Mitt. Geol.-Paläont. Inst. Univ. Hamburg	Heft 89	S. 55-84	Hamburg, Oktober 2005

A revision of the genus *Cupes* FABRICIUS, 1801 from Baltic amber and some notes on taxonomy and composition of the family Cupedidae (Coleoptera, Archostemata)

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With 46 figures

Contents

Abstract

A revision of the species of the genus *Cupes* FABRICIUS, 1801 from Baltic amber is given, including redescription and description of all species, namely *C. groehni* sp. nov., *C. hoffeinsorum* sp. nov., *C. kerneggeri* sp. nov., *C. motschulskyi* sp. nov., *C. rohdendorfi* IABLOKOFF-KHNZORIAN, 1960, *C. tesselatus* (MOTSCHULSKY, 1956), *C. komissari* sp. nov., and *C. weitschati* sp. nov. A neotype for *C. tesselatus* is designated and a key to the species from the Baltic amber is proposed. The generic names *Tenomerga* NEBOISS, 1984, syn. nov. and *Distocupes* NEBOISS, 1984, syn. nov. are regarded as junior synomyns of the genus *Cupes*.

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Zusammenfassung

Sechs neue Taxa der Gattung *Cupes* FABRICIUS,1801werden aus dem Baltischen Bernstein (Eozän) beschrieben: *C. groehni* sp. nov., *C. hoffeinsorum* sp. nov., C. *kerneggeri* sp. nov., *C. motschulskyi* sp. nov., *C. komissari* sp. nov. und *C. weitschati* sp. nov. Die Spezies *C. rohdendorfi* IABLOKOFF-KHNZORIAN, 1960 und C. *tesselatus* (MOTSCHULSKY, 1956) werden wiederbeschrieben. Der Neoptyus von *C. tesselatus* wird festgelegt und ein Schlüssel der bisher aus dem Baltischen Bernstein bekannten Spezies vorgeschlagen. Die Gattungs-Namen *Tenomerga* NEBOISS, 1984, syn. nov. and *Distocupes* NEBOISS, 1984, syn. nov. werden als jüngere Synonyme von *Cupes* betrachtet.

I. Introduction

In many publications referring to Baltic amber beetles, representatives of the genus *Cupes* FABRICIUS, 1801are mentioned or illustrated. The first species description of the family Cupedidae from this amber was made by MOTSCHULSKY (1956: *Cupoides tesselatus*). From that on specimens of this genus found in Baltic amber were usually named *C. tesselatus*. IABLOKOFF-KHNZORIAN (1960) described another species of the genus *Cupes* from Baltic amber as *C. rohdendorfi*, which later was synonymized with *C. tesselatus* by MOTSCHULSKY based on comparisons with drawings by PEYERIMHOFF (1909), IABLOKOFF-KHNZORIAN (1960), and (PONOMARENKO, 1969). As a result, in many cases specimens of the genus *Cupes* found in Baltic amber were named *C. tesselatus*. However, the type-species for the latter could not be found and therefore there is no objective reason for such synonymy. In this paper a neotype of *Cupes tesselatus* is designated which belongs to another species (different from *C. rohdendorfi*).

CROWSON (1981) pointed out that the appearance of this family (as well as the Archostemata sensu stricto: Cupedidae, Jurodidae, Ommatidae, Crowsoniellidae, Micromaltidae) was associated with the appearance of boring traces in fossil trees and cannot be linked with the Permian palaeoendemic groups. However, PONOMARENKO (1969) regarded that the differences between the Permian Permocupedidae and the Meso-Cenozoic Cupedidae are not so great, and that these families could link the Palaeozoic Protocoleoptera with the rest subordera or at least with the Archostemata. Nevertheless, PONOMARENKO (2003) also emphasized the absence of fossils connecting the Permian and Mesozoic xylophagous forms, which coincided chronologically with the gap in coal depositions (RETALLACK et al., 1996). At the end of Permian some coleopterous groups, recorded before and later, are not represented in depositions. Having appeared in the Middle Triassic the family Cupedidae is represented in fossil records from all periods of the Meso- and Cenozoic, although Mesocupedini (in contrast to the rest of the Cupedidae with flattened ventrites) do not reach the Cenozoic (PONOMARENKO, 1969; PONOMARENKO & KIREJTSHUK, 2005). In the extant fauna 33 species are known, distributed through many areas, but beyond Europe (and Western Palaearctic in general). Fossil cupedids were recorded in Europe also from the Miocene and even reached the Pliocene (PONOMARENKO, 1973; GERSDORF, 1976; TRÖSTER, 1993 etc.). Thus, this group became probably extinct in Europe, due to the climatic changes during the ice ages (HÖRNSCHEMEYER, 2004).

Comparison and further study of a number of specimens of the genus *Cupes* deposited in the collections of members of the "Amber working group" at the Geological-Palaeontological Institute and Museum, University of Hamburg, the Palaeontological Institute of the Russian Academy of Sciences (Moscow), and the Geowissenschaftliches Zentrum, Universität Göttingen, showed that they are scarcely conspecific.The purpose of the present paper is to find some diagnostic features to distinguish the different species of the genus

Cupes in Baltic amber. These specimens were preserved in fossil resin from one (or few) plant species, probably coniferous, and later redeposited in marine sediments during the Middle and Upper Eocene (LARSSON, 1972; WEITSCHAT & WICHARD, 2002). The specimens from the Baltic amber are treated here as contemporaneous. Besides, some critique of the generic taxonomy will be proposed.

II. Material and depository

All examined specimens originated from the Samland Peninsula (Kaliningrad Oblast), all or most of them from the Jantarnyi open pit. The majority of specimens are in collections of the "Amber working group" at the Geological-Palaeontological Institute and Museum, University of Hamburg (GPIM). According to the agreement with the collectors the holotypes of the new species published here will be deposited in the collections of the GPIM (coll. C. GRÖHN); in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (coll. F. KERNEGGER); in the Deutsches Entomologisches Institut, Müncheberg (coll. Chr. & H.W. HOFFEINS). Other specimens should be in the disposal of the collectors. The author also studied specimens deposited in the collections of the GPIM, the Palaeontological Institute of Russian Academy of Sciences, Moscow, and the Geowissenschaftliches Zentrum, University of Göttingen.

III. Notes on terminology for anterior wing venation

The elytra of most Archostemata have distinct ribs (primary, secondary and transverse veins) and cells (remains of the primary wing membrane). The author follows the terms elaborated by PONOMARENKO (1969) who considered that only 4 primary veins can still be traced in the elytra of *Cupes* species represented in the Baltic amber fauna. The vein M is located along the plane of the elytron and at its subvertical lateral slope. Between the suture and vein M, vein Cu and vein A2 are disposed , which end by a joined rib meeting with the vein M before the elytral apex. Finally, vein A3 is represented by a short and partly smoothed prescutellar oblique rib, isolating 2-3 prescutellar cells. Between the main primary veins M, Cu and A2 one intermediate (secondary) vein is seen quite clearly and sometimes these secondary veins are raised as primary ones. In contrast to the primary veins, the secondary elongate ones and transverse veins originated from the archedictyos and these veins can have, as primary veins, a rather stable configuration among close relatives.

IV. Systematic descriptions

Order Coleoptera

Suborder Archostemata

Superfamily Cupedoidea

Family Cupedidae

Subfamily Cupedinae

Genus *Cupes* FABRICIUS, 1801

= *Cupes* FABRICIUS, 1801: 66 (Type species: *Cupes capitatus* FABRICIUS, 1801, by monotypy); *Cupoides* MOTSHULSKY, 1856: 27 (type species: *Cupoides tesselatus* MOTSHULSKY,

1856, by monotypy); *Tenomerga* NEBOISS, 1984: 448 (type species: *Cupes mucida* CHEVROLAT, 1829, by subsequent designation), syn. nov.; *Distocupes* NEBOISS, 1984: 457 (type species: *Cupes varians* LEA, 1902, by subsequent designation), syn. nov.

Diagnosis: The genus is diagnosed by the tuberous dorsal surface of the head and the quite characteristic, rather stable configuration of the elytral veins (ribs). Members of it differ from the those of the rest cupedine genera as follows:

- *Adinolepis* NEBOISS, 1984 and *Ascioplaga* NEBOISS, 1984 in the more transverse head with more distinctly tuberous dorsal surface, and from the first also in the distinct scales (squamae) on the elytra;

- *Cupidium* PONOMARENKO, 1968 in the not strongly projecting anterior part of the head with rather large eyes and comparatively longer antennae, not so regularly suboval pronotum, and narrow prosternal process;

- *Miocupes* PONOMARENKO, 1973 in the much shorter temples (not longer than eyes), tuberous (not even) dorsal surface of head, distinct main primary veins M, Cu and A2 on elytra, and larger cellation on them;

- *Paracupes* KOLBE, 1898 in the not very transverse head with more or less distinctly tuberous dorsal surface, not distinctly pentagonal pronotum, joined veins Cu and A2 meeting vein M (but not with suture and linked with the oblique intermediate vein in distal half), and much shorter A3;

- *Priacma* LECONTE, 1874 in the more or less distinctly tuberous dorsal surface of head, markedly more distinct primary veins than intermediate ones, and more distinct cells, narrower neck (about half as wide as maximum width of head, while in *Priacma serrata* it is at least two thirds);

- *Priacmopsis* PONOMARENKO, 1966 in the smaller body size, somewhat longer prothoracic segment, and larger cellation on the elytra;

- *Prolixocupes* NEBOISS, 1984 in the not elongate head with usual shape, very distinct veins cells on the elytra, and not so narrow prosternal process, usually moderately extended behind procoxae;

- *Rhipsideigma* NEBOISS, 1984 in the not isolated three pairs of dorsal tubercles on the head, pronotum with a not so projecting anterior process, distinct elytral venation (without forking of the vein M at base) and lack of dense at not so acuminate elytral apices.

Notes: The present study of the amber specimens of this genus and its comparison with representatives of the recent faunas show that the generic separation proposed by NEBOISS (1984) should be revised. At first, the characters defined from the different peculiarities of "tarsal" grooves on the prosternum can scarcely be used as diagnostic. They are rather variable even in some recent species of "*Tenomerga*" and much more variable in the species of the Baltic amber (in some of them the tarsal grooves are completely unexpressed). The level of the development of tubercles on the dorsal surface of the head is also not reliable for a generic discrimination. Thus, it is impossible to link the species with similar characters known from Baltic amber and the recent faunas in any hypothetical model of phylogeny. After comparison of many species, including the type-species of the synonymized generic names, a new synonymy is proposed for *Cupes*, *Tenomerga* syn. nov., and *Distocupes* syn. nov. It seems to be rather reasonable to regard the "*capitatus*" group of species and the "*clathratus*" group of species etc. (ATKINS, 1963). Concerning the Baltic amber specimens of this genus studied here, characters, which were used to support some relationship between species concentrated on a certain territory, should be regarded as rather doubtful.

Sometimes for generic diagnostics the characters of the tarsal shape and some peculiarities in the shape of the antennomeres can be used, however, these characters indeed scarcely could demonstrate a trace of the family differentiation. CROWSON (1962) used the configuration of the gular sutures for generic diagnostics, but in the Baltic amber species they are also quite variable (although never confluent in the posterior half as in some recent *Prolixocupes*). The genital characters mentioned by NEBOISS (1984) are sometimes quite useful for a generic and subgeneric discrimination, although such characters cannot be obtained for most of the fossil specimens. The groups treated as *Adinolepis* and *Ascioplaga* have mostly genital differences from *Cupes* and, therefore, these taxa could be regarded more as a subgeneric rank rather than a generic one.

