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Current knowledge of Coleoptera (Insecta) from the Lower Cretaceous Lebanese amber and taxonomical notes for some Mesozoic groups

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Summary

This paper overviews more than 39 families of fossil Coleoptera from Lower Cretaceous Lebanese amber from nine outcrops. Lebanese amber contains the oldest representatives of the families Scydmaenidae (considered by some as a subfamily of Staphylinidae), Ptiliidae, Elodophalmidae, Clambidae, Throscidae, Lebanophytidae fam. n., Ptilodactylidae, Cantharidae, Melyridae, Dasytidae, Dermestidae, Ptinidae, Kateretidae, Erotylidae, Latridiidae, Laemophloeidae, Salpingidae, Anthicidae, Melandryidae, Aderidae, Curculionidae (Scolytinae). The families Chelonariidae and Scraptiidae are known from both Lebanese amber and Baissa, with both sites having a comparable age. The subfamilies Trechinae (Carabidae), Euaesthetinae (Staphylinidae) and Liparochrinae (Hybosoridae) first appear in the fossil record in Lebanese amber. The Coleoptera in Lebanese amber mostly belong to groups with arboreal habits (as found today in wood and tree fungi). *Eochelonarium belle* gen. et sp. n., *Rhizophtoma synchrotronica* sp. n., *Rhizobactron marinae* gen et sp. n. and *Atetrameropsis subglobosa* gen. et sp. n. are described from Lebanese amber. A new subfamily in the family Cerophytidae is proposed for *Aphytocerus communis* Zherichin, 1977 (Aphytocerinae subfam. n.) and new genus *Baissopsis* gen.nov. is erected for *Baissophytum amplus* Chang, Kirejtshuk et Ren, 2011. Also a new interpretation of the taxon "Lasiosynidae" is provided by placing it as a subfamily in the family Eulichadidae with two genera (*Lasiosyne* Tan, Ren et Shih, 2007 and *Bupredactyla* Kirejtshuk, Chang, Ren et Shih, 2010), while the other genera initially regarded as "Lasiosynidae" were tentatively transferred into Eulichadinae sensu n. (*Mesodascilla* Martynov, 1926; *Tarsomegamerus* Zhang, 2005; *Brachysyne* Tan et Ren, 2009; *Anacapitis* Yan, 2009; *Parelateriformius* Yan et Wang, 2010 and *Cretasyne* Yan, Wang et Zhang, 2013) with the new synonymy of *Tarsomegamerus* and *Parelateriformius* syn. n. The genus *Mesaplus* Hong, 1983 described in the family Triaplidae is also transvered to Eulichadinae. The genera *Artematopodites* Ponomarenko, 1990; *Dzeregia* Ponomarenko, 1985 and *Glaphyropteroides* Handlirsch, 1906 proposed for species known only by separate elytra and recently

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included in the "family" Lasiosynidae (Yan et al., 2013) are regarded as Elateriformia *incertae sedis*. The first insect from the newly discovered outcrops of Nabaa Es-Sukkar – Brissa: Caza (District) Sir Ed-Danniyeh, Mouhafazet (Governorate) Loubnan Esh-Shimali (North Lebanon) is described and the first general description of this outcrop is made.

Keywords
Coleoptera; Lower Cretaceous; Lebanese amber; new family; new subfamily; new genera; new species; new synonymy; taxonomic changes; new combination; phylogeny; fossil record; paleobiota; paleofauna

Introduction

The Cretaceous represents one of the most interesting periods for studying the evolutionary history of the recent biota. It is when the origin and radiation of the angiosperms occurred and when most of our contemporaneous insect families first appeared. Amber is a wonderful tool for palaeontologists as it contains a variety of biological inclusions in pristine, three-dimensional form. It provides a straightforward study of the minutest structural and anatomical details (comparable to freshly collected material) of biological inclusions, and now it is even possible to detect internal anatomical features, thanks to X-ray tomography techniques. Amber deposits occur all over the world and range from a few million to 320 million years in age (mid Carboniferous) (Sargent Bray and Anderson, 2009). Until recently, Lebanese amber was considered as the oldest amber with biological inclusions, but lately Schmidt et al. (2012) found some arthropod inclusions in Triassic amber from Dolomite mountains, Alps (Italy) after screening some 70,000 amber pieces. However, no beetles are known from this source. Lower Cretaceous Lebanese amber and other Middle Eastern ambers, (e.g. Jordan: Kaddumi, 2005) remain the oldest with extensive biological inclusions. In Lebanon, 19 amber outcrops from Late Jurassic and more than 450 Lower Cretaceous amber outcrops have been found. Curiously, only 22 Cretaceous outcrops among all those studied have yielded biological inclusions. The insects recovered in Lebanese amber provide considerable information on many groups completely absent from lacustrine sediment deposits and therefore are of unique scientific value. The importance of "Lebanese" insects is amplified because they originated during a period of biotic transformations leading to the formation of Cenozoic and recent biotas.

Biota of Lebanese amber

Amber in Lebanon is mostly found in lens of dark clay associated with lignite and plant debris, and in purely fluvial depositional systems, i.e. in channels, or river banks. Some deposits have been subjected to marine influences and occur in deltaic or littoral zones (intertidal areas). Lebanese amber is often buried in the primary deposit together with lignite and fossil leaves from the resin producing tree. If transported, it was only for short distances, based on the exceptional preservation state of the palynomorphs. The study of amber inclusions and palynology indicate that the amber forest was a dense impenetrable one, with a hot humid tropical or subtropical climate. Inclusions in

Lebanese amber are frequent (an inclusion occurs in every 25-30 small amber pieces, for material obtained from fossiliferous outcrops) and diverse (19) insect orders are represented: Archeognatha, Blattodea, Coleoptera, Collembola, Dermaptera, Diptera, Ephemeroptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Mantodea, Neuroptera, Odonata, Orthoptera, Psocodea, Thysanoptera, Thysanura, and Trichoptera). The specimens deposited in Lebanese amber usually represent the smallest members of the groups. Diptera constitute nearly 50% of the inclusions, followed by Hemiptera (17%), Acari (8%), Hymenoptera (6%), Coleoptera (3%), Thysanoptera (3%) with fewer in the remaining orders. These results are certainly not representative of the actual entomofauna of the Lebanese amber forest, but are biased by the presence of certain orders (e.g. nematoceran Diptera are frequently found in large swarms around trees, while other insect groups are more selective). Most of the insect groups in Lebanese amber indicate a hot, humid climate with arboreal and litter habitats, which corroborates with the results of palynological studies, i.e. a dense, wet and hot tropical forest.

Coleoptera of Lebanese amber

This paper is the eighth contribution of descriptions of Coleoptera from Lebanese amber collected in Oise falls (Kushel and Poinar, 1993; Lefebvre et al., 2005; Kirejtshuk and Azar, 2008; Kirejtshuk et al., 2009a, b; 2011; Kovalev et al., 2013) and it provides the first preliminary analysis of representatives of the order from this source. Some data on Coleoptera in Lebanese amber were published previously by Crowson (1981), Whalley (1981); Poinar (1992), Poinar and Milki (2001), Grimaldi and Engel (2005), Kirejtshuk and Azar (2007), however, family assignments in the last six publications should be considered as tentative. In general the specimens found in Lebanese amber are very unusual and, therefore, not easy to assign to modern families. Continued research with detailed descriptions will better determine the range of Coleoptera in these deposits.

During the past few years, some 130 beetles in different conditions of preservation were examined. They originated from different outcrops listed below. Most well-preserved specimens, which ranged from 1-3 mm in length, were prepared for preliminary identification and described. The Coleoptera from Lebanese amber mostly contain groups with arboreal habits (as found in wood and tree fungi). They have been assigned to the families Micromalthidae, Scydmaenidae, Throscidae, Lymexylidae, Cucujoidea (at least Monotomidae, Erotylidae, Silvanidae and Laemophloeidae), Tenebrionoidea (at least Salpingidae, Melandryiidae, Scraptiidae, Mordellidae), and Curculionoidea (both Metrioxenoidinae from Nemonychidae and Scolytinae from Curculionidae), etc. Other sylvan groups were associated with leaf litter and decomposing organic matter (i.e., Clambidae). It is very interesting that a great number of species in the families Salpingidae and Aderidae could have lived in wood as well as in leaf litter. Probably some groups could have been “anthophagous” (i.e. Kateretidae), whose recent members are completely anthophagous (in both larval and imaginal stage of ontogenesis).

Lebanese amber contains the oldest representatives of the families Scydmaenidae (considered also a subfamily of Staphylinidae), Elodophalmidae, Clambidae, Throscidae, Lebanophytidae fam. n., Ptilodactylidae, Cantharidae, Melyridae, Dasytidae, Dermestidae, Ptinidae, Kateretidae, Erotylidae, Latridiidae, Laemophloeidae, Salpingidae, Anthicidae, Melandryidae, Aderidae, Curculionidae. Besides, the families Chelonariidae and Scraptiidae are known by earliest members from both Lebanese amber and Baissa (both sites have a comparable age (Medvedev, 1969; unpublished data) and probably from Truga (Kirejtshuk and Ponomarenko, 2012). Finally, the subfamilies Trechinae (Carabidae), Euaesthetinae (Staphylinidae) and Liparochrinae (Hybosoridae) first appear in the fossil record in Lebanese amber. Two clearly distinct families await description, namely one near Trogossitidae and a new "termitophilous" group of Scarabaeoidea based on Crowson (1981). Some groups, which still require a detailed examination, represent very peculiar lineages that could be regarded as completely new families or subfamilies. They are cited below as ? Decliniidae, ? boganiid-like, ? silvanid-like and additional taxa without any family attribution.

