G. G. 1961. Mezozojskie i kajnozjskie molljuskie kontinental'nyh otloženij sibirskoj platformy, Zabajkal'ja i Mongolii. Moskva -Leningrad; known to the author only from references.
- MILLER D. R. 1984. Phylogeny and classification of the *Margarodidae* and related groups (*Homoptera: Coccoidea*). Verh. X SIEEC, Budapest, 1983, pp. 322-324.
- MORRISON H. 1928. A classification of the higher groups and genera of the coccid family *Margarodidae*. US Dept. Agric. Res. Serv., Techn. Bull., Washington D. C., **52**: 1-239.
- PAMPALONI L. 1903. Microflora e microfauna nel disodile di Melilli in Sicilia. Boll. Accad. gioenia, Sci. Nat., Catania, **67**: 248-253.
- SCUDDER S. H. 1890. The Tertiary insects of North America. US Geol. Survey of the Territories, Washington D. C., **13**: (*Coccidae*) 241-242.

- SIEWNIAK M. 1976. Zur Morphologie und Bionomie der Kiefernborrkenschildlaus, *Matsucoccus pini* (GREEN) (*Hom. Coccoidea: Margarodidae*). Z. angew. Ent., Hamburg, **81**: 337-362.
- SUKACHEVA I. D. 1968. Mezozojskie ručejniki Zabajkal'ja. Paleont. Ž., Moskva, **1968**: 59-75.
- THERON J. G. 1958. Comparative studies on morphology of male scale insects. Ann Univ., Stellenbosch, (A), **34**: 1-71.
- YOUNG B. L., MILLER D. R., McCLURE M. S. 1984. Atractivity of the female sex pheromone of Chinese *Matsucoccus matsumurae* (KUWANA) to males of *M. matsumurae* in Japan and to males of *M. resinosae* BEAN and GODWIN in the United States (*Margarodidae, Coccoidea, Homoptera*). Centr. Shanghai Inst. Ent., Shanghai, **4**: 1-20.
- ZEUNER F. E. 1938. Die Insektenfauna des Mainzer Hydrobienkalks. Paleont. Z., Berlin., **20**: 104-159.
- ZHERIKHIN V. V. 1978. Razvitie i smena melovyh i kajnozojskikh faunisticseskikh kompleksov. Tr. Paleont. Inst. AN SSSR, Moskva, **165**: 1-198.

Instytut Zoologii Stosowanej
Akademia Rolnicza
al. Mickiewicza 24, 30-059 Kraków

STRESZCZENIE

[Tytuł: *Eomatsucoccus* gen. n. (*Homoptera, Coccinea*) z syberyjskich pokładów dolnokredowych]

Cztery okazy samców znalezione w dolnokredowych pokładach południowej Syberii pozwoliły na ustanowienie nowego rodzaju — *Eomatsucoccus* gen. n., z dwoma gatunkami — *E. sukachevae* sp. n. i *E. popovi* sp. n. Główne cechy *Eomatsucoccus*, zwłaszcza budowa skrzydeł, ściśle odpowiadają stosunkom u trzeciorzędowych i współczesnych *Matsucoccidae*, co oznacza, że czerwce te osiągnęły obecny poziom organizacji ok. 130 mld lat temu.

Eomatsucoccus jest najstarszym znanym obecnie, a równocześnie wyspecjalizowanym, czerwcem; dywergencja *Coccinea* musiała się więc odbyć w środkowym mezozoiku lub wcześniej.

РЕЗЮМЕ

[Заглавне: *Eomatsucoccus* gen. n. (*Homoptera, Coccinea*) из нижнего Мела Сибири]

В Нижнемеловых отложениях южной Сибири были найдены четыре особи самцов, по которым установили новый род — *Eomatsucoccus* gen. n., с двумя видами — *E. sukachevae* sp.n. и *E. popovi* sp.n. Главные признаки

Eomatsucoccus, а особенно строение крыльев полностью соответствуют тому, что эти червецы достигли современного уровня организации около 130 млн. лет назад.

Eomatsucoccus является найстаршим, а одновременно выспециализированным червцом; таким образом, дивергенция *Coccinea* должна была произойти в середине Мезозойской эры или ранее.