All recent specimens of the family examined and the specimens known from illustrations have very short and transverse antennomere 2, while most of the amber specimens bear subquadrate or even slightly elongate ones. Besides, in most amber specimens the flagellomeres are more or less subcylindrical, while among the recent species the flagellomeres have an expressed tendency to flattening. The specimens representing the Baltic amber fauna of the genus *Cupes,* in contrast to most of the recent ones, have somewhat less acuminate elytral apices. Besides, compared with the recent ones, amber specimens have a more uniform pattern of coloration of the scales (squamae) on the dorsum, and a more uniform type of cells on the elytra

The elytral venation seems to be a good diagnostic character for grouping and clarifying the phylogenetic relationships among Cupedidae, although reliable conclusions need a detailed comparative study of the characters among many recent and extinct species. The amber specimens of *Cupes* seem to demonstrate an archaic "generalized" type of venation, basal for the subfamily Cupedinae (more or less resembling the generalized type of the elytral venation of the recent Asian species of the genus). This type can be seen in *C. rohdendorfi* (fig. 40 - spec.no. 650) and is quite characteristic of many species in both Baltic amber and recent fauna. Besides, a specimen from the Cenomanian amber of France deposited in the Musée Nationale d'Histoire Naturelle is characterized by the same type of elytral venation (a picture was sent to the author by A. NEL). However, some species from the Baltic amber show certain modifications (see below) and even within the recent members of the genus some rather strong modifications can be traced as well (ATKINS, 1963).

Cupes groehni sp. nov.

(figs.1 - 5, 35 - 37)

Material: Holotype: Typ.Kat.Nr.4420, coll.Geologisch-Paläontologisches Institut und Museum, Universität Hamburg, (no.4071, ex coll. C. GRÖHN, Hamburg)

Paratypes: No.372, coll. Chr. & H. HOFFEINS (Hamburg);Typ.Kat.Nr.4421, coll. Geologisch-Paläontologisches Institut und Museum, Universität Hamburg, (no.4318 ex coll. C. GRÖHN, Hamburg), with one Chironomidae; no.790, coll. G. HERRLING (Engter); no.792 coll. G. HERRLING (Engter), with stellate hairs.

Derivatio nominis: This new species is devoted to Carsten GRÖHN (Glinde, Hamburg).

Description: Holotype (almost complete; left antennomeres 8-11 and left mesotibia and mesotarsus are missing; medially with a great crevice approaching to the dorsum of the beetle): Length 10.7mm, width 3.0 mm, height 1.6 mm. Rather long, moderately convex dorsally and ventrally; with extremely dense, yellowish grey scales (masking the coloration of body surface),

although some obscure infuscation consisting in longitudinal patches and subapical band traced on elytra; on antennae and other appendages scales gradually becoming narrower.

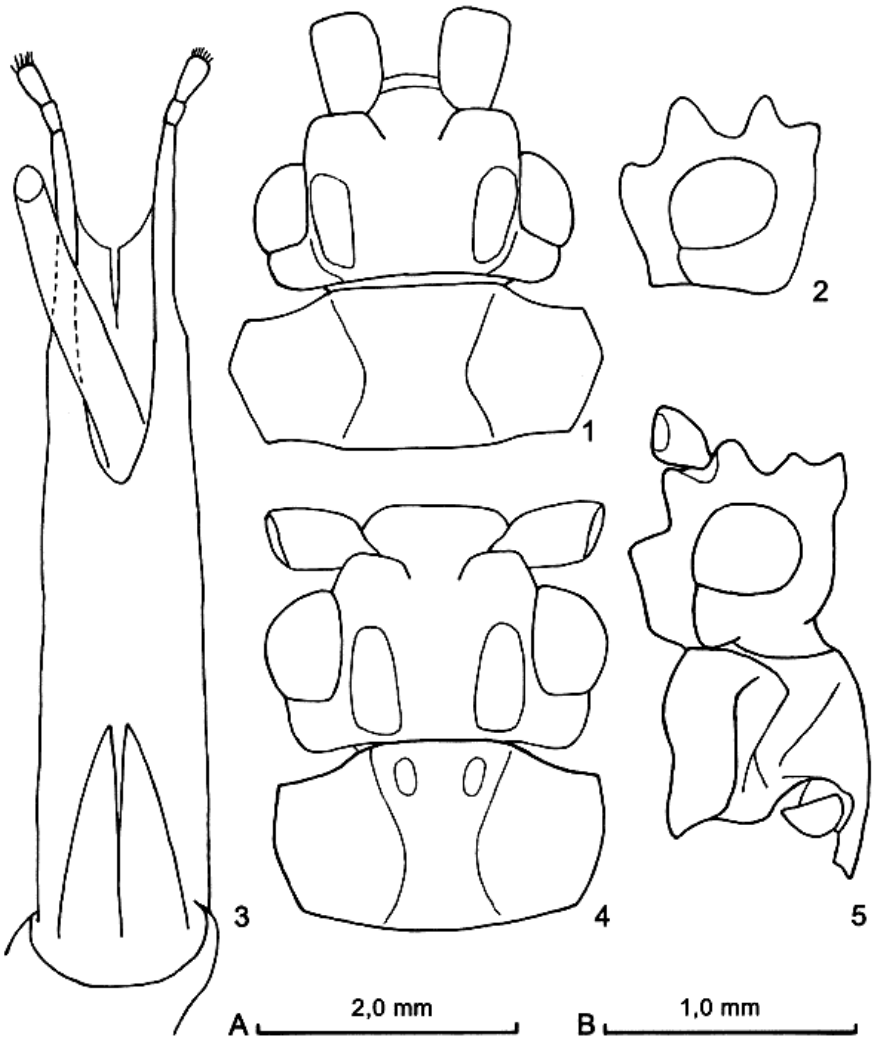
Surface of head with 2 paramedian pairs of tubercles (posterior ones longitudinal and narrow, more elevated anteriorly and reaching level of anterior third of eyes; anterior ones transverse and gently swollen); bases of anterior tubercles closed; bases of posterior tubercles separated by a subflattened interspace, divided by a shallow longitudinal furrow. Eyes rather large, about 2.5 times as long as temples. Labrum narrowly exposed. Mandibles slightly exposed from under labrum. Antennae (more than 5.5 mm) nearly half as long as body; scape slightly oval, somewhat less than twice as long as thick; antennomere 3 subcylindrical, about 2.5 times as long as antennomere 2, and slightly longer than antennomere 4; antennomere 2 slightly shorter than thick; ultimate antennomere missing. Pronotum from base gradually widened anteriorly to the middle, subparalel-sided before anterior angles and strongly narrowed in anterior third, with a median rather elevated stripe along the entire length, narrowed in the middle and widened both anteriorly and posteriorly (without longitudinal median furrow); anterior angles subrectangular, posterior ones with blunt indistinct apices, posterior edge slightly convex in the middle and subsinuate at posterior angles. Scutellum moderately vaulted and rather widened before subtransverse posterior edge. Elytra with clearly raised vein Cu and A2 joining and meeting vein M; intermediate vein between veins M and Cu visible along the entire length; vein A3 distinct.

Mentum subquadrangular. Only apices of palpi exposed. Gular sutures somewhat arcuate and narrowest in the middle. Prosternum rather swollen and comparatively weakly depressed at anterior edge, its intercoxal process very narrow, rather curved along coxae and far extended behind them. Mesosternum moderately swollen, with rather deep fossae (1st - at anterior edge receiving apex of prosternal process and 2nd - at posterior edge). Metasternum rather swollen and with a comparatively deep median depression at metacoxae. Hypopygidium more than twice as long as each of ventrites 2-4, somewhat longer than wide and narrowly rounded at apex.

Tibiae rather narrow and rather widened at apex, about as wide as epipleura at base. Femora much more than twice as wide as tibiae. Tarsi about as wide as tibiae. Protarsomere 1 about 1.5 times as long as wide, mesotarsomere 1 about 2 times as long as wide and meta-tarsomere 1 about 3.5 times as long as wide. Metatarsomere 1 almost twice as long as meta-tarsomere 5.

Paratype no.872, ♀, both ultimate antennomeres missing, with a great crevice along the right part of pronotum, head and right antenna): Length 10.2 mm. Elytra completely with uniformly light scales, but base of pronotum, posterior and anterior tubercles of head rather infuscate. Posterior tubercles of head less narrow and area between them with a weak median furrow. Pronotum comparatively wider, with a weak median furrow and without pair of paramedian fossae at anterior edge. Antennae (4.3 mm) less than half as long as body length; scape slightly oval, not more than 1.5 times as long as thick; antennomere 3 subcylindrical and about 2.5 times as long as antennomere 2; antennomere 2 markedly shorter. Apex of prosternal process not visible, because it is inserted into fossa of mesosternum. Metasternum moderately swollen. Hypopygidium about as long as wide and moderately rounded at apex. Tibiae slightly widened apically. Ovipositor somewhat similar to that in *C. rohdendorfi* (spec. no. 999/2), but more shortly forked and with much longer and 2-segmented styli.

Paratype Typ.Kat.Nr.4421 (almost completely preserved, but with cut last antennomeres of both antennae, medially with a great crevice approaching to the dorsum): Length 11.2 mm, height 1.5 mm. Pronotum markedly wider than head at eyes, more transverse.



Figs. 1-5: *Cupes groehni* sp. nov.; paratype, ♀, no.872, coll. Chr. & H.-W. HOFFEINS, ; **1**: Head and pronotum with outline of tubercles on head, median elevated part of pronotum, and paramedian depressions at its anterior part, dorsal; **2:** Head, lateral; **3:** Ovipositor, dorsal; **4:** Holotype, Typ.Kat.Nr..4420, coll. Geologisch-Paläontologisches Institut und Museum, Universität Hamburg, (no.4071, ex coll. C. GRÖHN, Hamburg); head and prothoracic segment, median elevated part of pronotum, and paramedian depressions at its anterior part, dorsal; **5:** Ibid., lateral. Scale: **A:** Figs.1 - 2, 4 - 5; **B:** Fig.3.

Antennae much longer (7.0 mm), with longer and thinner antennomeres, scape about as long as wide, ultimate antennomere more than 5 times as long as wide.

Paratype no.790, (complete): Length 11.5 mm, width 2.6 mm. Head, pronotum and elytral base rather darkened. Pronotum about as wide as head at eyes. Ultimate antennomere more than 5 times as long as wide. Hypopygidium as long as wide and subangular at apex.

Paratype: no.792, (complete, but with thick opaque milky cover on right parts of head and pronotum as well as on ventral side): Length 8.7 mm. Antennomere 2 slightly more than twice as long as scape.

Variability: A certan variability can be traced in the size and density of scales. Specimens no.372 and no.792 in contrast to the other type specimens have the posterior tubercles gradually elevated from the base, but, on the other hand, the pronotum of the specimens no.372

and no.790 in contrast to others, is comparatively much wider (wider than head at eyes), shorter and more convex. Besides, the *Cupes* specimen figured in WEITSCHAT & WICHARD (2002) seems to belong to this species, and is characterized by the comparatively gradually elevated posterior tubercles on the head and a pronotum markedly wider than the head at eyes.