The peculiarities of presentation of different groups deserve a particular consideration. In addition to the rather small body size of beetle inclusions obtained from Lebanese amber and peculiar family composition the presentation of each family could be regarded as more or less characteristic. The comparatively great number of Throscidae (comparable with Elateridae) and absence of Eucnemidae is scarcely occasional, although it is unknown what kind of indication could be in this fact. Nevertheless it could be supposed that usually smaller members of Throscidae in general had more chance to come into resin deposits in comparison with usually larger members of Elateridae (in both fossils and Recent fauna). Therefore, the number of Elateridae in Lebanese amber is comparable with that of Throscidae and can be interpreted by relatively small proportion of small species among the elaterids that existed at that time (could be as small as such proportion in the Recent fauna). The comparatively great number of Scirtoidea represented by different families is also rather significant and also diversity of the extinct family Elodophthalmidae known only from Lebanese amber is particularly striking (as well as absence in Lebanese amber of the Mesozoic Mesocinetidae Kirejtshuk et Ponomarenko, 2010). The family Scydmaenidae is comparatively numerous and represented by the groups which have scarcely been altered till now (S.I. Kurbatov and P. Jałoszyński, pers. comm.). This circumstance applies estimation of the rank of Scydmaenidae (or Scydmaeninae). The same needs to be estimated when defining the rank of the bark beetle known from Lebanese amber (Barremian-lowermost Aptian) and archaic curculionids only in the upper layers of the Lower Cretaceous (Kirejtshuk et al., 2009).

It should be particularly noted that Lebanese amber is the oldest deposits with a rather great number of Cucujformian beetles of different superfamilies (including Bostrichoidea, Lymexyloidea, Cleroidea, Cucujoidea, Tenebrionoidea and also Curculionoidea). The general slow alteration of the Mesozoic faunistic composition seemed to start as in many other insect groups from the Middle Jurassic and perhaps at the Rubicon of Jurassic and Cretaceous reached the maximal intensity. Faunistic changes during the Lower Cretaceous seemed to partly coincide with increasing of the

proportion of Angiosperms in floral composition. The dynamics of appearance of different superfamilies from the most archaic Cleroidea in the Lower Jurassic till the Rubicon of the Jurassic and Cretaceous from where the most superfamilies appears in the fossil record (Kirejtshuk and Ponomarenko, 2012). Somehow the materials from Lebanese amber seem to be able to be compared with those from Liaoning (Yixian Formation) (Kirejthuk et al., 2010b) which can be regarded also as comparable in age. However, the latter contains a considerable proportion of different groups of Tenebrionoidea and also Chrysomeloidea with lack of Cucujoidea, while Lebanese amber demonstrates comparable portions of Tenebrionoidea and Cucujoidea but with lack of Chrysomeloidea. Both resources have some groups of Tenebrionoidea which are rich the Recent epoch, but concrete families in composition Jehol and "Lebanese" faunas are mostly different. It is not clear why a great number of Salpingidae and Aderidae presents from Lebanese amber, although the latter, if its Mesozoic members had a mode of life comparable with that in recent group, could have a coincidence in the season of resin secretion of trees producing amber and emergence of the aderid adults. Another thing is that the cucujoids are absent in Liaoning and well represented by many families in Lebanese amber. Moreover the cucujoid species found in Lebanese amber belong to the groups rather different from those represented in the Recent fauna and very difficult to identify, although some forms have rather typical appearance (f.e., Lebanese Kateretidae or Latridiidae). The alone deposition containing cucujoid representatives is Mongolian Shar-Teg with the Upper Jurassic deposits (Kirejtshuk and Ślipiński, in preparation). Below the list of families of Coleoptera recorded in Lebanese amber there are mentioned the groups which remain without family attribution. It is rather meaningful that most of these forms seem to belong to the superfamily Cucujoidea. Among cucujoids, the family Monotomidae shows a comparative great number of species and genera, although half of specimens are tentatively put in this group.

Methods

Many of the Lebanese amber specimens are temporarily deposited in the Muséum National d'Histoire Naturelle, Paris (further MNHN). For their study, basic optical equipment was used, in particular a stereomicroscope (Olympus SCX9), and inverted microscope (Olympus CK 40) in the Paris Museum, and a stereomicroscope microscope (Leica MZ 16.0) in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (further ZIN).

Strata

Lower Cretaceous; Barremian-lowermost Aptian in general (circa 125-135 My), but could be earlier (Azar, 2012 etc.)

Localities

Nabaa Es-Sukkar – Brissa (North Lebanon); Hammana – Mdeyrij, Bouarij, Ain Dara, Kfar Selouane, Falougha (Central Lebanon); Bkassine, Roum – Aazour – Homsiyyeh, Rihane (South Lebanon).

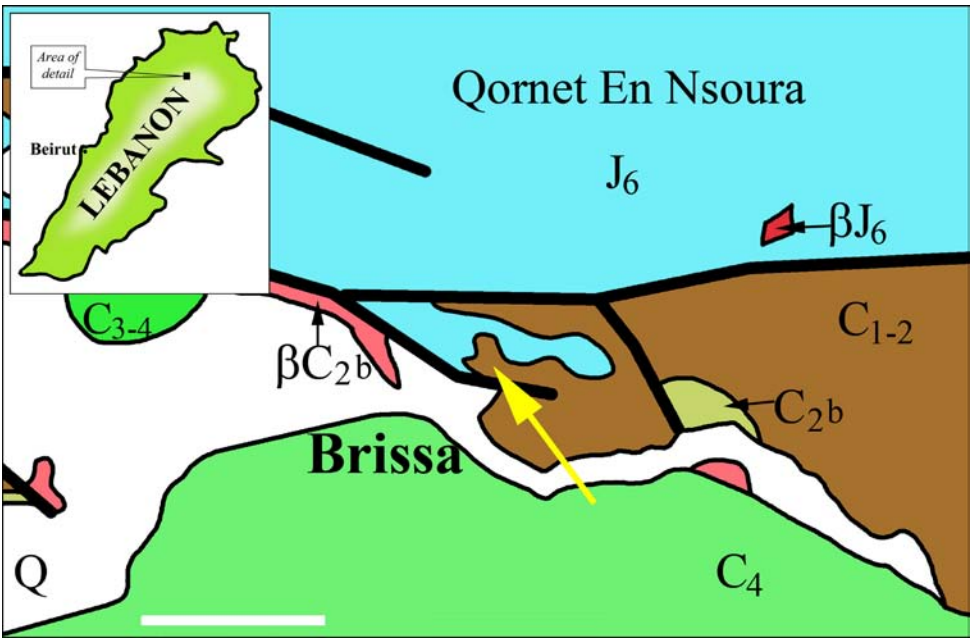

Figure 1. Geological map of the outcrop of Nabaa Es-Sukkar - Brissa. Abbreviations: J6 = Kimmeridgian; J6 = Volcanic Kimmeridgian; C1-2 = Neocomian / Lower Aptian; C2b = Late Aptian; C2b = Volcanic Aptian; C3-4 = Albian / Cenomanian; C4 = Cenomanian; Q = Quaternary; thick lines represent faults. Scale bar = 1 km.

Outcrop of Nabaa Es-Sukkar – Brissa (Figs 1 and 2)

In the paper the first insect from this outcrop is described from the newly discovered outcrop of Nabaa Es-Sukkar – Brissa: Caza (District) Sir Ed-Danniyeh, Mouhafazet (Governorate) Loubnan Esh-Shimali (North Lebanon). Two outcrops were found, the first situated in the upper side of the dam of Brissa, and the second one in the vicinity of Nabaa Es-Sukkar (Sugar Spring), between the spring of Nabaa Es-Sukkar and the dam of Brissa, both in Caza (district) Sir-Ed-Danniyeh, Mouhafazat Loubnan Esh-Shemali (Governorate of North Lebanon); discovered in June 2011, during geological expedition with the participation of Dany Azar, Sibelle Maksoud, from the Lebanese University; and Kamil Ziadé. Amber of first outcrop is yellow, and orange, found in grey sandstone of Neocomian age. Amber of the second outcrop is found as large pieces (some of it attempts the size of a baby head) with different taint of yellow, orange, red, and bony colours; in layers of dark grey clay and shale associated with lignite and plant debris. About 50 fossil insects were found in this later amber, with only two visits to the outcrop for nearly one hour each time.

Families of Coleoptera in Lebanese amber

(specimens longer than 2.5 mm provided with measurement of their length).

Figure 2. Nabaa Es-Sukkar - Brissa amber outcrop. This figure is published in color in the online version.

1. Micromalthidae Barber, 1913 – 1 specimen: "JS27" of the genus *Cretomalthus* described by Kirejtshuk and Azar (2008); Bkassine (Jouar Ess-Souss) outcrop.
2. Carabidae Latreille, 1802 – 1 specimen: "JS-166/A (BM 273)" from the Acra collection, yellow specimen from Bembidiini Stephens, 1827 (Trechinae Bonelli, 1810); Bkassine (Jouar Ess-Souss) outcrop.
3. Staphylinidae Lameere, 1900 – 2 specimens: "1008" of the genus *Libanoeuaesthetus* Lefebvre, Vincent, Azar et Nel (Euaesthetinae Thomson, 1859) described by Lefebvre et al. 2005 and "1247A"; Hammana – Mdeirij and Ain Dara outcrops.
4. Scydmaenidae Leach, 1815 – 8 specimens: "851", "1461-B", "1461-C" (Fig. 3 A), "TAR-167A", "TAR-167e", "TAR-107A", "JG 194/12 (BM34)" and "JG 322 (BM 430)" from different subfamilies (tribes); Hammana – Mdeirij, Bouarij and Jouar Ess-Souss outcrops.
5. Ptiliidae Erichson, 1845 – 3 specimens: "TAR 169" (Fig. 3 B), "1063" and "NBS-2E" from different groups, and the latter specimen has the four-segmented long tarsi, not strongly reduced membrane of hindwings fringed along their margin and some characters (long palpi) which are reminiscent of those of Hydraenidae Mulsant (this specimen could be described as a member of the new family), 1844; Nabaa Es-Sukkar – Brissa, Bouarij and Hammana – Mdeirij outcrop.
6. Hybosoridae Erichson, 1847– 1 specimen: "TAR 39" of the genus *Libanochrus* Kirejtshuk, Azar et Montreuil, 2011 (Liparochrinae Ocampo, 2006) described by Kirejtshuk et al. (2011); Hammana – Mdeirij and Bouarij outcrops.
7. Probable new family of the superfamily Scarabaeoidea – 3 specimens (Fig. 3 C) with body larger than 3.0 mm (Krell, in preparation); Hammana – Mdeirij, Bouarij and Jouar Es-Souss (Bkassine) outcrops.