Diagnosis: This species is very distinct from the congeners of the Baltic amber due to its very narrow and long intercoxal process of prosternum, characteristic shape of the pronotum with the posterior edge slightly convex in the middle, and the subsinuate at posterior angles. Besides, it seems to have the gular sutures somewhat arcuate and narrowest in the middle. From other Baltic amber species with two pairs of dorsal paramedian tubercles on the head it differs in the characters mentioned in the key (see below). The cells of the elytra of this new species are suboval to polygonal and more or less subcircular, although some cells are rather somewhat transversely oval than subcircular (somewhat like those in *C. motschulskyi* sp. nov.)

Compared with the recent *C. japonicus* TAMANUKI, 1928 this species has a more robust body, more uniform coloration of scales on the dorsum, somewhat weaker paramedial tubercles on the head, longer antennomere 2 (in *C. japonicus* it is about 1/4 as long as an-tennomere 3 , while in *C. groehni* sp. nov. it is only about 2/5-1/3), pronotum more narrowed posteriorly, and 2-segmented styli. In comparison with the recent *C. multoni* GESTRO, 1910 it has a larger and more robust body, more uniform coloration of scales on the dorsum, much shorter antennae (in *C. multoni* they are much longer than the body), markedly larger eyes, longer antennomere 2 (in *C. multoni* it is about 1/5 as long as the antennomere 3, while in *C. groehni* sp. nov. it is only about 2/5-1/3), pronotum more widened anteriorly (in *C. multoni* strongly narrowed at base and subparallel-sided in anterior 4/5), with less sharp median ridge along the whole length, not distinct paramedian ridges in its anterior half, and less explanate sides, cells on elytra looking larger (because of smaller and less dense scales), and markedly weaker vein Cu.

Cupes hoffeinsorum sp. nov.

(figs.6 - 7)

Material: Holotype, no.1036-2, coll. Chr. & H.W. HOFFEINS (Hamburg), with three ant like leave beetles, a collembola, a beetle larva, eight gall midges, a conifer needle, and stellate hairs.

Derivatio nominis: This new species is devoted to Christel & Hans-Werner HOFFEINS (Hamburg).

Description: Holotype almost completely preserved, except missing right middle leg; with strong opaque white milky cover on most part of the ventral side: Length 7.3 mm, width 2.0 mm. Rather long, moderately convex dorsally and ventrally; with extremely dense and dark scales (only inner surface of elytral cells yellowish); scales on most part of ventral side seemingly yellowish grey; on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae.

Surface of head with 2 paramedian pairs of dorsal tubercles (posterior ones larger and disposed along the inner edge of eyes), well raised and gently swollen; anterior tubercles suboval and their base closed; interspace between longitudinal posterior tubercles rather wide, flattened and without median furrow; distance between antennal insertions about as wide as thickness of scape. Eyes comparatively large, about 2.5 times as long as temples. Labrum scarcely visible. Mandibles somewhat exposed from under labrum. Antennae rather long (nearly 5.1 mm) and comparatively thin, about 5/7 as long as body; scape slightly oval, slightly longer than thick; antennomere 3 subcylindrical and about 2.5 times as long

as antennomere 2, and slightly longer than antennomere 4; antennomere 2 about as long as thick; ultimate antennomere about 8 times as long as thick. Pronotum narrowest at base and gradually arcuately widened anteriorly and strongly narrowed in anterior third, with a median slightly elevated stripe (without longitudinal furrow), rather widened in anterior half and without paramedian fossae at anterior edge, anterior angles subrectangular and posterior ones with blunt indistinct apices, its posterior edge slightly convex, lateral parts widely explanate. Scutellum subqudrangular. Elytra with clear vein Cu and A2 joining posteriorly and meeting vein M; intermediate vein between veins M and Cu scarcely more raised only at base; vein A3 not expressed.

Mentum, palpi, pro- and mesosterna as well as ventrites invisible; gular sutures probably concave. Metasternum slightly vaulted. Hypopygidium somewhat less than twice as long as each of ventrites 2-4, somewhat shorter than wide and subangular at apex.

Legs moderately developed. Tibiae moderately narrow and slightly widened apically, slightly narrower than epipleura at base. Femora slightly more than twice as wide as tibiae. Tarsi seemingly at least as wide as tibiae. Mesotarsomere 1and metatarsomere 1 about 2.5 times as long as wide.

Diagnosis: This new species is very similar to *C. tesselatus* with a weak development of the two pairs of dorsal tubercles of the head, differing from it in the characters mentioned in the key below. See also diagnosis of the latter.

Cupes kerneggeri sp. nov.

(figs.8 - 11, 38)

Material: Holotype, ♀, no.70/2001, coll. F. KERNEGGER (Hamburg), with 5 coprolithes and stellate hairs (in syntetic resin).

Derivatio nominis: This new species is devoted to Friedrich KERNEGGER (Hamburg).

Description: Holotype completely preserved, but part of the surface of ventral side with milky cover. Length 6.5 mm, width 1.8 mm, height 1.2 mm. Rather slender, moderately convex dorsally and ventrally; with extremely dense yellowish grey scales on most part of surface, although scales between dorsal tubercles of head, median elevated stripe on pronotum as well as on lateral parts and 2 transverse bands on elytra (just behind the middle and at apices) partly darkened; on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae.

Surface of head with posterior weak dorsal tubercles, situated along lateral edge of eyes; anterior tubercles scarcely expressed at antennal insertions, disk of head mostly flattened and with narrow longitudinal median line; distance between antennal insertions narrower than thickness of scape. Eyes moderately large, about twice as long as temples. Labrum well exposed. Mandibles scarcely exposed from under labrum. Antennae (3.7 mm) markedly less than 2/3 as long as body; scape slightly oval, somewhat less than 1.5 times as long as thick; antennomere 3 subcylindrical and about twice as long as antennomere 2, and slightly longer than antennomere 4; antennomere 2 slightly longer than thick; ultimate antennomere about 3 times as long as thick. Pronotum narrowest at base, posterior edge nearly straight, gradually widened anteriorly (till the middle), subparallel-sided in anterior half and strongly narrowed in anterior third, with a median rather elevated ridge along the entire length, not divided by a longitudinal furrow and without a pair of shallow paramedian fossae at anterior edge, anterior angles rather acute and somewhat projecting, but posterior ones with blunt indistinct apices, lateral parts widely explanate. Scutellum rather

vaulted and rather widened before subtransverse posterior edge. Elytra with clear vein Cu and A2 joining posteriorly and meeting vein M; intermediate vein between veins M and Cu well raised along entire length; vein A3 not expressed.

Mentum subquadrangular. Only apices of palpi exposed from under ligula. Gular sutures convex and most separated in the middle. Prosternum moderately swollen and slightly depressed at anterior edge, its intercoxal process not curved along coxae, not extended behind procoxae and narrowing just at rounded apex. Mesosternum slightly swollen, with two rather shallow fossae (1st - at apex of prosternal process, and 2nd - at posterior edge). Metasternum slightly swollen and with shallow median depression at metacoxae. Hypopygidium about twice as long as each of ventrites 2-4, nearly shorter than wide and widely rounded at apex.

Tibiae moderately narrow and slightly widened apically (particularly at apex), nearly as wide as epipleura at base. Femora much more than twice as wide as tibiae. Tarsi markedly wider than tibiae. Protarsomere 1 slightly longer than wide, mesotarsomere 1 about 1.5 times as long as wide, and metatarsomere 1 somewhat more than twice as long as wide; metatarsomere 1 slightly longer than metatarsomere 5.

Diagnosis: This new species is well characterized by the weakly tuberous dorsal surface of the head, shape of pronotum, not raised vein A3, clearly convex gular sutures with the greatest distance in the middle, comparatively short antennae, nearly not anteriorly depressed prosternum, and rather short and wide tarsi. The latter character does not allow to put this species into both *Cupes* or *Tenomerga* sensu NEBOISS, 1984.

Cupes motschulskyi sp. nov.

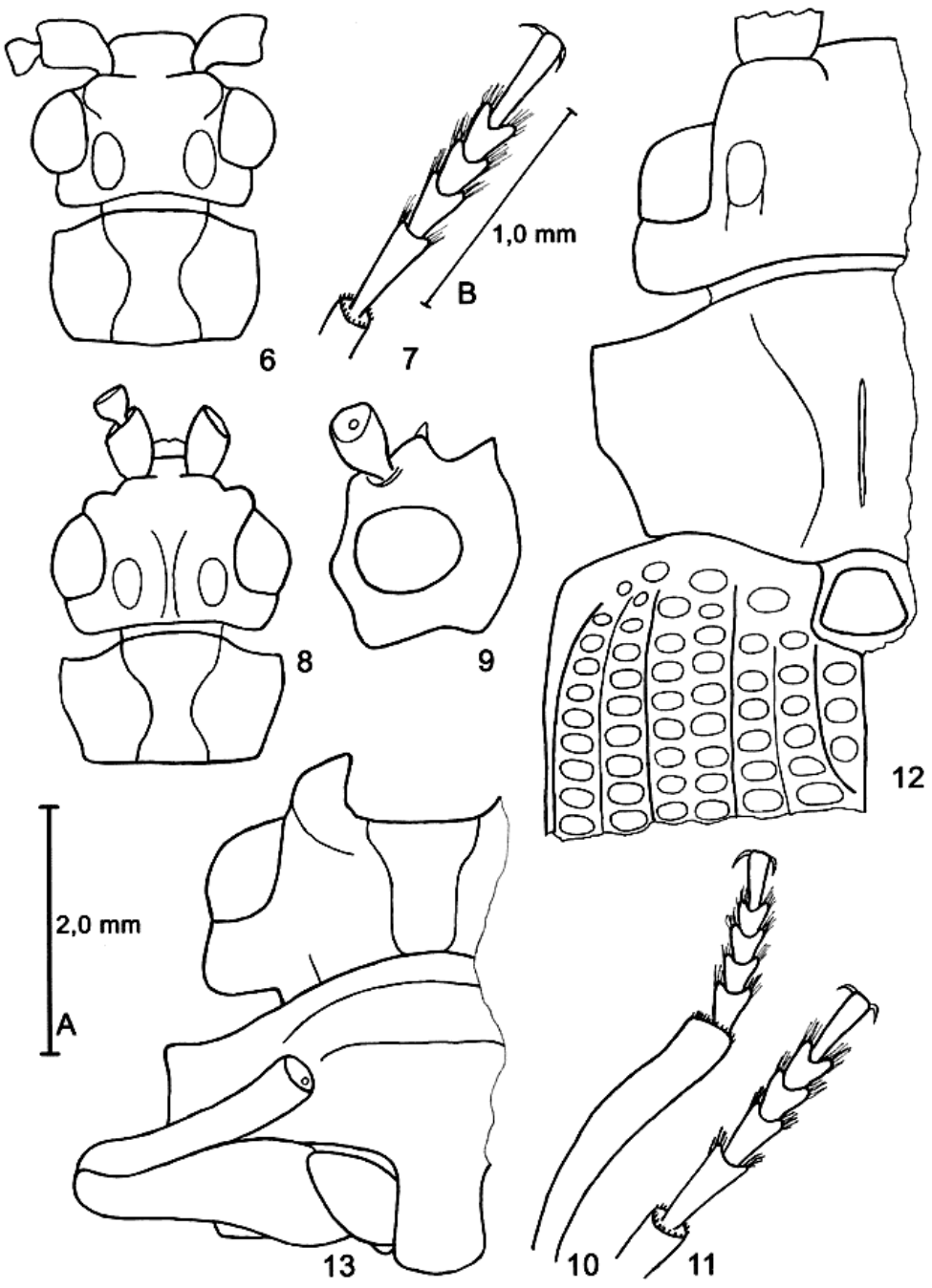
(figs.12 - 13)

Material: Holotype, no.363/130, coll. Palaeontological Institute Russian Academy of Sciences, Moscow, with one Thysanoptera; paratype, no.3750, coll. Geowissenschaftliches Zentrum, Universität Göttingen, with a subquadrangular layer of some coprolithes at anterior half of the body.