8. Scirtidae Fleming, 1821 – 2 specimens: "HAR-2" (complete beetle with strongly declined head 3.2 mm), "JG 78/21 (F66)" and "TAR 168A", representing two new subfamilies (one with a very short metaventrite ("HAR-2": Fig. 3 D) and another with a very short prosternum and pronotum); Hammana – Mdeirij, Bouarij, Jouar Ess-Souss and Roum – Aazour – Homsiyyeh outcrops.
9. Decliniidae Nikitsky, Lawrence, Kirejtshuk et Gratshev, 1994 – 1 specimen: "793A-E", resembling scirtids but with a long prosternum and a rather wide prosternal process; Hammana – Mdeirij outcrop.
10. Elodophthalmidae Kirejtshuk et Azar, 2008 – 4 specimens: two of the genus *Elodophthalmus* first described by Kirejtshuk and Azar (2008); "TAR-63" and "1462" of other undescribed genera; Hammana – Mdeirij and Bouarij outcrops.
11. Clambidae Fischer von Waldheim, 1821 – 2 specimens: "752" and "90" of the genus *Eoclambus* first described Kirejtshuk and Azar (2008); Hammana – Mdeirij outcrop.
12. Elateridae Leach, 1815 – 6 partly fragmented specimens with body of 2.0-3.5 mm long: "845-G", "JG 41/1 (BM174)", "JG 389/2 (F39,40)", "JG 389/19 (F65)", "JG 387/7 (F59)", "JG 248/14" and "JG 250/17 (BM1019)" (including head and prothoracic segment "JG 250/10 (BM977)" probably separated from the same specimen with very large triangular metacoxal femoral plates as those in Desmatini Dolin, 1975; Hammana – Mdeirij Jouar Ess-Souss outcrops.
13. Throscidae Laporte, 1840 – 4 specimens: "TAR-165C", "750", "JG 79/71 (BM665)" and "FAL-3B" described in Kovalev et al. (2013) show the characters, some of which are shared with members of the subfamily Poterginae Cobos, 1961 and 3 specimens "623", "J-5" and "J-3A"; Hammana – Mdeirij, Bouarij, Jouar Ess-Souss (Bkassine) and Falougha outcrops; the last one being a completely new one discovered in 2012 by Dany Azar and Sibelle Maksoud. One specimen of this family was erroneously regarded as a member of Eucnemidae (Kirejtshuk and Azar, 2008).
14. Lebanophytidae fam. n. – 1 specimen: "840AB" of the genus *Lebanophytum* first described by Kirejtshuk and Azar (2008); Hammana – Mdeirij outcrop.
15. Chelonariidae Blanchard, 1845 – 1 specimen: "K2B" of the genus *Eochelonarium* gen. n. described in the present work; Kfar Selouane outcrop.
16. Ptilodactylidae Laporte, 1836 – 1 specimen: "1281" (complete beetle with declined head 3.6 mm) (Fig. 3E), partly destroyed but with clear characters of the complex genera near *Ptilodactyla* Illiger, 1807; Hammana – Mdeirij outcrop.
17. Cantharidae Imhoff , 1856 – 1 specimen: "1465" with posterior body portions broken or missing; Hammana – Mdeirij outcrop.
18. Lymexylidae Fleming, 1821 – 2 specimens: "852" (complete beetle 4.2 mm long) and "TAR 165 r" (beetle with missing distal part of abdomen 7.0 mm long) with nearly complete elytra with each representing a new genus; Hammana – Mdeirij and Bouarij outcrops.
19. new family trogossitid-like (Trogossitidae Latreille, 1802) – 5 specimens: "J-6F", "NBS -4C", "841BC", "474B" and "TAR-101A" somewhat resembling *Calitys* Thomson, 1859 but with oval and open posteriorly procoxal cavities and long

erect setae on dorsum; Nabaa Es-Sukkar – Brissa, Hammana – Mdeirij, Bouarij and Jouar Es-Souss (Bkassine) outcrops.

20. ? Cleridae Latreille, 1802 – 1 specimen: "689", with very slender body, 6 abdominal ventrites, tarsi 5-5-5 consisting of simple tarsomeres, clubbed antennae and somewhat transverse and projecting procoxae, but with destroyed dorsal surface of integument; Hammana – Mdeirij outcrop.
21. Melyridae Leach, 1815 – 1 specimen: "TAR-55H" (Fig. 3 E), small and similar to recent members of the subfamily Malachiinae Fleming, 1821; Bouarij outcrop.
22. Dasytidae Laporte, 1840 – 1 specimen: "1106" (3.0 mm long) representing a small and rather slender black species; Hammana – Mdeirij outcrop.
23. Dermestidae Latreille, 1807 – 5 specimens: including "939" of the genus *Cretonodes* Kirejtshuk et Azar, 2009 (Trinodinae Casey, 1900; Cretonodini Kirejtshuk et Azar, 2009) described by Kirejtshuk et al. (2009), and also "2011"; "51", "TAR-102A" and "55A" (all belonging to undescribed genera of the same tribe); Hammana – Mdeirij and Bouarij outcrops.
24. Ptinidae Latreille, 1802 – 1 specimen: "RIH-1IJ" (complete beetle 3.3 mm long) belonging to the subfamily Anobiinae Fleming, 1821; Rihane outcrop.
25. Boganiid-like (Boganiidae Sen Gupta and Crowson, 1966) – 3 specimens: including "1032", "619" and "911", small species with a (sub) coriaceous dorsum, transverse procoxae, moderately long and clubbed antennae or with comparably long and subfiliform antennae; Hammana – Mdeirij outcrop.
26. Kateretidae Erichson, 1943 – 1 specimen: "1136" of the genus *Lebanoretes* first described by Kirejtshuk and Azar (2008); Hammana – Mdeirij outcrop.
27. Erotylidae Latreille, 1802 – 1 specimen: "JG 194/1 (BM 559)" of the subfamily Xenoscelinae Ganglbauer, 1899, with body at least 3.0 mm, diffusely punctured and finely pubescent elytra, 4-segmented loose antennal club and widely lobed tarsomeres 1-3; Jouar Ess-Souss outcrop.
28. Monotomidae Laporte, 1840 – 6 specimens: "845D", "845E" and "1512" of the genus *Rhizophtoma* (Rhizophtominae Kirejtshuk et Azar, 2009), first described by Kirejtshuk et al., (2009), and also "NBS-4B" here described in the genus *Rhizobactron* gen. n., "JG79/20" (BM317)", "JG 79/B" and "735 B" (three last specimens are tentatively put in this group because of resembling a lyctin (Lyctinae Billberg, 1820; Bostrichidae Latreille, 1802), they bear rather loose antennal blub and fringed lateral edges of the pronotum and elytra); Hammana – Mdeirij, Jouar Ess-Souss (Bkassine), Bouarij and Nabaa Es-Sukkar – Brissa outcrops.
29. Latridiidae Erichson, 1842 – 3 specimens, including "1453" of the genus *Archelatrius* Kirejtshuk et Azar (Latridinae sensu str.) described by Kirejtshuk et al. (2009), "TAR-103A" of the genus *Tetrameropsis* (Tetrameropsinae Kirejtshuk et Azar, 2008) first described by Kirejtshuk and Azar (2008) also "474A" of the genus *Atetrameropsis* gen. n. (Tetrameropsinae); Hammana – Mdeirij and Bouarij outcrops.
30. Silvanid-like (Silvanidae Kirby, 1837) – 2 specimens: "866" presenting a rather flattened body (3.2 mm long) missing most median parts and most leg segments but with the dorsal surface of the head, finely crenellate pronotal sides and

lobed tarsomeres 1-3, and "NBS-5" with the head and antennae (both near Silvaninae sensu str.); Hammana – Mdeirij outcrop and Nabaa Es-Sukkar – Brissa outcrops.

31. Laemophloeidae Ganglbauer, 1899 – 1 specimen: "1" (Fig. 3 G), somewhat similar to species of *Charaphloeus* Casey, 1916 (Laemophloeinae sensu str.); Hammana – Mdeirij outcrop.
32. Salpingidae Leach, 1815 – 5 specimens: "RIH-1Y" (Fig. 3 1Y), "RIH-35AB", "RIH-34" (rather destroyed), "RIH-1a" (rather destroyed) and "RIH-1H" (complete beetle 2.8 mm) that resemble some Salpinginae s.str. with tarsi 4-4-4; Rihane outcrop.
33. Anthicidae Latreille, 1819 – 1 specimen: "846" of the genus *Camelimorpha* (Macratriinae LeConte, 1862; Camelomorphini Kirejtshuk et Azar, 2008) first described by Kirejtshuk and Azar (2008); Hammana – Mdeirij outcrop.
34. Melandryiidae Leach, 1815 – 4 specimens: "1019ab" (beetle with missing apices of elytra and abdomen 3.2 mm long), "735 A" (complete beetle 4.8 mm long), "JG 13 + 14/23 (F26, F25)" and "RIH-1Q", all of the subfamily Malandryinae sensu str.; Hammana – Mdeirij, Jouar Ess-Souss and Rihane outcrops.
35. Scraptiidae Gistel, 1848 – 2 specimens: "1358" and "RIH-31" (Fig. 3 H) (with melandryid heads and transrugose elytral integument); Hammana – Mdeirij and Rihane outcrops.
36. Mordellidae Latreille, 1802 – 1 specimen: "RIH-5" (beetle partly destroyed and with missing apices of elytra and abdomen 2.7 mm); Rihane outcrop.
37. Aderidae Csiki, 1909 – 9 specimens "JG 204/15", "96", "1282", "AD4A", "1521", "1239", "853-F" (mostly destroyed), "NBS-2F" and "822" (Fig. 3 J); Nabaa Es-Sukkar – Brissa outcrop [North Lebanon]; Hammana – Mdeirij, Ain Dara, Rihane and Jouar Es-Souss (Bkassine) outcrops.
38. Nemonychidae Bedel, 1882 – 2 specimens: one from the Poinar collection at the Oregon State University and "TAR-171A" of the genus *Libanorhinus* Kuschel et Poinar, 1993 (Metrioxenoidinae Legalov, 2009); Bouarij and Jouar Es-Souss (Bkassine) outcrops.
39. Curculionidae Latreille, 1802 – 1 specimen: "956" of the genus *Cylindrobrotus* Kirejtshuk, Azar, Beaver, Mandelshtam and Nel, 2009 (Scolytinae Latreille, 1804; Cylindrobrotini Kirejtshuk, Azar, Beaver, Mandelshtam et Nel, 2009) described by Kirejtshuk et al. (2009); Hammana – Mdeirij outcrop.

Families *incertae sedis*

1. 1 byrrhoid specimen: "808CD" represented by the head and prothorax (2.0 mm long) with an extremely thin filiform antennae, a rather wide prosternal process, thin and long five-segmented pro- and mesotarsi, very large eyes and widely separated pro- and meso-coxae; Hammana – Mdeirij outcrop.
2. 1 cucujoid specimen: "RIH-1R" resembling a cryptophagid, but with rather long tarsi; Rihane outcrop.

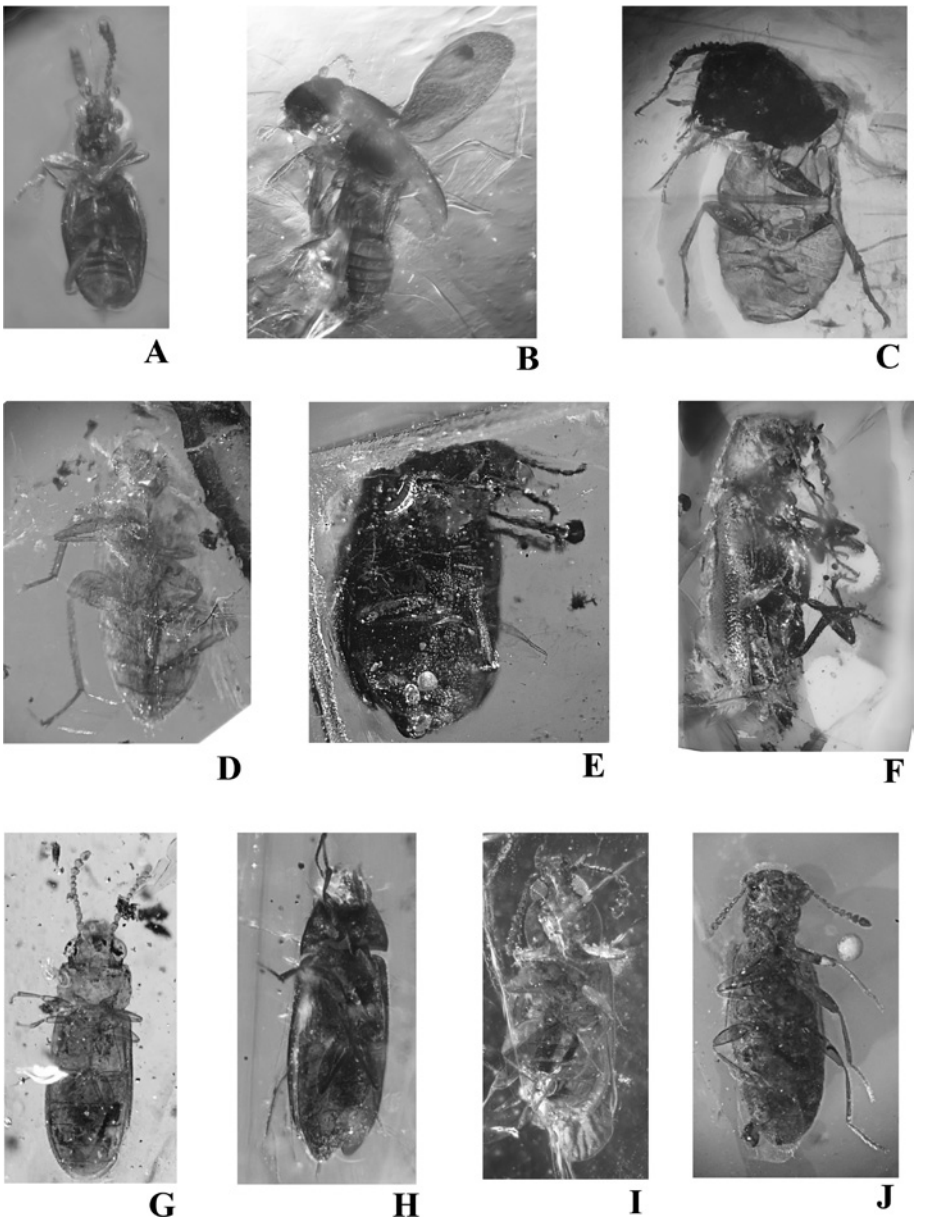

Figure 3. Coleoptera. (A) Scydmaenidae, gen. et sp., "1461-C", ventral view. Length of specimen 0.6 mm. (B) Ptiliidae, gen. et sp., "TAR-169", dorsolateral view. Length of specimen 0.8 mm. (C) Probable new family of Scarabaeoidea, gen. et sp., "AB-62", ventral view. Length of specimen more than 3.0 mm. (D) Scirtidae, gen. et sp., "HAR-2", ventral view. Length of specimen 3.2 mm. (E) Ptilodactylidae, gen. et sp., "1281", ventral view. Length of specimen 3.6 mm. (F) Melyridae, gen. et sp., "TAR-55A", lateral view. Length of specimen 1.9 mm. (G) Laemophloeidae, gen. et sp., "1", ventral view. Length of specimen 1.7 mm. (H) Scraptiidae, gen. et sp., "RIH-31", ventral view. Length of specimen 2.0 mm. (I) Salpingidae, gen. et sp., "RIH-1Y", ventral view. Length of specimen 2.1 mm. (J) Aderidae, gen. et sp., "822", ventral view. Length of specimen = 1.4 mm. This figure is published in color in the online version.

3. 1 cucujoid specimen: "849" resembling a silvanid with long filiform antennae and tarsi 5-5-5, but with strongly lobed tarsimere 4 and transverse procoxae; Hammana – Mdeirij outcrop.
4. 1 cucujoid specimen: "JG 384/1 (BM414)"; with cerophytid-like appearance, particularly with characteristic antennal insertions, and also with large antennomere 2, narrowly separated oval pro- and mesocoxae, rather separated metacoxae, tarsi 5-5-5 with lobed tarsomeres 1-4; Jouar Ess-Souss.
5. 1 tenebrionoid specimen: "TAR-1E" somewhat resembling a boganiid (2.8 mm) with the oval procoxae, heteromeran tarsal formula (5-5-4) and strongly lobed penultimate tarsomeres; Bouarij outcrop.
6. 1 tenebrionoid specimen: "849" (complete beetle with missing anterior part of head 4.8 mm long) somewhat resembling slender Colydiinae with depressed median part of pronotum and widely explanate promotal and elytral sides, but with tarsal formula 5-5-4.
7. 1 specimen of a very small cantharoid larva: "1012AB"; Hammana – Mdeirij outcrop.
8. 1 specimen of a very small lymexylid-like larva: "RIH-1J" with a strongly swollen prothorax; Rihane outcrop.
9. 1 specimen of rather small staphylinid-like larva: "JG 78/8 (F42)" with somewhat swollen thoracic segments, long and narrow urogomphi and with a pair of long acuminate processes on abdominal segment VIII (comparable with urogomphi); Jouar Ess-Souss outcrop.
10. 16 specimens in different state of preservations, mostly from the subfamily Cucujoidea, also one from the Elateroidea, and one from Tenebrionoidea; different outcrops.

New taxa

Family Lebanophytidae Kirejtshuk, fam. n.

Type genus *Lebanophytum* Kirejtshuk et Azar, 2008
Included genera: only type genus.

Notes

The type genus of the new family was quite adequately described (Kirejtshuk and Azar, 2008). The close relationship of *Lebanophytum* to the family Cerophytidae is quite evident because of the very characteristic structure of the anterior part of the head with the closed antennal sockers and somewhat retracted mouthparts, peculiar structure of the prosternum and interlocking mechanism, and also the profemur with a clear, rather long fold on the inner surface for the receiption of the protibia. The body size of *Lebanophytum* is similar only to species of *Aphytocerus* Zherichin, 1977 (also first described as Cerophytidae), but the other groups consist of much larger representatives. Both mentioned genera are rather distinct from all recent and fossil Cerophytidae (Costa et al., 2003; Chang et al., 2011a, b) and need to be regarded separately. See also below in the Taxonomic notes.