Derivatio nominis: The name of this species is devoted to V. MOTSCHULSKY, an outstanding entomologist, who first described species of the genus *Cupes* from Baltic amber.

Description: Holotype, no.363/130, almost completely preserved, although left sholder approached to surface of the amber piece cut due to polishing; with one specimen of Thysanoptera at underside surface of the amber piece; most part of ventral side with a thick milky layer and some gas bubbles along right lateral side; large crevice along the right side; many small crevices and gas bubbles dispersed throughout amber piece. Length 16.1mm, width 5.6 mm. Moderately wide, slightly convex dorsally and ventrally; subunicolorous with dense greyish scales; on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae; scutellum with blackish dense pubescence; underside mostly with dense greyish scales.

Surface of head with 2 pairs of dorsal paramedian tubercles (anterior pair at antennal insertions moderately raised, gently swollen and nearly transverse; intermediate= posterior ones at base of eyes rather raised, suboval and somewhat extended behind the level of posterior edge of eye) bases of anterior tubercles rather separated; interspace between posterior tubercles rather flattened and with median line; distance between antennal insertions about as broad as thickness of scape. Eyes moderately large, almost 1.5 times as long as temples. Labrum invisible due to milky cover. Mandibles slightly exposed from below. Antennae (7.1 mm) somewhat less than half as long as body; scape subquadrate to slightly



Figs. 6-7: *Cupes hoffeinsorum* sp. nov., holotype; no.1036/2, coll. C. & H.-W. HOFFEINS (Hamburg); **6:** Head and pronotum with outline of tubercle, and median elevated part of pronotum, dorsal; **7:** Metatarsus, dorsal; **Figs. 8-11:** *Cupes kerneggeri* sp. nov., holotype, ♀, no.70/2001, coll. F. KERNEGGER (Hamburg); **8:** Head and pronotum with outline of tubercles, median furrow on head, and median elevated part of pronotum; **9**: Head, lateral; **10**: Protibia and protarsus, dorsal; **11:** Metatarsus, dorsal; **Figs. 12-13:** *Cupes motschulskyi* sp. nov., paratype, no.3750, coll. Geowissenschaftliches Zentrum,Universität Göttingen; **12:** Head and prothoracic segment with outline of tubercles, median elevated part, and median furrow on pronotum, dorsal; **13:** Ibid., ventral with outline gular sutures and tarsal grooves on prosternum.
Scales: **A:** Figs. 6, 8 - 9, 12 - 13; **B:** Figs.7, 10 - 11.

longer than wide; antennomere 3 subcylindrical and about 3 times as long as antennomere 2, and about as long as antennomeres 4-8 and 11 taken separately; antennomere 2 about half as long as thick; ultimate antennomere about 3 times as long as thick; antennomeres becoming narrower apically. Pronotum from base gradually widened anteriorly (till the middle) and subparallel-sided before narrowing anterior fourth, with median elevated ridge along the entire length, divided by a longitudinal furrow in posterior 2/3; anterior angles nearly right; posterior ones with blunt apices; posterior edge oblique at sides and subemar-ginated at scutellum. Scutellum moderately vaulted and widened before subtransverse posterior edge. Elytra with clear veins Cu and A2, vein A2 somewhat weakened before joining vein Cu and further meeting vein M; intermediate vein between vein M and vein Cu well raised along entire length (except anterior part); vein A3 well developed and limited to 3 distinct cells.

Most ventral sclerites invisible because of milk cover. Hypopygidium somewhat less than twice as long as each of ventrites 2-4, not longer than wide. Legs visible only from one side (similar to those in the paratype).

Paratype no.3750, antennomeres, except 6-7 basal ones, missing; along lateral edges with a continuous crevice and some small crevices seen from below; some gas bubbles seen from below and numerous very small gas bubbles disposed along ventral side; posterior part of prosternum, meso- and metasterna, except premetacoxal space, base and sides of abdomen with milky cover. Length 18.1mm, width 7.1mm, height 2.1 mm. Body with dense dark scales (some scales in paramedian depressions of pronotum and on elytra greyish and the latter forming 3 indistinct lighter bands: 1st - at base, 2nd - before the middle, and 3rd - before the apex, and also within basal and premedian bands a light stripe visible between vein M and vein Cu), body coloration nearly blackish; on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae; scutellum with blackish dense pubescence; underside mostly with dense greyish scales.

Surface of head with 2 pairs of well raised and gently swollen dorsal paramedian tubercles (anterior pair at antennal insertions rather weak and transverse; intermediate=posterior ones at base of eyes elongate and not extended behind the level of posterior edge of eye); bases of anterior tubercles rather separated; interspace between posterior tubercles rather flattened; distance between antennal insertions about as broad as thickness of scape. Labrum invisible under crevice. Mandibles slightly exposed from under labrum. Right antenna with 7 segments and left one with 6 (remainder cut); scape subquadrate to slightly longer than wide; antennomere 3 subcylindrical and about 3 times as long as antennomere 2 and slightly longer than antennomere 4 and 5 taken separately; antennomere 2 about 2/3 as long as thick. Pronotum with posterior edge clearly emarginated at scutellum. Elytra with clear veins Cu and A2, vein A2 very weakened before joining vein Cu and further meeting vein M; intermediate vein between vein M and vein Cu well raised along entire length (except anterior part); vein A3 well developed and limited to 3 distinct cells.

Mentum trapezoid and strongly narrowed anteriorly. Palpi not exposed from under ligula. Gular sutures slightly convergent before the middle and at base. Prosternum rather swollen and distinctly depressed at anterior edge, its intercoxal process very slightly curved along coxae, subparallel-sided and about as wide as epipleura at base and extended beyond the posterior edge of procoxae. Meso- and metasterna slightly swollen but outline of most sclerites invisible because of milky cover. Hypopygidium about twice as long as each of ventrites 2-4, somewhat longer than wide and subacuminate at apex.

Tibiae rather narrow and slightly widened apically, about 2/3 as wide as epipleura at base. Femora much more than twice as wide as tibiae. Tarsi markedly wider than tibiae.

Protarsomere 1 slightly longer than wide, and metatarsomere 1 about 3 times as long as wide; metatarsomere 1 somewhat less than twice as long as 5th.

Diagnosis: This new species is the largest among the congeners and can easily be identified according to the characters in the key below. In addition, this new species has a rather transverse 2nd antennomere, about as transverse as that in many recent species of the genus *Cupes* and all recent Cupedidae, but markedly more transverse than in all amber species. Besides, its mentum, in contrast to other species of the genus, is much more strongly widened. It is somewhat similar to *C. groehni* sp. nov. differing from latter not only in the larger body size, but also in the more clearly transverse cells on elytra, the venation at elytral apices, the wider prosternal process, and the shorter 2nd antennomere.

Cupes rohdendorfi IABLOKOFF-KHNZORIAN, 1960

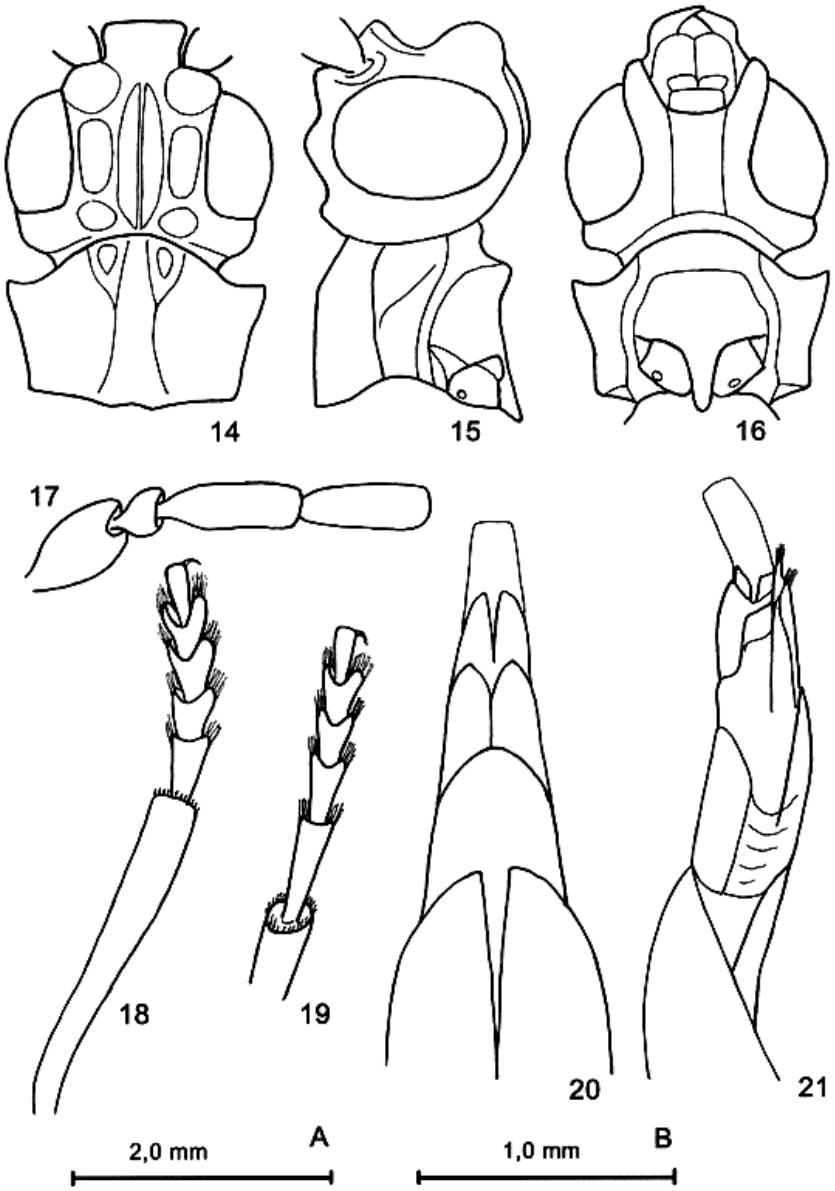
(figs.14 - 23, 39 - 43)

Material: Holotype, no.364/105, Palaeont. Inst., Russian Academy of Sciences, Moscow (collector P.Z. VINOGRADOV-NIKITIN); no.3/1999, coll. F. KERNEGGER (Hamburg), (in syntetic resin); no. 650, coll. C. GRÖHN (Hamburg) with stellate hairs; no.999/1, coll. Chr. & H.-W. HOFFEINS (Hamburg), (in syntetic resin); no.999/2, coll. Chr. & H.-W. HOFFEINS, (Hamburg), (in syntetic resin); no.22, coll. Geologisch-Paläontologisches Institut und Museum, Universität Hamburg.