Diagnosis

Body comparably small, elongate, rather convex dorsally and ventrally; integument with dense and fine diffuse hairs; dorsal punctation more or less uniform, including that on elytral disks. Head subprognathous and subtriangular. Labrum well exposed, subquadrangular. Mandibles not exposed from under frons. Antennae 11-segmented, comparatively long and subfiliform to submoniliform. Pronotum narrowly explanate at lateral edges, its anterior edge slightly convex and posterior one straight in the middle and emarginate at sides, anterior angles widely rounded and posterior ones rectangular, with sides and emarginate parts of base bordered. Scutellum strongly transverse and widened to truncate apex. Elytra moderately long, rather convex and steeply sloping and slightly declined on ventral sides, with distinct lateral carina, adsutural lines not expressed, epipleura well expressed at base and becoming obsolete distally. Head with rather large subvertical genal ridges, with gular sutures widely separated. Mentum very transverse. Ligula rather long and palpal insertions located close to apex. Labial palpomeres 3-segmented with ultimate palpomere flattened and subtriangular to securiform. Prosternum strongly convex along the middle and sharply elevated along notosternal suture, its process narrow and narrowing apically to angular excision of mesoventrite; notosternal sutures distinct; prohypomeres apparently not closing procoxal cavities. Procoxae transverse. Distance between mesocoxae nearly 3.5 times as great and that between metacoxae about 2.5 times as great as that between procoxae. Mesoventrite with a median subpentagonal plate and anterior excision to receive prosternal process. Mesocoxal cavities oval and closed externally. Metaventrite with its anterior edge between coxae convex and its posterior edge between coxae angularly and deeply excised. Metacoxae transverse with scarcely raised femoral plate. Ventrite 1 somewhat longer than ventrites 2 and 3 combined. Epipleura gradually narrowing posteriorly, but not reaching middle of elytra. All trochanters of elongate type and very long. Tibiae long and narrow, comparable in width and length; spurs not raised. Femora moderately compressed. Tarsi 5-segmented, tarsomeres 1-3 with oblique apices and few long setae (longer on underside than above); tarsomere 4 shortest and subcylindrical (not lobed); tarsomere 5 longest.

Comparison

This new family is very distinct from related groups in Elateroidea Leach, 1815 in the following peculiar combination of characters: subprognathous head, transverse procoxal cavities closed or extremely narrowly open posteriorly, separated metacoxae, head with rather large subvertical genal ridges, gular sutures widely separated, mesoventrite with median subpentagonal plate excised anteriorly for receiving prosternal process. Lebanophytidae fam. n. is most similar to the comparatively diverse family Cerophytidae (Kirejtshuk and Azar, 2008), although a wide comparison of the new family with various groups of the latter can be possible after description of many fossil genera from the Jurassic and Cretaceous. See also comparison with other families in Costa et al. (2003) and Chang et al. (2011a, b).

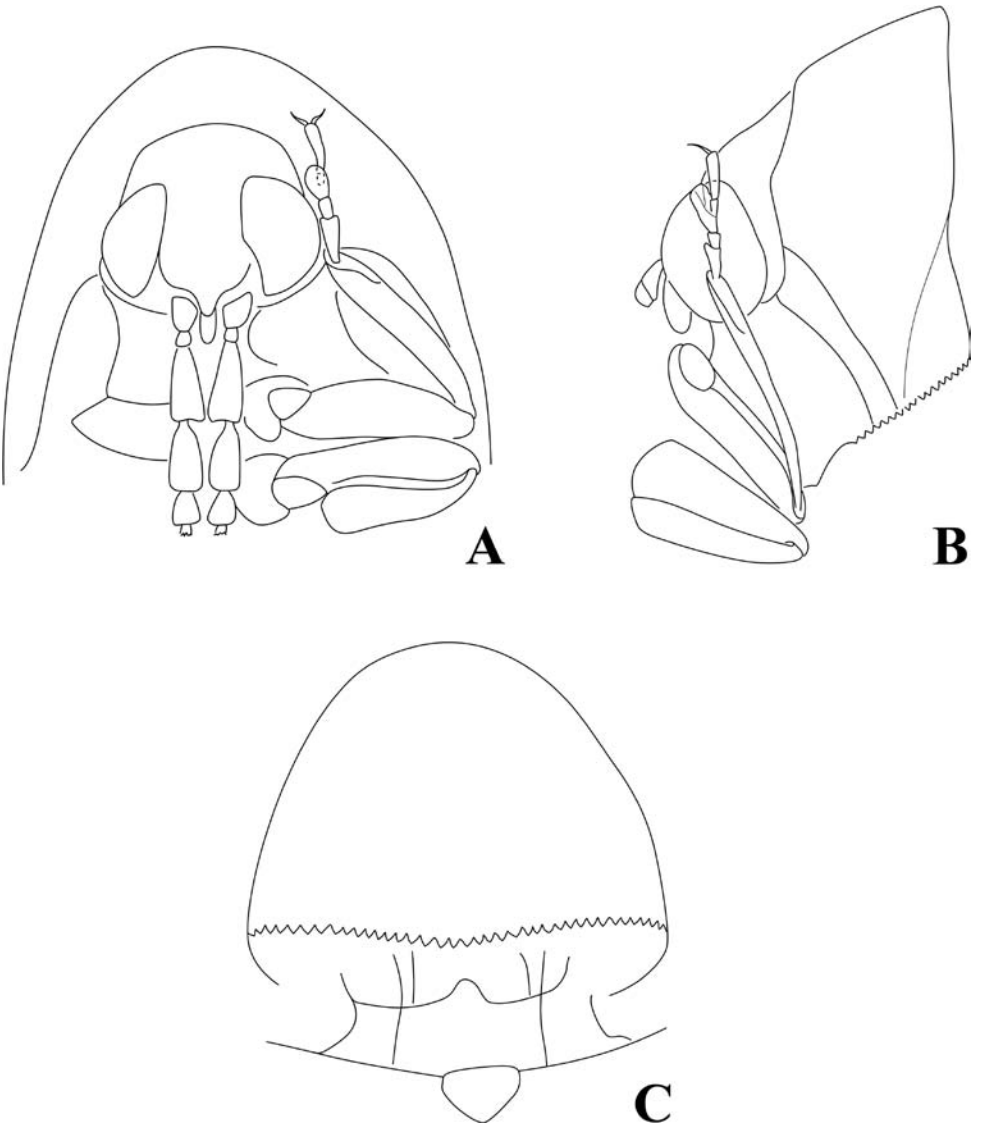

Figure 4. *Eochelonarium bellum* gen. et sp. n. (Chelonariidae), holotype. (A) Body, dorsal view. (B) Idem, lateral view. (C) Idem, ventral view. Length of specimen = 2.2 mm.

Family Chelonariidae Blanchard, 1845

Genus *Eochelonarium* Kirejtshuk, gen. n.

Type species *Eochelonarium belle* sp. n.

Etymology

The name of new genus is derived from the Greek "eos" (ἠώς – dawn) and generic name "*Chelonarium*". The gender is neuter.

Diagnosis

Medium-sized body (based on the study of the head, pro- and mesothorax); head with very large eyes – distance between them nearly as great as transverse diameter of eye from the front; distance between antennal insertions less than width of scape; antennae rather long with part of flagellomeres dilated and compressed (at least antennomeres 3-5); anterior part of pronotum rather elongate, continuing on the underside and, therefore anterior edge of dorsal surface of pronotum extends beyond anterior edge of pronotum (distance between anterior edge of pronotum and anterior edge of dorsal surface of pronotal disc much greater than the width of protibia); prothorax without clear excavate area for receipt of anterior legs; protibia very narrow and slightly curved, protrochanter small, triangular.

Comparison

This new genus is rather distinct due to the somewhat great distance between the anterior edge of the pronotum and the anterior part of its dorsal surface, very thin protibiae and weakly excavated prosternal sides and prohypomera. The new genus is also characterized by very fine and short subrecumbent hairs on the integument and also the eyes comparatively larger those in most recent members of the family. The generic structure of the family is still not sufficiently elaborated. The genus *Chelonarium* Fabricius, 1801 includes about two hundreds of recent species already described, which are rather diverse and spread over most tropical areas of the world. There have been some genera were proposed, although now only three genera are usually recognized as quite isolated taxa (*Chelonarium*, *Pseudochelonarium* Pic, 1916 and *Brounia* Sharp, 1878). This family is much more numerous and many recent species need to be described. After description of some recent species of the family a detailed revision of the genera of it will be possible. Nevertheless, during this study the representatives of most species of Chelonariidae (including many type series) were used for comparison of the new Cretaceous genus. The latter can be tentatively discriminated from the recent groups due to the following characters which are present in the recent members:

– in"*Citharophorus* Méquignon, 1934" and "*Dermetostoma* Méquignon, 1934" (both tentative members of *Chelonarium*): deeply concave dorsal surface of the pronotal disk with a sharp surrounding carina, anterior edge of carina of the dorsal surface closely reaching the anterior edge of the pronotum (distance between them markedly less than the width of protibia), depressions in the prothorax for receiving the anterior legs, rather wide protibia and stout erect setae on the dorsum (Fig. 6 A-D);
– in *Pseudochelonarium* Pic, 1916 (including *Neochelonarium* Méquignon, 1935): slightly convex dorsal surface of the pronotal disk without a surrounding carina, the anterior edge of dorsal surface coincides with the anterior edge of the pronotum, depressions on the prothorax for receipt of the anterior legs, rather wide protibia and stout erect and suberect setae on the entire integument (Fig. 6 E-F);