Redescription: Holotype, (completely preserved; with a large crevice along lateral side of body reaching surface of the amber piece and some small crevices along surface of amber): this specimen was described by IABLOKOFF-KHNZORIAN (1960) and his description was later corrected by PONOMARENKO (1969). It is rather similar to the specimen no.3/1999, but its body looking like unicolorous because of uniform coloration of scales.

Specimen no.3/1999 (with gas bubbles at anterior part of head, base of pronotum, and in posterior part of right elytron as well as on middle of mesosternum and abdomen; also with a crevice along right lateral side, absent apex of right ultimate antennomere and exposed terminalia), ♂: Length 7.6 mm, width 2.1mm, height 1.5 mm. Rather slender, moderately convex dorsally and ventrally; with extremely dense yellowish grey scales (masking the coloration of body surface), coloration uniform, although some of the elevated parts of head and pronotum as well as some parts of elytra slightly infuscated; on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae; scutellum and elevated median part of pronotum also with blackish dense pubescence.

Surface of head with 3 paramedian pairs of well raised and gently swollen dorsal sub-oval tubercles (posterior ones smallest and their anterior edge located at level of posterior edge of eyes): bases of anterior tubercles closed; between bases of intermedial and posterior tubercles with an elevated median stripe divided by a longitudinal furrow; distance between antennal insertions somewhat larger than thickness of scape. Eyes rather large, more than 3 times as long as temples. Labrum well exposed and with some long hairs along middle of anterior edge. Mandibles slightly exposed from under labrum. Antennae (4.9 mm) about 2/3 as long as body long; scape slightly oval, somewhat less than twice as long as thick; antennomere 3 subcylindrical, about 3 times as long as antennomere 2, and slightly longer than antennomere 4; antennomere 2 slightly longer than thick; ultimate antennomere about 6 times as long as thick. Pronotum narrowest at base, gradually widened anteriorly (till anterior angles) and strongly narrowed in anterior third, with median elevated ridge along entire length, divided by a longitudinal furrow; a pair of shallow paramedian fossae at anterior :



Figs. 14-21: *Cupes rohdendorfi* IABLOKOFF-KHNZORIAN, ♂, spec. no.3/1999, coll. F. KERNEGGER (Hamburg), **14:** Head and prothoracic segment with outline of tubercles on head, median elevated part of pronotum and paramedical depressions at its anterior part, dorsal; **15:** Ibid., with outline of tarsal grooves on prosternum, lateral; **16:** Ibid., with outline of tarsal grooves on prosternum, ventral; **17**: Basal antennomes; **18:** Protibia and protarsus, dorsal; **19:** Metatarsus; **20:** Aedeagus, dorsal; **21:** Aedeagus, lateral. Scales: **A:** Figs.14-16; **B:** Figs.17-21.

dge; anterior angles rather acute and somewhat projecting; posterior ones with blunt indistinct apices; posterior edge nearly straight. Scutellum rather vaulted and widened before subtransverse posterior edge. Elytra with clear veins Cu and A2, joining posteriorly and meeting vein M; intermediate vein between primary vein M and Cu well raised only in anterior half; vein A3 well developed.

Mentum subquadrangular. Only apices of palpi exposed from under ligula. Gular sutures subparallel-sided. Prosternum rather swollen and distinctly depressed at anterior edge, its intercoxal process very slightly curved along coxae and slightly narrowing posteriorly and

extended beyond the posterior edge of procoxae. Mesosternum slightly swollen, with shallow fossae at apex of prosternal process and at middle of posterior edge. Metasternum slightly swollen and with a shallow median depression at metacoxae. Hypopygidium about twice as long as each of ventrites 2-4, somewhat longer than wide and narrowly rounded at apex.

Tibiae rather narrow and very slightly widened apically, somewhat narrower than epipleura at base. Femora much more than twice as wide as tibiae. Tarsi markedly wider than tibiae. Protarsomere 1 about 1.5 times as long as wide, mesotarsomere 1 about 3 times as long as wide and metatarsomere 1 about 4 times as long as wide; metatarsomere 1 somewhat less than twice as long as metatarsomere 5.

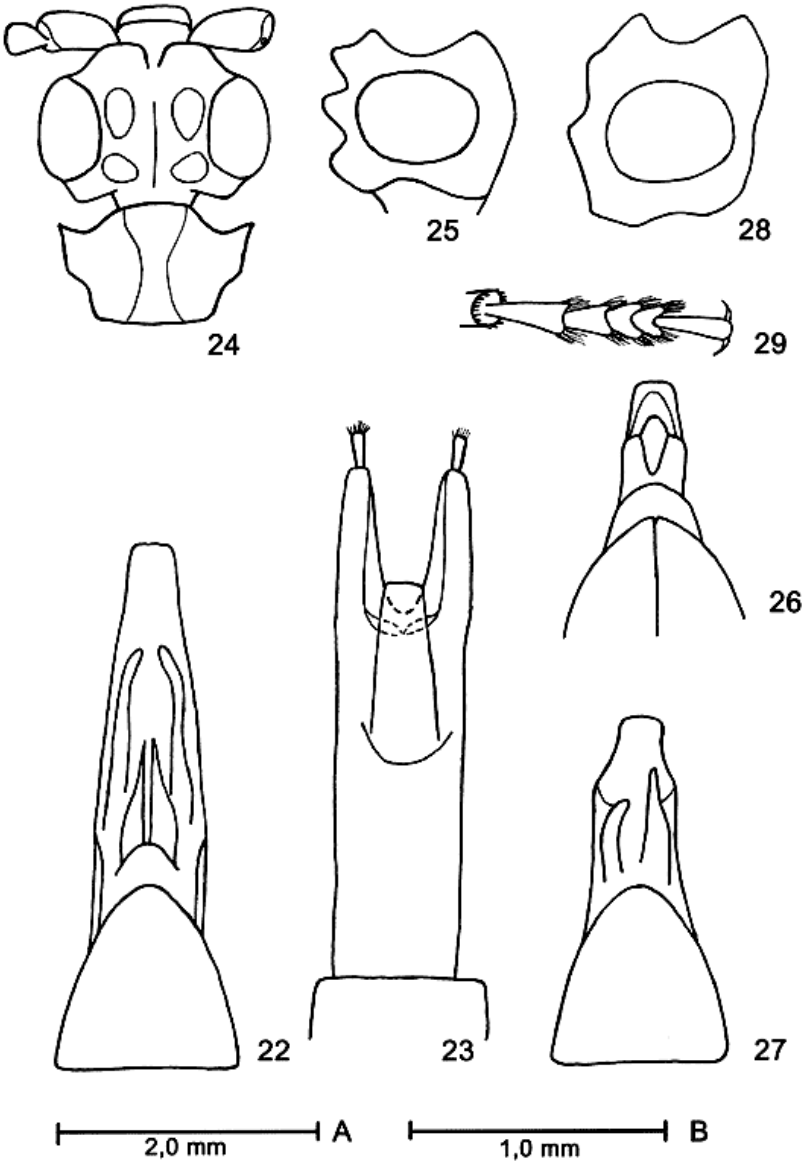
Parameres about twice as long as sternite IX, their apices narrowing and clearly curved medially.

Specimen no.650 (almost completely preserved, although 2 last right antennomeres missing and antennomere 9 lying at the amber surface; surface of dorsum, antennae, underside of head, prosternum, prohypomera and anterior legs quite clear, but remainders with milky cover), probably ♂; in contrast to no.3/1999: Length 7.2 mm, width 2.1 mm, height 1.6 mm. Body more subunicolorous, i.e. with lighter elevated parts of dorsum. Scutellum with grey dense pubescence. Eyes about 3 times as long as temples. Mandibles scarcely exposed from under labrum. Antennomere 3 about 2.5 times as long as antennomere 2; ultimate antennomere about 5 times as long as thick. Pronotum with posterior edge rather convex and slightly angularly sinuate at scutellum.

Specimen no.999/2 (without left antenna and hardly visible ventral surface of head, pro- and mesosterna), probable male; in contrast to no.650: Length 6.4 mm, width 1.9 mm. Anterior part of head and labrum less exposed anteriorly before anterior tubercles of head. Anterior dorsal tubercles of head somewhat transverse. Eyes somewhat smaller and about twice as long as temples. Scape comparatively small; antennomere 2 rather transverse than subquadrate. Pronotal posterior edge gently convex. Scutellum as coloured as most part of body. Metasternum with much deeper median depression at metacoxae. Hypopygidium less than twice as long as each of ventrites 2-4, somewhat shorter than long and more widely rounded at apex.

Mesotarsomere 1 about 2 times as long as wide and metatarsomere 1 about 3 times as long as wide. Dorsal scales partly infuscate, particularly along sides of elytra and with a subapical transverse band on elytra.

Specimen no.999/1 (with head rotated and turned in median axis, unfolded right posterior wing (partly deflected ventrally), many gas bubbles along underside and exposed terminalia), ♀; in contrast to speciemn no.650: Length 8.1 mm, width 2.4 mm. Head and apices of elytra slightly infuscate and with traceable subapical band of elytra. Anterior dorsal tubercles of head markedly more raised and posterior dorsal tubercles almost reaching the level of middle of eye length. Median elevation of head between intermedial and posterior tubercles scarcely raised and median furrow is lacking. Temples significantly larger. Eyes smaller, about 1.5 times as long as temples. Antennae somewhat narrower and comparatively shorter (about 5 mm); antennomere 3 about 3 times as long as antennomere 2. Pronotum much more widened anteriorly and with more projecting anterior angles, with a median elevation widened anteriorly and parted by a longitudinal furrow only in anterior half, its posterior edge slightly sinuate at scutellum. Scutellum as coloured as most part of body. Hypopygidium about as long as wide and moderately widely rounded at apex. Protarsomere 1 slightly longer than wide, mesotarsomere 1 about twice as long as wide and metatarsomere 1 about 3 times as long as wide. Ovipositor with 1-segmented styli.



Figs. 22-23: *Cupes rohdendorfi*; **22:** Spec. no.3/1999,♂, aedeagus, ventral; **23:** Spec. no.999/2, ♀, ovipositor, ventral; **24-27:** *C.* aff. *rohdendorfi*; **24:** Spec. no.791, head and pronotum with outline of tubercles and median furrow on head, as well as median elevated part of pronotum, dorsal; **25**: Head, lateral; **26**: Aedeagus, dorsal; **27:** Aedeagus, ventral; **28-29:** *Cupes tesselatus*, neotype, Typ.Kat.Nr.4442; **28:** Head, lateral; **29:** Metatarsus, dorsal. Scales: **A:** Figs.24-25, 29; **B:** Figs.22-23, 26-27, 29.

Specimen no.22 (almost completely preserved, with long vertical crevice along dorsum), probably ♂: Length 6.8 mm, height 1.5 mm. Nearly unicolourous.

Probable variability: A certan variability can be traced in size and density of scales.

Diagnosis: This species is distinct from the most members of the genus known from Baltic amber in the 3 paramedian pairs of dorsal suboval tubercles on head. Besides, it is characteristic of the comparatively large eyes (perhaps, at least in males), pronotum almost regularly widened anteriorly, head and pronotum with an elevated median ridge

longitudinally divided by a furrow, rather swollen prosternum, comparatively narrow tibiae, subuniform yellowish grey coloration of scales and setae on body sclerites and appendages. This species is also characterised by the posterior edge of pronotum rather convex, and slightly angularly sinuate at scutellum. One specimen (♂) having the mentioned diagnostic characters shows, however, great differences, including differences in genitalia, that it can scarcely be regarded as conspecific with *C. rohdendorfi*. On the other hand, this species is very similar to *C. komissari* sp. nov., but differs from the latter in the characters mentioned in the key below (see also the diagnosis of this new speices).

Cupes rohdendorfi shares some resemblance with *C. capitatus* (most similar body outline, antennae closer to anterior end of eyes, pronotum not wider than the head at temples), but has a dark head with not elongate posterior tubercles, less transverse antennomere 2, markedly thinner basal antennomeres, not interrupted (conjoined) tarsal grooves on prosternum, distinct A3, more raised tubercles on head. Besides, this amber species in comparison with the recent *C. favella* NEBOISS, 1984 has a darker dorsum, not sinuate lateral edge at anterior angles, less transverse antennomere 2, subcylindrical basal antennomeres, and distinct A3; as well as in comparison with the recent *C. cinereus* SAY, 1831 it has a darker dorsum, more raised tubercles, and much longer temples of head, less transverse antennomere 2, and subcylindrical basal antennomeres.

Cupes aff. *rohdendorfi* IABLOKOFF-KHNZORIAN, 1960, sp. 1

(figs.24 - 27, 44)

Material: No.791, coll. G. HERRLING (Engter), with stellate hairs, some specimens of acari, and two true midges..

Notes: This specimen is very similar to specimens here named as *C. rohdendorfi* and *C. komissari* sp. nov., and can be described only by the mention of the characters distinguishing it from the latter (see the below key to species and diagnosis of *C. komissari* sp. nov.). It also has somewhat different apices of parameres.

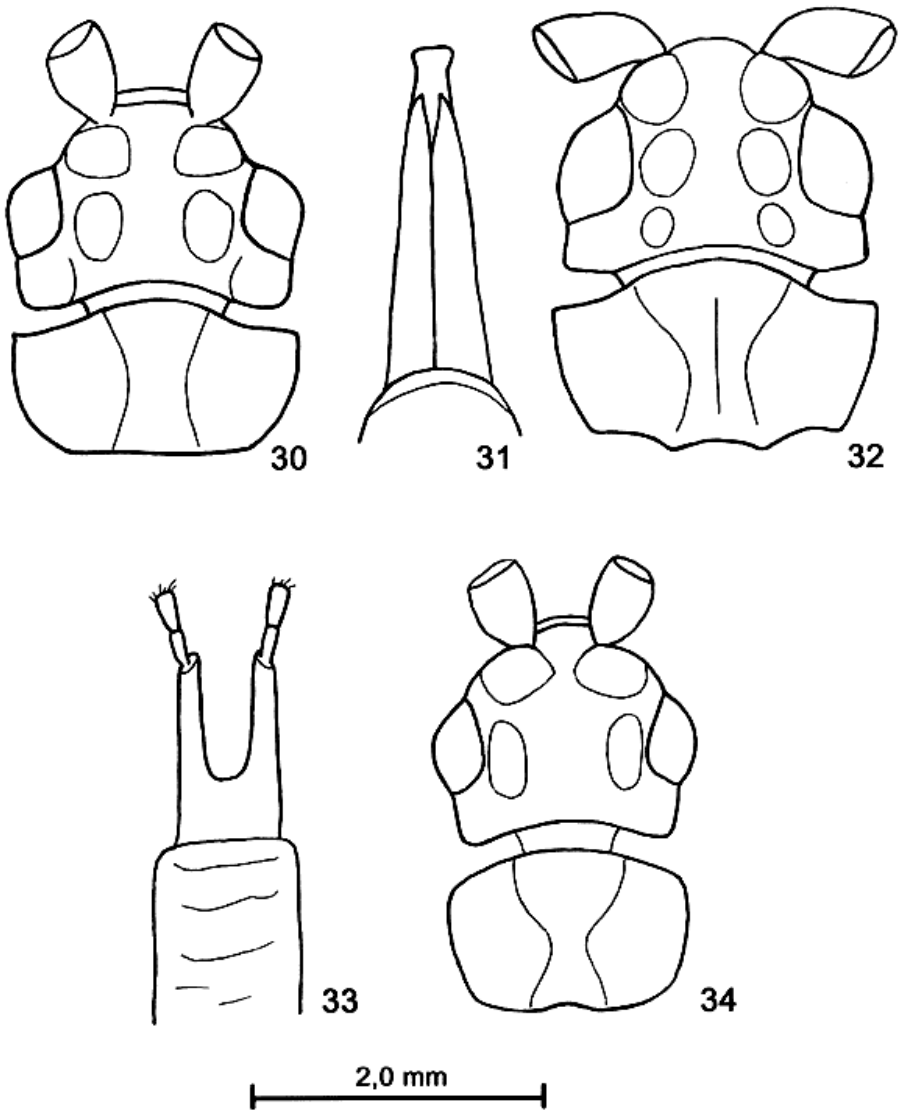
Description: (body with exposed apex of left hind wing and cut apical antennomeres of both antennae as well as with many gas bubbles and milky cover on the underside); ♂, with slightly exposed apex of aedeagus: Length 7.1 mm, width 2.3 mm, height 1.0 mm. Body less convex and with more infuscated outer and apical parts of elytra (base of elytra and scutellum rather blackish). Posterior tubercles of head more raised and somewhat transverse. Pronotum markedly wider (more transverse) with convexity along its outline in anterior third, also with distinctly projecting anterior angles, almost regularly convex posterior edge, and an elevated median stripe not divided by a furrow. Hypopygidium about as long as wide at base and moderately (not so narrowly) rounded at apex.

Cupes tesselatus (MOTSHULSKY, 1856)

(figs.28 - 31, 45)

Cupoides tesselatus MOTSHULSKY, 1856: 27.

Material: Neotype, Typ.Kat.Nr.4422, Geologisch-Paläontologisches Institut und Museum, Universität Hamburg, (no.4225, ex coll. C. GRÖHN, Hamburg), with stellate hairs, an aunt, and a true midge; no.1036-3, coll. Chr. & H.W. HOFFEINS, with stellate hairs and remains of a dipterans; no. K1351, ("*Cupes tesselatus* teste POPOV".) Geowissenschaftliches Zentrum, Universität Göttingen.



Figs. 30-31: *Cupes tesselatus*, **30:** Spec. no.1036/3, head and pronotum with outline of tubercles on head and median elevated part of pronotum, dorsal; **31:** Specimen no. K1351,♂, aedeagus, dorsal; **32-33:** *Cupes komissari* sp. nov., holotype, no.3750; **32:** Head and prothoracic segment with outline of tubercles on head, median elevated part of pronotum and paramedical depressions at its anterior part dorsal; **33:** Ovipositor, dorsal; **34:** *Cupes weitschati* sp. nov., holotype no.372, head and pronotum, dorsal.
Scale: **A:** Figs.30 - 34.

Description: Neotype (almost completely preserved, although without left protarsomeres 2-5; surrounded by some crevices along both sides of dorsal surface and with many small crevices at the middle pronotum and along the underside, besides, one elongate gas bubble disposed along right side of pronotum), probable ♂(because the pygidium and hypopygidium are partly "open" and the genital capsule somewhat extruded from abdomen has a shape of ♂rather than ♀): Length 8.1 mm, width 2.3 mm, height 1.5 mm. Rather long, moderately convex dorsally and ventrally; with extremely dense scales (masking the coloration of body surface); scales on head and pronotum yellowish grey, although those along median parts of pronotum somewhat infuscate; scales on elytra forming a rather

characteristic pattern of brownish and yellowish grey spots (with 3 transverse bands across the disk); on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae.

Surface of head with 2 paramedian pairs of dorsal suboval tubercles, well raised and gently swollen (posterior ones smaller, more elevated and disposed along inner edge of eyes) bases of anterior tubercles closed; bases of posterior tubercles widely separated; distance between antennal insertions seeming markedly narrower than thickness of scape; interspace between tubercles subflattened. Eyes moderately large, almost 2 times as long as temples. Labrum not visible from above, but seemingly well exposed and with some hairs along transverse anterior edge. Mandibles moderately exposed from under labrum and with narrow and rather acute apices. Antennae 4.9 mm long, about 3/8 as long as body; scape subcylindrical, somewhat less than twice as long as thick; antennomere 3 subcylindrical, about 2.5 times as long as antennomere 2, and slightly longer than antennomere 4; antennomere 2 slightly longer than thick; ultimate antennomere at most 4 times as long as thick. Pronotum from base gradually widened anteriorly and at the middle becoming subparallel-sided, in front of anterior angles it strongly narrowed anteriorly, with a median, rather elevated stripe along the entire length, this ridge not divided by a furrow and without a pair of clear paramedian fossae at anterior edge; anterior angles subrectangular and scarcely projecting, posterior ones with blunt indistinct apices, its posterior edge nearly straight. Scutellum strongly vaulted and somewhat widened before subtransverse posterior edge. Elytra with clear veins Cu and A2, joining posteriorly and meeting vein M; intermediate vein between vein M and Cu well raised along almost entire length; vein A3 distinct.

Mentum subquadrangular. Palpi well exposed from under ligula; last labial palpomere subcylindrical and long; last maxillary palpomere long, strongly widened apically and with oblique apical edge. Gular sutures subparallel. Prosternum rather swollen and distinctly depressed at anterior edge, its intercoxal process invisible. Mesosternum invisible. Metasternum very slightly swollen and with a shallow median depression at metacoxae. Hypopygidium about 2.5 times as long as each of ventrites 2-4, seemingly 1 and 1/3 as long as wide, strongly excavate in distal third and distinctly acuminate at apex.

Tibiae moderately narrow and very slightly widened apically, somewhat narrower than epipleura at base. Femora about twice as wide as tibiae. Tarsi about as wide as tibiae. Protarsomere 1 slightly longer than wide, mesotarsomere 1 about 1.5 times as long as wide and metatarsomere 1 somewhat less than twice as long as wide; metatarsomere 1 about 1.5 times as long as Metatarsomere 5.

Specimen no.1036-3 (with cut apex of right elytron and antennomeres 6-11, left protarsomere 5 and left mesotarsomeres 2-5; surrounded by many crevices at prosternal segment and head, and also at apex): Length 9.0 mm, width 2.8 mm. Coloration of scales and setae rather subuniform light. With shallow median furrow in distal 2/3 of head. Temples somewhat larger and slightly shorter than eye length. Scape slightly longer than wide. Labrum seemingly more projecting anteriorly. Intermediate vein between vein M and vein Cu not raised (!); vein A3 strongly weakened (!). Prosternal process rather narrowing apically. Hypopygidium somewhat shorter, about as long as wide, less strongly excavate in distal third and with angular (but not so acuminate) apex (seeming sexual dimorphism – see description of the neotype).

Specimen no.K1351 (broken obliquely along median plane of body, right antenna with only 5 and left one with 4 segments, median part of elytra missing; numerous small crevices in different planes), ♂with visible aedeagus inside broken part of inclusion: Length 9.6 mm, width 4.8 mm. Antennomere 2 slightly shorter, nearly 2/3 as long as thick. Elytra sub-

unicolorous because of uniform light scales. Veins Cu and A2 more or less well raised in comparison with the intermediate veins surrounding them. Hypopygidium similar to that in the specimen no.1036-3. Aedeagus with parameres somewhat shorter than penis trunk.

Probable variability: A certan variability can be traced in size, coloration and density of scales.