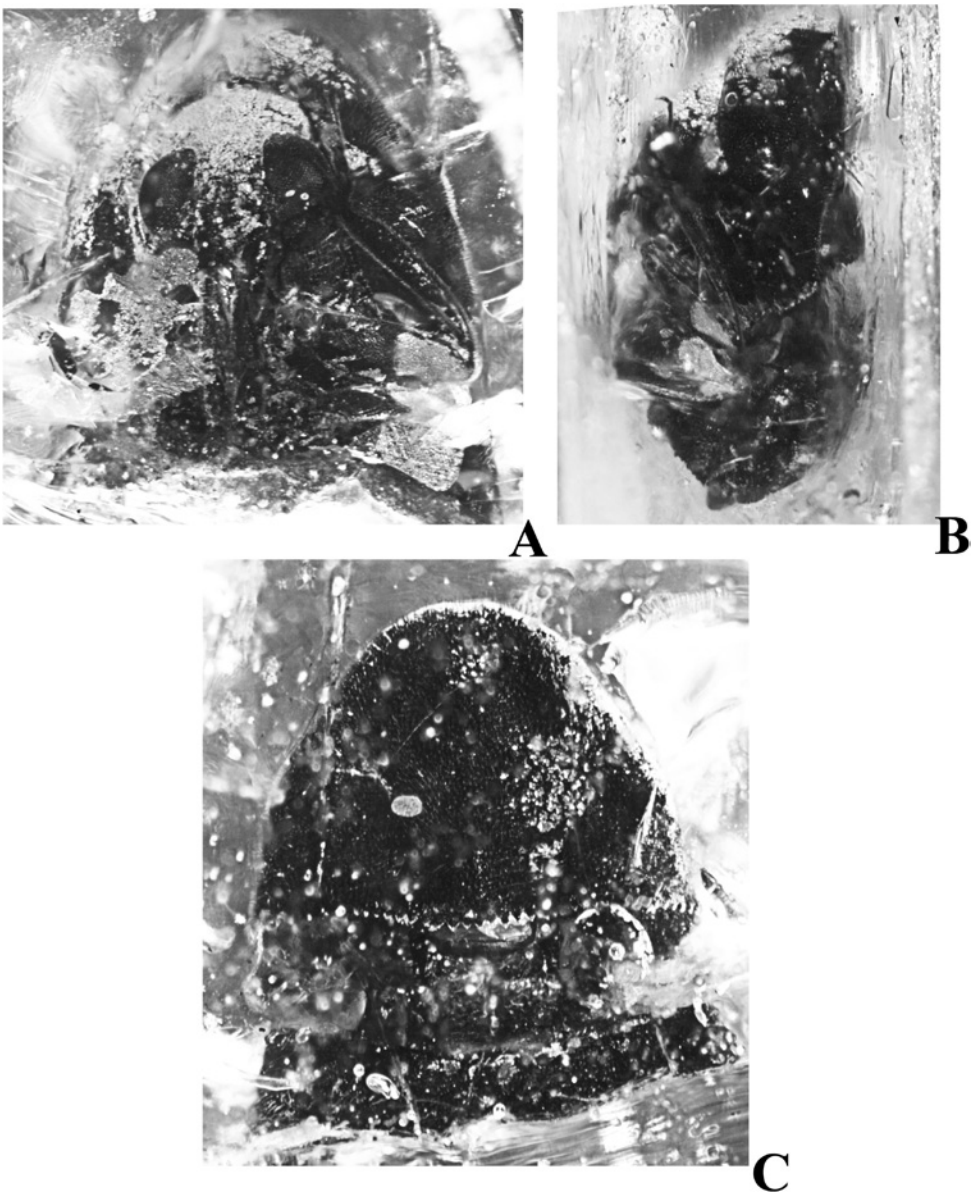

Figure 5. *Eochelonarium bellum* gen. et sp. n. (Chelonariidae), holotype. (A) Body, dorsal view. (B) Idem, lateral view. (C) Idem, ventral view. Length of specimen = 2.2 mm. This figure is published in color in the online version.

– in *Chelonarium*: clearly concave dorsal surface of the pronotal disk with a more or less sharp surrounding carina, the anterior edge of the carina on the dorsal surface closely reaching the anterior edge of the pronotum (distance between them is usually less than the width of the protibia), depressions of the prothorax for receipt of the anterior legs, not infrequently a rather wide protibia (at least wider than scape);

– in *Brounia*: strongly convex dorsal surface of the pronotal disk, anterior edge of the pronotum rather far from the anterior edge of the dorsal surface of the pronotal disc (distance between them more than twice as great as the width of protibia), lack of a depression in the prothorax for receipt of the anterior legs and protibia slightly wider than scape (known after Sharp, 1878 and Leschen and Early, 2004).

Notes

This family was also found in lacustrine sediments of Baissa (Russia, Buryatya, Transbaikalia; Lower Cretaceous) and Baltic amber (Upper Eocene), where it seems to be represented by genera different from all ones proposed before.

Eochelonarium belle **Kirejtshuk, sp. n.**

(Figs 4 and 5)

Etymology

The epithet of this new species means "beautiful", "handsome", "good-looking", "fine", "pretty".

Material

Holotype "K-2B" (Kfar Selouane outcrop), sex unknown; specimen represented by head and pro- and mesothorax with appendages (although antennomeres 6-11, right anterior and intermediate legs are missing) is included in the piece of homogenous amber with many small gas vesicles diffusely dispersed and intermixed with small pieces of dark organic matter and small cracks of different orientation. This piece of amber is placed in a rectangular parallelepiped (5.0 x 3.0 x 1.7 mm) made from microscope cover slips.

Description

Holotype. Pro- and mesothorax 2.3 mm long, 2.1 mm wide, 1.2 mm high; apparently subelliptic, slightly convex dorsally and moderately ventrally; subunicolorous blackish; all sclerites covered with very dense, fine and very short hairs, length of which is somewhat less than interspaces between their insertions. Integument with extremely fine punctures about as large as eye facets, interspaces between them about as great as a puncture diameter (or slightly greater on dorsal surface of pronotum) and very densely microreticulated. Head retracted into subtrapezoid foramen of prothoracic segment, eyes subhemispherical, very large and very fine facets; frons extending anteriorly by a narrow median process between antennal insertions; labrum and other mouthparts not visible. Antennae apparently comparatively long (at least antennomere 5 reaching the amber surface; scape subequal in length with antennomere 5 about three times as long

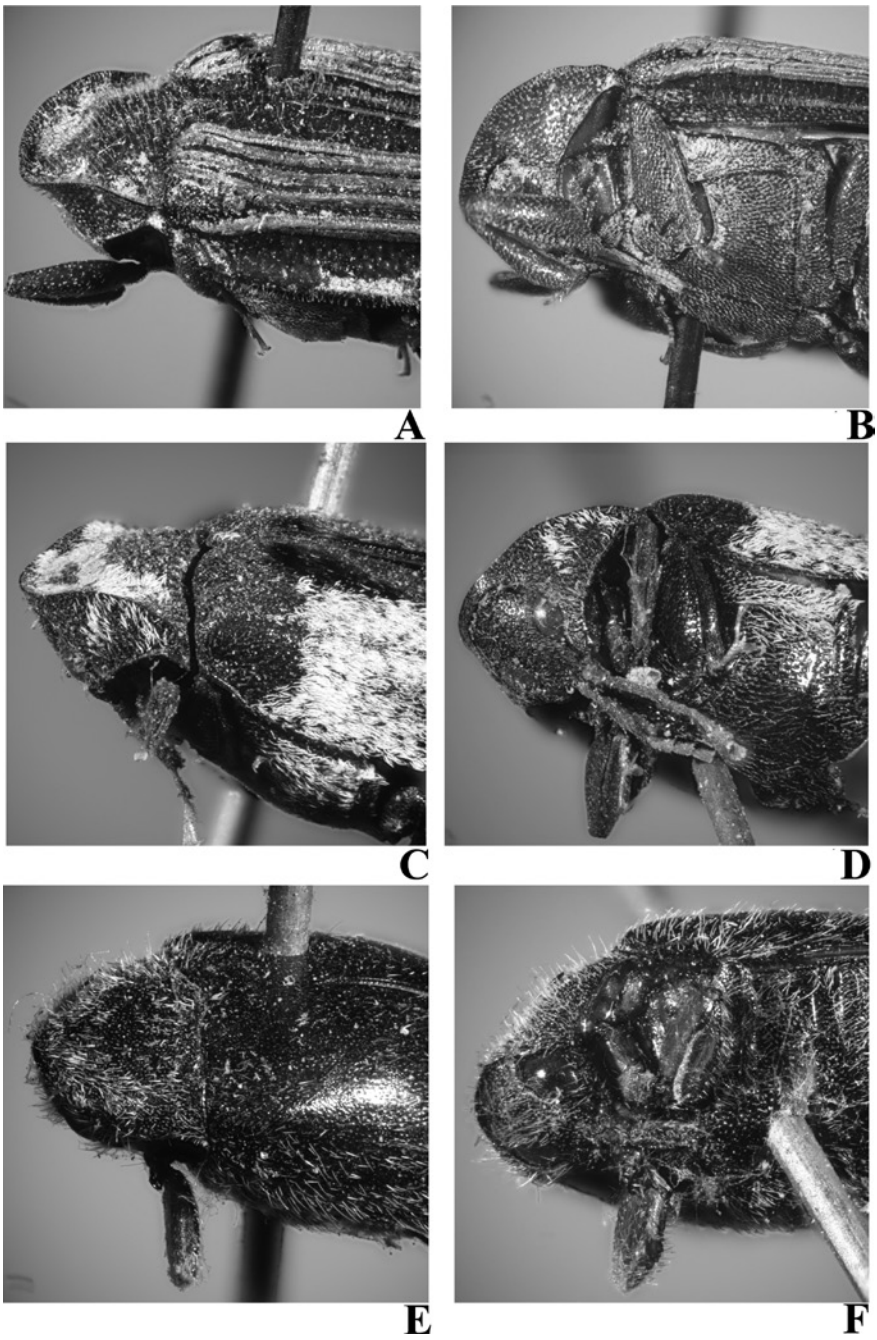

Figure 6. Recent Chelonariidae. *Chelonarium liratulum* Ancey 1884 (*Chitarophorus*), syntype (MNHN), body length 8.2 mm: (A) anterior part of body, dorsolateral view. (B) Idem, ventrolateral view. *Chelonarium semivestitum* Méquignon, 1934 (*Dermestosoma*), syntype, (MNHN), body length 7.2 mm: (C) anterior part of body, dorsolateral view. (D) Idem, ventrolateral view. *Pseudochelonarium sp*. (MNHN), body length 6.4 mm: (E) anterior part of body, dorsolateral view. (F) Idem, ventrolateral view. This figure is published in color in the online version.

as antennomere 2; antennomere 3 about five times as long as antennomere 2 and antennomere 4 about four times as long as antennomere 2. Pronotum with anterior edge dislodged on underside and anterior part of pronotum about three times as long, with extension on underside, as width of protibia; dorsal surface somewhat convex at base and very slightly depressed before posterior angles and anteriorly, without sharp surrounding carina; lateral carina reduced to obsolete border on underside; posterior edge with coarse and regular crenulations; pronotosternal suture distinct; spaces for anterior legs not clearly depressed and isolated; procoxal cavities strongly transverse with rather long outer edge. Pro- and mesocoxae narrowly separated and rather projecting. Scutellum moderately large, subpentagonal and arcuate at apex. Elytral base with regular microsculpture. Protibia very narrow (about as wide as scape) and slightly curved, protrochanter small, triangular; mesotibia more than 1.5 times as wide as protibia and somewhat curved. Tarsi 5-5-?5; tarsomeres 1 and 5 comparable in length and longest; tarsomere 4 shortest and narrowest; tarsomeres 2 and 3 comparable in length and each somewhat longer than tarsomere 4; tarsomere 3 with one rather long membraneous lobe arcuate at apex; claws narrow and moderately long.

Family Monotomidae Laporte, 1840

Subfamily Rhizophtominae Kirejtshuk et Azar, 2009

Notes

This subfamily was proposed for one genus described after examining three specimens regarded at the time of description as conspecific. Further study of these specimens and also one additional specimens confirms that instead, three species are represented in the available material. As a result, the holotype and one paratype of *Rhizophtoma elateroides* Kirejtshuk et Azar, 2009 from the same outcrop belong to one species, while the remaining paratype of this species should be regarded as a separate species and the additional specimen of this group should be described in a separate new genus.

Genus *Rhizophtoma* Kirejtshuk et Azar, 2009

Type species *Rhizophtoma elateroides* Kirejtshuk et Azar, 2009

***Rhizophtoma synchrotronica* Kirejtshuk, sp. n.**

(Fig. 7)

Etymology

The epithet of this new species indicates that it was studied with x-ray microscopy in the European Synchrotron Radiation Facility (Grenoble).

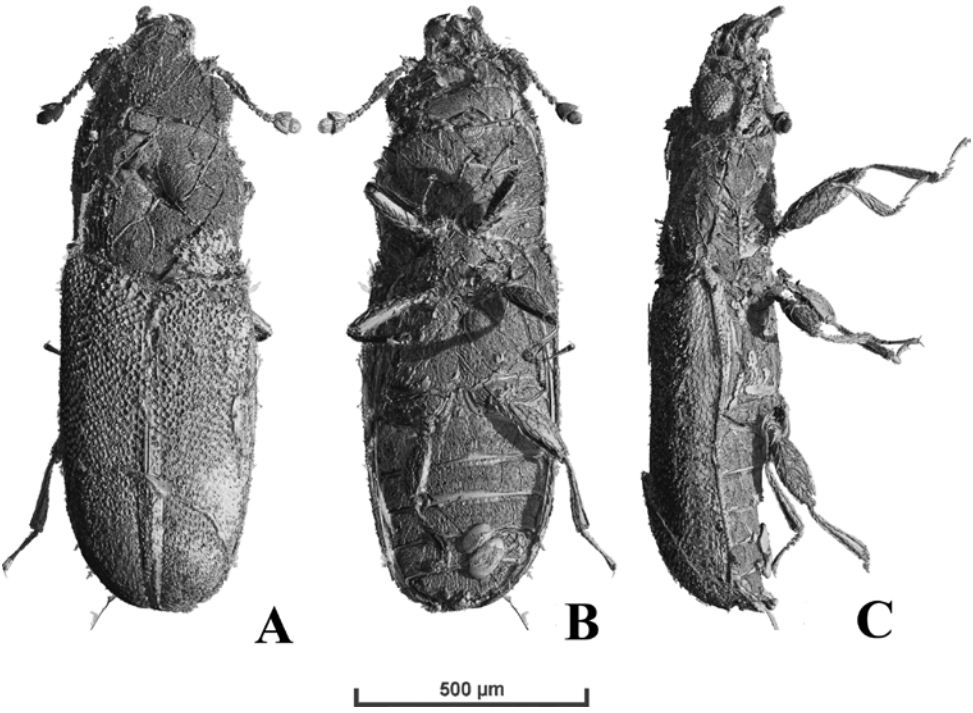

Figure 7. *Rhizophtoma synchrotronica* sp. n. (Monotomidae, Rhizophtominae), holotype. (A) Body, dorsal view. (B) Idem, ventral view. (C) Idem, lateral view. Length of specimen = 1.3 mm. After Kirejtshuk et al., 2009.

Material

Holotype "1512"(Hammana – Mdeirij outcrop) (previously designated as a paratype of *R. elateroides* and as a probable ♀), sex unknown; the complete beetle is enclosed in an amber piece embedded with Canada Balsam in a rectangular glass parallelopiped.

Diagnosis

This new species differs from the another congener by having the pronotal posterior angles not acutely projecting, nor crenellate sides of pronotum, a very transverse scutellum, clearly expressed adsutural lines on the elytra, elytral apices covering most of the pygidium and the hypopygidium with a length subequal with that in each of ventrites 2-4. Also, the holotype of this new species is somewhat larger and wider than the specimens of *R. elateroides*. and the new species has the more parallel-sided pronotum (not bell-shaped as in *R. elateroides*).

Description

Holotype. Body 1.3 mm long, 0.4 wide, about ? 0.1 mm high. Very similar to the holotype and paratype of *R. elateroides* ("845D" and "845E"), except for the characters mentioned in the above diagnosis.

Genus *Rhizobactron* Kirejtshuk, gen. n.

Type species *Rhizobactron marinae* sp. n.

Etymology

The name of the new genus is formed from the Greek "rhiza" (ρίξά - root, stump, stub) and "bactron" (βάκτρον - stick; cane; stuff). The gender is neuter.

Diagnosis and comparison

This new genus differs from *Rhizophtoma* (another member of the subfamily) only in the very slender and subhemicylindrical body, distinct scales on the dorsal sclerites, 3-segmented antennal club, subparallel-sided pronotum, elytra subparallel-sided and with the lateral edges turned ventrally (not visible dorsally), obsolete epipleura, ventrite 1 as long as each of ventrites 2-4 and subparallel-sided tibiae (not subtriangular).

***Rhizobactron marinae* Kirektshuk, sp. n.**

(Figs 8 and 9)

Etymology

The species is named in honour of the wife of the senior author, Marina V. Kirejtshuk.

Material

Holotype "NBS-4B" (Nabaa Es-Sukkar – Brissa outcrop), sex unknown; complete specimen with posterior end twice broken is included in a thin quadrangular piece of homogenous amber (3 mm long and 4 mm wide) with many small cracks along the underside of the specimen; the integument of the underside is not clearly visible because of a "milky cover" and cracks. The piece of amber was embedded with Canada Balsam between two round microscope cover slides. This fossil is the first insect to be described from the newly discovered Nabaa Es-Sukkar – Brissa outcrop: (Figs 1, 2) (see above).

Description

Holotype (male). Length 1.2, width 0.2, height about ? 0.1 mm. Elongate, rather convex dorsally and subflattened ventrally; unicolorous black; dorsum without a clear shine; underside somewhat shining; dorsum with dense, nearly inconspicuous and subrecumbent dark hairs and rather sparse and very conspicuous whitish scales; underside with only slightly conspicuous and fine pubescence. Punctation and sculpture of of body integument not clearly visible.