Diagnosis: This species is characterized by the nearly straight posterior edge of pronotum, comparatively short tarsi, comparatively short and thick ultimate antennomere, pronotum with subparallel sides in anterior half and rather short tarsi. Having 2 pairs of the gently swollen paramedian tubercles, it differs from *C. hoffeinsorum* sp. nov. (in this character) in markedly smaller eyes, at most twice as long as temples; shorter metatarsomere 1, yellowish grey scales on body; less raised veins Cu and A2 as well as intermeiate vein between veins M and Cu, thicker antennomeres and tarsomeres.

Notes: MOTSCHULSKY (1856) proposing *Cupoides tesselatus* for one amber inclusion in the G. BERENDT collection (Danzig) compared it with the North American "*Cupes atomaria*" and pointed out that the amber species was narrower and with length "3 ½ lines". This species of *Cupes* could be *C. capitatus* or *C. cinereus* SAY, 1831. Both have the raised intermediate and posterior paramedian tubercles on head, i.e. their head is similar only to that of *C. rohdendorfi* in Baltic amber . It was a reason to regard both names proposed for Baltic amber inclusions as synomyns (PONOMARENKO, 1969). However, it is impossible to apply to such synonymy as having an objective reason. In this paper a neotype of *C. tesselatus* is designated, because the type specimen has been lost.

Cupes komissari sp. nov.

(figs. 32 - 33)

Material: Holotype, ♀, no.III B233, (Telephoridae", "*Cupes tesselatus* (MOTSCHULSKY, 1856), Yu. POPOV det. 1990"), coll. Geowissenschaftliches Zentrum, Universität Göttingen.

Derivatio nominis: This new species is devoted to Mikhail KOMISSAR, friend of the author from his school time.

Description of holotype (with cut and missing part of pronotum, scutellum and anterior third of elytra; ventralside partly with "milky cover" (mostly at border of thoracic sclerites), a lot of small crevices along lateral and ventral side): Length 7.2 mm, width 2.3 mm, height 1.3 mm. Rather slender, slightly convex dorsally and ventrally; with extremely dense yellowish grey scales (masking the coloration of elytra and underside), although head and prothoracic segment rather brownish; antennae and other appendages with scales gradually transforming into subrecumbent, rather stout setae.

Surface of head with 3 paramedian pairs of well raised and gently swollen dorsal tubercles (intermediate ones suboval, posterior ones somewhat elongate and their anterior edge located anteriorly from posterior edge of eyes) bases of anterior tubercles 2/3 as separated as thickness of scape; interspace between bases of intermedial and posterior tubercles subflattened (medially slightly convex); distance between antennal insertions somewhat narrower than thickness of scape. Eyes moderately large, somewhat less than twice as long as temples. Labrum well exposed. Mandibles slightly exposed from under labrum, with apices transversely oriented. Antennae (3.8 mm) slightly more than half as long as body and slightly flattened; scape slightly oval, somewhat less than 1.5 times as long as thick; antennomere 3 subcylindrical and about 2.5 times as long as antennomere 2 and slightly longer than antennomere 4; antennomere 2 about as long as thick; ultimate

antennomere about 4 times as long as thick. Pronotum from base, gradually and arcuately widened anteriorly (to anterior angles) and strongly narrowed in anterior fourth, with a median elevated ridge along entire length, divided by a longitudinal furrow; a pair of shallow paramedian fossae at anterior edge scarcely expressed; anterior angles right to obtuse and slightly projecting; posterior ones with blunt indistinct apices; posterior edge bisinuate. Scutellum missing. Elytra with missing anterior third, but remainder with clear veins Cu and A2, joining posteriorly and meeting vein M; intermediate vein between vein M and Cu not raised; vein A3 missing.

Mentum subtrapezoid, slightly widened anteriorly. Only ultimate palpomeres exposed and distinctly widened before truncate apex. Gular sutures somewhat convergent in posterior half. Prosternum rather swollen and distinctly depressed at anterior edge, its intercoxal process very slightly curved along coxae, slightly narrowing posteriorly, and not extended beyond the posterior edge of procoxae. Mesosternum medially subflattened, with a fossa at posterior edge. Metasternum slightly swollen and with a shallow median depression at metacoxae. Hypopygidium about twice as long as each of ventrites 2-4, somewhat shorter than wide and widely rounded at apex.

Tibiae rather narrow and very slightly widened apically, markedly narrower than epipleura at base. Femora about twice as wide as tibiae. Tarsi slightly wider than tibiae. Protarsomere 1 about 1.5 times as long as wide, mesotarsomere 1 more than 3 times as long as wide; metatarsomere 1 about twice as long as 5th.

Ovipositor with 2-segmented styli.

Diagnosis: This new species is similar and, perhaps, closely related to *C. rohdendorfi*, but differs from it in the somewhat elongate posterior tubercles on the head and their anterior edge located anteriorly from posterior edge of eyes, subflattened interspace between the paramedian tubercles; distance between antennal insertions somewhat narrower than thickness of scape; smaller eyes; distinctly shorter scape and flagella; wider mentum; gular sutures somewhat convergent in posterior half; narrower prosternal process not extended beyond the posterior edge of procoxae; narrower legs and 2-segmented ovipositor.

Cupes weitschati sp. nov.

(figs. 34, 46)

Material: Holotype, Typ.Kat.Nr.4422, coll. Geologisch-Paläontologisches Institut und Museum, Universität Hamburg, (ex. coll. C. GRÖHN, GLINDE, no.4261), with stellate hairs, a juvenile spider, and a gall midge.

Derivatio nominis: This new species is devoted to Dr. Wolfgang WEITSCHAT, Geologisch-Paläontologisches Institut und Museum, Universität Hamburg.

Description of holotype (almost completely preserved, except missing right middle leg; dorsum partly with "milky cover"; lot of crevices and gas bubbles at left lateral side and along underside plane in anterior half; after additional polishing right anterior and posterior legs, mouthparts and antennal apices cracked and broken): Length 7.0 mm, width 2.3 mm. Rather long, moderately convex dorsally and ventrally; with extremely dense scales (masking the coloration of body surface); scales on head, apical and narrow median parts of pronotum rather dark; scales on wide lateral parts of pronotum and underside as well as scales and setae on appendages completely yellowish grey; scales on elytra forming a rather characteristic pattern of brownish and yellowish grey spots (only subapical band

without interruption); on antennae and other appendages scales gradually transforming into subrecumbent, rather stout setae.

Surface of head with 2 paramedian pairs of dorsal tubercles (posterior ones smaller and disposed along inner edge of eyes), well raised and gently swollen: anterior tubercles rather transverse than suboval and their base closed; between bases of suboval posterior tubercles with a rather wide and elevated median stripe divided by a longitudinal furrow; distance between antennal insertions about as wide as thickness of scape. Eyes moderately large, about 1.5 times as long as temples. Labrum scarcely visible. Mandibles somewhat exposed from under labrum. Antennae about 4/7 as long as body (with length 3.9 mm) and comparatively thick; scape slightly oval, somewhat less than twice as long as thick; antennomere 3 subcylindrical and about twice as long as antennomere 2 and slightly longer than antennomere 4; antennomere 2 slightly longer than thick; ultimate antennomere not more than 4 times as long as thick. Pronotum from base gradually arcuately widened anteriorly and strongly narrowed in anterior third, with a median slightly elevated stripe (without longitudinal furrow), rather widened in anterior half and with a pair of shallow paramedian fossae at anterior edge, anterior angles widely rounded and posterior ones with blunt indistinct apices, its posterior edge slightly convex (pronotum somewhat asymmetrical with left anterior angle more widely rounded). Scutellum subquadrangular. Elytra with clear veins Cu and A2, joining posteriorly and meeting vein M; intermediate vein between primary vein M and vein Cu visible along almost entire length; vein A3 slightly expressed.

Mentum, palpi, pro- and mesosterna invisible. Gular sutures observable through a crevice, looking subparallel-sided. Prosternal process scarcely narrowed before rounded apex. Metasternum subflattened and without clear median depression at metacoxae. Hypopygidium somewhat less than twice as long as each of ventrites 2-4, somewhat shorter than wide and widely rounded at apex.

Tibiae moderately narrow and slightly widened apically, very slightly narrower than epipleura at base. Femora slightly more than twice as wide as tibiae. Tarsi seemingly at least as wide as tibiae. Mesotarsomere 1 and metatarsomere 1 about 2.5 times as long as wide.

Diagnosis: This new species is very distinct among the extinct and extant congeners due to its transversely suboval pronotum with slightly and gently convex posterior edge. Besides, this new species is characterized by the anteriorly widened median elevated stripe without a clear dividing furrow on the pronotum; temples only slightly shorter than eyes; scales forming a pattern in coloration of elytra, consisting of brownish and yellowish grey spots; peculiar coloration of the head and pronotum. From *C. rohdendorfi* it differs also in the comparatively thick (or probably somewhat dilated) antennomeres, 2 pairs of paramedian tubercles on the head, intermediate vein between primary vein M and Cu is well raised along almost its entire length.

Fig. 35 -37: *Cupes groehni* sp. nov. from Baltic amber (Eocene); **35:** Paratypus, no.792, coll.G. HERRLING (Engter), general dorsal view; **36:** Holotype, Typ.Kat.Nr.4420, coll. GPIMH, (no.4041, ex. coll. C. GRÖHN, Glinde), general ventral view; **37:** Paratype, ♀, no.372, coll. Chr. & H.-W. HOFFEINS (Hamburg), ovipositor; dorsal; **38:** *Cupes kerneggeri* sp. nov., holotype, from Baltic amber (Eocene); no.70/2001, coll. F. KERNEGGER (Hamburg), general ventral view.

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IVc. Key to species of the genus *Cupes* from Baltic amber

1. Elytral cells more or less transversely oval; larger (16.1-18.1 mm); prosternal process subparallel-sided before widely rounded apex and only slightly narrower than epipleura at base; head with 2 pairs of paramedian dorsal tuberles (anterior at antennal insertions very weak and intermediate=posterior at base of eyes slightly elongate); vein A2 more or less weakened before joining vein Cu; vein A3 well raised and limited, 3 distinct cells; space between intermediate tubercles rather flattened; gular sutures slightly convergent before the middle and at base. Figs. 12 - 13 ..... *C. motschulskyi* sp. nov.

- Elytral cells more or less oval to polygonal, but not transverse (rarely some of cells indistinctly transverse); smaller (less than 12 mm); prosternal process narrowing to subacute apex and about half as wide as epipleura at base; vein A2 very usually not weakened before joining vein Cu; vein A3, if well raised, limited 2 indistinct cells 2

2. Head with 3 paramedian pairs of dorsal suboval tubercles; eyes approximately 3 times as long as temples; tarsi distinctly narrower than tibiae; intermediate vein with a short basal rib visible between primary veins M and Cu at most only in anterior half of elytra; metatarsomere 1 about twice as long as metatarsomere 5 3

- Head at most with 2 paramedian pairs of dorsal suboval tubercles and gently elevated along the middle; eyes smaller, distinctly less than 3 times as long as temples; tarsi about as wide as tibiae or somewhat wider 5

3 (2). Pronotum slightly narrower and with nearly straight posterior edge, regularly widened anteriorly or somewhat sinuate along sides and with an elevated median stripe longitudinally divided by a furrow; posterior tubercles of head not clearly transverse; median space between paramedian tubercles distinctly swollen; ultimate antennomere markedly more than 4 times as long as wide; scales on body sclerites usually subuniform and greyish in coloration (although a light infuscation can be traced on elevated parts of head and pronotum as well as on elytra); body moderately convex (with height markedly more than 1 mm); ♂: parameres gradually narrowing apically and distinctly curving inwards; ♀: ovipositor with 1-segmented styli. 6.4 - 8.1 mm. Figs. 14 - 23, 39 - 43 .... *C. rohdendorfi* Iablokoff-Khnzorian, 1960

- Pronotum slightly wider and with convex or bisinuate posterior edge, with convexity along its sides at anterior third and an elevated median stripe not divided by a furrow; body less convex (with height about 1 mm) 4

4 (3). Pronotum with convex posterior edge and anterior angles rather projecting latero-anteriorly; posterior tubercles of head clearly transverse; median space between paramedian tubercles distinctly swollen; scales on body sclerites rather different in coloration (producing a clear infuscation traced on elevated parts of head and pronotum as well as on elytra); ♂: parameres narrowing only just at tip and almost straight. 7.1 mm. Figs. 24 - 27, 44 .... *C.* aff. *rohdendorfi* Iablokoff-Khnzorian, 1960, sp. 1

- Pronotum with distinctly bisinuate posterior edge and anterior angles rather projecting latero-anteriorly; posterior tubercles of head not transverse; median space between paramedian tubercles subflattened; scales on body sclerites subunicolorous; ♀: ovipositor with 2-segmented styli. 7.2 mm. Figs. 32 - 34 ..... *C. komissari* sp. nov.

5 (2). Dorsal surface of head weakly tuberous: basal tubercles slightly prominent at base of eyes and anterior tubercles scarcely expressed at antennal incertions; pronotum sides arcuately widened anteriorly and with straight posterior edge; scape comparatively small, narrower than eye, subtriangular, about 1.5 times as long as wide at apex; antennomere

3 only twice as long as antennomere 2; ultimate antennomere about 3 times as long as thick; gular sutures convex and with most distance in the middle; metatarsomere 1 slightly longer than metatarsomere 5; vein A3 not raised; posterior edge of pronotum nearly straight. 6.5 mm. Figs. 8-11, 39 ..... *C. kerneggeri* sp. nov.

- Dorsal surface of head with distinct dorsal tubercles; scape as wide as or wider than eye; antennomeres comparatively narrower and longer 6

6 (5). Pronotum suboval, with stump angles, gently convex posterior edge and median elevated ridge widened anteriorly; head with 2 pairs of dorsal tubercles moderately raised; temples only slightly shorter than eyes; scales forming a pattern in coloration of elytra (only subapical transverse band not interrupted), consisting of brownish and yellowish grey spots; head as well as elytral apex and narrow median stripe on pronotum brownish; intermediate vein between primary veins M and Cu visible along almost entire length. 7.0 mm. Figs. 34, 46 ..... *C. weitschati* sp. nov.

- Pronotum with sides widened at base, subparallel-sided in anterior half, subtrapezoid with its median ridge subparallel-sided and without clear fossae at anterior edge 7

7 (6). Pronotum clearly wider than head at temples (as wide as head at eyes or wider); posterior paramedian tubercles of head shaped like longitudinal ridges with acute anterior angle and interspace between them with a median furrow; pronotal sides gently widened an-teriorly; posterior edge of pronotum very convex at scutellum and subsinuate at posterior angles; metatarsomere 1 almost twice as long as metatarsomere 5. 8.7-11.5 mm. Figs. 1-5, 35 - 37 ..... *C. groehni* sp. nov.

- Pronotum not wider than head at temples; posterior paramedian tubercles of head gently swollen, but with subvertical anterior plane and interspace between them subflattened; pronotal sides more widened anteriorly; posterior edge of pronotum at most slightly and gently convex or almost straight; metatarsomere 1 distinctly less than twice as long as metatarsomere 5 8

8 (7). Pronotum narrower than head at temples, its posterior edge distinctly convex; eyes about 2.5 times as long as temples; scales on body sclerites dark; veins Cu and A2 scarcely more raised than intermediate veins from both sides; intermediate vein between veins M and Cu not raised; antennomere 3 about 3 times as long as antennomere 2; ultimate antennomere about 6 times as long as wide; hypopygidial apex rounded (at least in one sex); body and appendages with dark scales and setae of subuniform coloration; meta-tarsomere 1at least 4 times as long as wide and about as long as metatarsomere 5; vein A 3 not raised. 7.3 mm. Figs. 6 - 7 ..... *C. hoffeinsorum* sp. nov.

- Pronotum as wide as head at temples, its posterior edge straight; eyes markedly smaller, at most twice as long as temples; scales on body sclerites mostly greyish; veins Cu and A3 well expressed and additional rib between vein M and vein Cu well raised along almost entire length; antennomere 3 about 2.5 times as long as antennomere 2; ultimate antennomere about 3 times as long as wide; body with light (yellowish grey) scales, although elytra with 3 transverse darker bands across the disk; "male" hypopygidium acuminate at apex; metatarsomere 1 about twice as long as wide and longer than metatarsomere 5; vein A 3 quite distinct. 8.1-9.0 mm. Figs. 28 - 31, 45 ..... *C. tesselatus* (MOTSCHULSKY, 1856)

Figs. 39-42: *Cupes rohdendorfi* IABLOKOFF-KHNZORIAN, 1960, from Baltic amber (Eocene); **39**: No.3/1999 coll. F. KERNEGGER (Hamburg), general ventral view; **40:** No.650, coll. C. GRÖHN (Glinde), general dorsal view; **41**: Same specimen, general ventral view; **42:** No.999/1,♀, coll. Chr. & H.-W. HOFFEINS (Hamburg), posterior wing.

Fig. 43: *Cupes rohdendorfi* IABLOKOFF-KHNZORIAN, 1960, coll. Chr. & H.-W. HOFFEINS (Hamburg), ovipositor, ventral; **Fig. 44:** *Cupes* aff. *rohdendorfi* IABLOKOFF-KHNZORIAN, no.791, coll. G. HERRLING (Engter), general dorsal view; **Fig. 45:** *Cupes tesselatus* (MOTSHULSKY, 1856), neotype, Typ.Kat.Nr.4422 coll. GPIMH, general dorsal view; **Fig. 46:** *Cupes weitschati* sp. nov., holotype, Typ-Kat.Nr.4423, coll. GPIMH, general dorsal view.

Acknowledgements

The author greatly appreciate to Wolfgang WEITSCHAT (Geological-Palaeontological Institute and Museum University of Hamburg (GPIM), who encouraged the author to make this revision, invited him to Hamburg for the study of the coleopterous inclusions in Baltic amber, and made the color fotos for this publication, as well as to A.G. PONOMARENKO (Palaeontological Institute of Russian Academy of Sciences, Moscow) outstanding specialist in Archostemata and fossil Coleoptera, who add a lot of very valuable remarks, while the present study was carrying on. He sends his sincere thanks to Thomas HÖRNSCHEMEYER and Mike REICH (Geowissenschaftliches Zentrum, Universität Göttingen) for the loan of *Cupes* from Baltic amber and A. NEL (Museum National d'Histoire Naturelle, Paris) for data on very interesting specimen from the Cenomanian amber of France. The author's pleasant duty is to express his sincere thanks also to the members of the "Amber working group" at the Geolocical-Palaeontological Museum University of Hamburg (Friedrich KERNEGGER, Carsten GRÖHN, Christel & Hans-Werner, and Achim HERRLING), who provided him with specimens for study. This study was supported by the programme of the Presidium of the Russian Academy of Sciences "Origin and evolution of biosphere" and a grant from the Royal Society, allowed to make important comparisons of the species from Baltic amber with recent species deposited in the Natural History Museum in London. F.-T. KRELL, and M. BARCLAY from the London Museum made an important assistance to the author, while he was preparing this study. T. HÖRNSCHEMEYER found that the species named here as *C. motschulskyi* sp. nov. schould be regarded as an undescribed species and he also checked the text of this paper, and made some important critique. YU. POPOV bought a specimen of *C. motschulskyi* sp. nov., which was here designated as its holotype.

References

ATKINS M.D. (1963): The Cupedidae of the world. – Canad. Entomologist, **95:** 140-162.

CROWSON R.A. (1962): Observation on the beetle family Cupedidae, with description of two fossil forms and a key to the recent genera. – Ann. & Mag. Nat. Hist., (5) **13:** 147-157.

CROWSON R.A. (1981): The biology of the Coleoptera. - London-N.Y., Academic press, 1-802.

GERSDORF E. (1976): Dritter Beitrag über Käfer (Coleoptera) aus dem Jungtertiär von Willershausen, Bl. Northeim 4226. – Geol. Jahrb., **A 36**: 103-145.

HÖRNSCHEMEYER T. (2004): Die Phylogenie der Archostemata (Insecta:Coleoptera) und die Evolution der Flügelbasis der holometabolen Insekten. - Habil.schrift zur Erlangung der venia legendi für das Fach Zoologie in der Biologischen Fakultät der Georg-August-Universität Göttingen, 1-263.

IABLOKOFF-KHNZORIAN S.M. (1960): Novye zhestkokrylye iz baltiyskogo yantarya (New beetles from Baltic amber). – Paleontologichesky J., 1960 **(3):** 90-101.

LARSSON S.G. (1978): Baltic Amber – a Palaeobiological Study. Copenhagen, Entomonograph, **1:** 1-192.

MOTSCHULSKY V. (1956): Études Entomologiques. - Helsingfors, Soc. Lit Finnoise, **5**: 21-38.

NEBOISS A. (1984): On family Cupedidae (Coleoptera). - Proc. R. Soc. Victoria, **72 (1):** 12-20.

PEYERIMHOFF , P. de (1909): Le *Cupes* de l'ambre de la Baltique. - Bull. Soc. Ent. France, **1909**: 57-60.

PONOMARENKO A.G., (1969): Istoricheskoye razvitie zhestkokrylykh-arkhostemat [Historical development of the Archostematan beetles]. - Trudy paleontologicheskogo instituta AN SSSR [Proc. Palaeontol. Inst. USSR Ac. Sci.], **125:** 1-233. (in Russian)

- (1973): Erster Fund eines Cupediden im Neogen Europas (Coleoptera: Cupedidae). – Vestnik Cs. Spol. Zool., **37 (2):** 101-103.

- (2003): Ecological evolution of beetles (Insecta: Coleoptera). - Acta zool. Cracoviensia, **46**,

supplementum – Fossil Insects: 319-328.
PONOMARENKO A.G. & KIREJTSHUK A.G. (2005): Catalogue of Fossil Coleoptera. - www.zin.ru/Animalia/Coleoptera/eng/paleosy0.htm (July 2005).
RETALLACK G.J., VEEVERS J.J. & MORANTE R. (1996): Global coal gap between Permian-triassic extinction and Middle Triassic recovery of peat-forming plants. – Bull. Geol. Soc. America, **108:** 195-207.
TRÖSTER G. (1993): Zwei neue mitteleuropäische Arten der Gattung *Tenomerga* Neboiss 1984 aus dem Mitteleozän der Grube Messel und des Eckfelder Maares (Col.: Archostemata: Cupedidae). - Mainzer Naturwissenschaftliches Archiv **31:** 169-176.
WEITSCHAT W. & WICHARD W. (2002): Atlas of plants and animals in Baltic amber. - München, Verlag Dr. F. PFEIL, 1-256.