Head transversely subtriangular, slightly and evenly convex dorsally, somewhat longer than distance between moderately large eyes with moderately large facets;

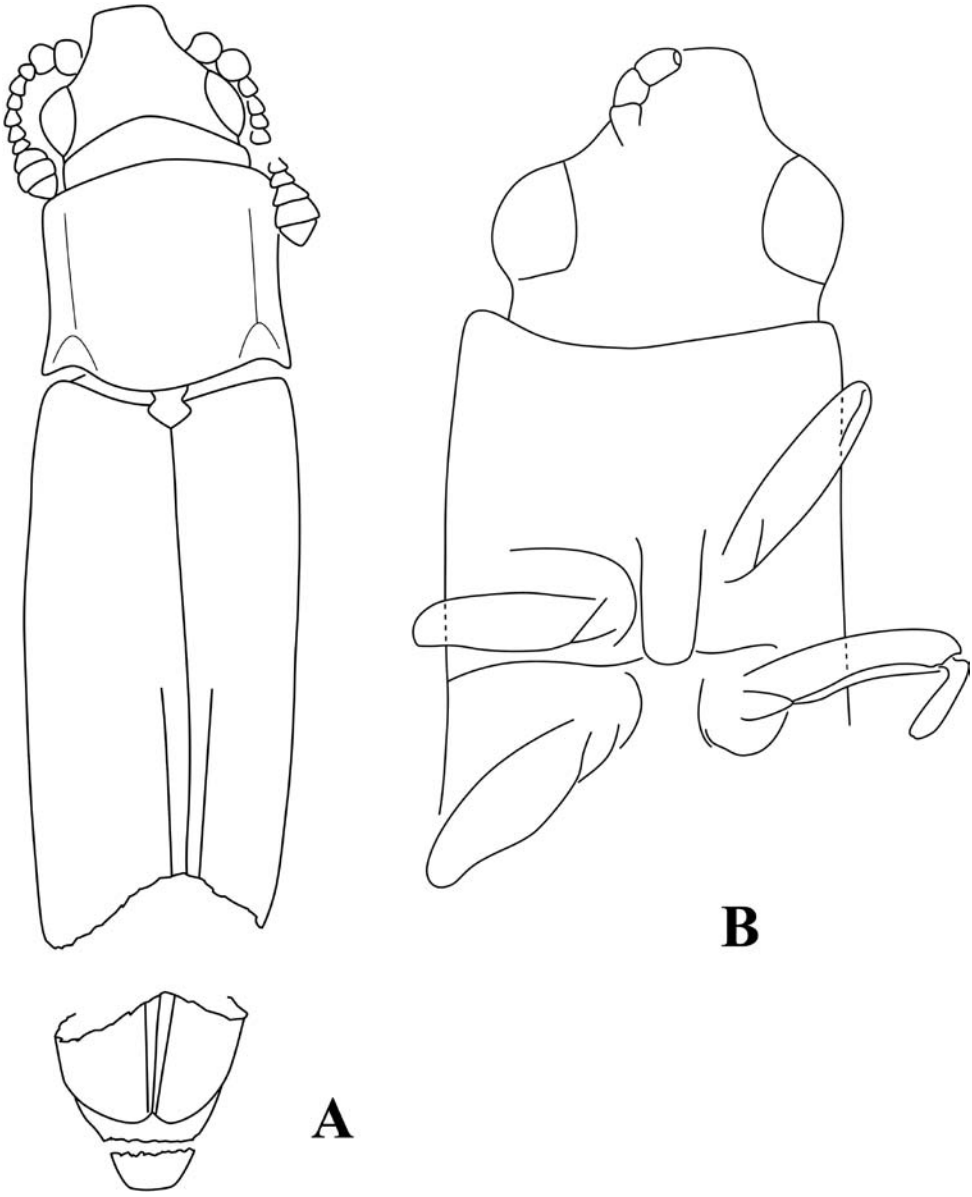

Figure 8. *Rhizobactron marinae* gen. et sp. n. (Monotomidae, Rhizophtominae), holotype. (A) Body, dorsal view. (B) Head and prothoracic segment, ventral view. Length of specimen = 1.2 mm.

distance between the eyes about three times as great as transverse diameter of one eye; antennal insertions located at anterior edge of frons and covered with a dilatation of frons. Labrum, mentum and labial palpi not visible clearly. Ultimate maxillary palpomere less than twice as long as thick, subcylindrical to suboval. Antennae 11-segmented, with flagellum submoniliform, 3-segmented and not compressed antennal club; scape and antennomere 2 globular and largest, antennomeres 3-8 subconical and

slightly thickened apically; antennomeres 9 and 11 comparable in length, and antennomere 11 subspherical at apex. Pronotum subquadrangular, about as long as wide, slightly and evenly convex at disk and widely explanate along non-crenulate lateral carina; triangularly depressed area at each posterior angle; posterior angles very acute and rather projecting, anterior edge convex and posterior one bi-sinuate. Scutellum transverse, arrow-like and narrowed at base, with barely distinct apex. Elytra about 2.5 times as long as wide combined, rather convex along middle and steeply sloping at sides, subparallel-sided and arcuately oblique at apices, forming a small sutural angle, adsutural lines well expressed in distal half. Pygidium mostly exposed from under apices of elytra and very widely rounded to subtruncate at apex.

Eyes on underside somewhat larger than on dorsal side. Prosternum rather medially vaulted, its length before procoxae about 1.5 times as long as metaventrite; process moderately narrow and not projecting beyond posterior edge of prohypomera. Procoxal cavities transverse, closed posteriorly. Distance between procoxae subequal to that between metacoxae and apparently slightly less than that between mesocoxae, and ½ as great as the width of antennal club. Mesocoxae transversely suboval. Metaventrite slightly convex along the middle and without visible longitudinal suture or line, posterior edge between coxae angularly excised. Metepisterna apparently moderately narrow and gradually widening anteriorly. Abdominal ventrites 1-4 subequal in length; hypopygidium slightly longer and widely rounded at apex. Elytral epipleura extrenely narrow and apparently expressed only in anterior half.

Legs narrow and moderately long. Trochanters slightly elongate. Tibiae very thin and slightly longer than femora, subparallel-sided (not triangular), with sparse setae and distinct spurs. Femora apparently of usual configuration, thickest at the middle and at least 2.0-2.5 times as wide as corresponding tibiae. Tarsi about 3/5 as long as tibiae (metatarsus longer than pro- and mesotarsi), tarsomeres 1-3 narrowly lobed and short, tarsomere 4 about as long as previous ones combined, claws very long and thin, about as long as tarsomere 4.

Family Latridiidae Erichson, 1842

Subfamily Tetrameropsinae Kirejtshuk et Azar, 2008

Notes

This subfamily was proposed for one species with 4-segmented tarsi (*Tetrameropsis mesozoica* Kirejtshuk et Azar, 2008). The subfamily, in contrast to other groups of the family, is characterized by the not coarsely cellular dorsal integument, rather large eyes, rather long prosternal process, sharp ridges on mesoventrite isolating the median depression for reception of the apex of intercoxal process, not wide anterior part of frons, sharp ridge on metaventrite isolating the median part of the sclerite from lateral ones, comparatively large scutellum and deep adsutural lines on elytra. The second member described here also has 4-segmented tarsi and other mentioned characters are more similar to those of the type genus in the subfamily than to those in other

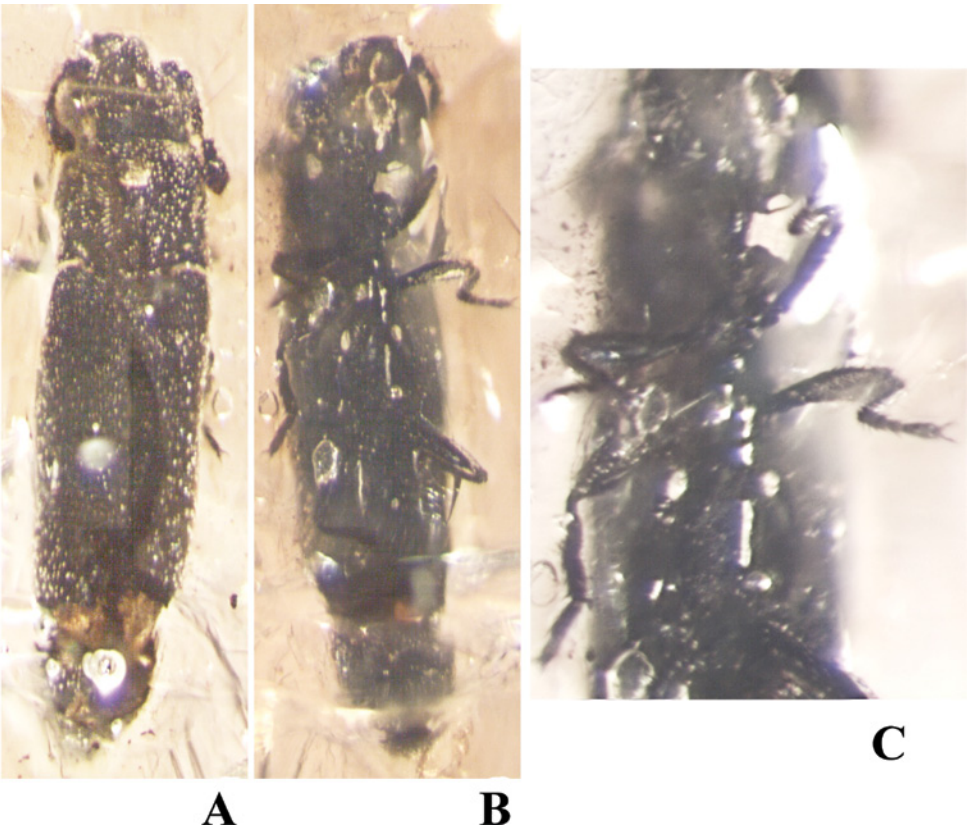

Figure 9. *Rhizobactron marinae* gen. et sp. n. (Monotomidae, Rhizophtominae), holotype. (A) Body, dorsal view. (B) Idem, ventral view. (C) Thorax and legs, ventral view. Length of specimen = 1.2 mm. This figure is published in color in the online version.

latridiids. All these peculiarities make it possible to regard the genera of this group as a separate family related to true Latridiidae.

Genus *Atetrameropsis* Kirejtshuk, gen. n.

Type species *Atetrameropsis subglobosa* sp. n.

Etymology

The name of the new genus is derived from the Greek negative prefix "*a*" and generic name "*Tetrameropsis*". The gender is feminine.

Diagnosis and comparison

This new genus differs from *Tetrameropsis* (another member of the subfamily) by having a more robust and subglobous body with denser and more conspicuous light pubescence, transverse and convex pronotum, subtrapezoid scutellum, cylindrical and

elongate ultimate maxillary palpomere, very wide prosternal process with truncate apex, convex metaventrite without depressions isolated by sharp ridges and lack of the oval window at base of the abdominal ventrite 1.

Atetrameropsis subglobosa Kirejtshuk, sp. n.

(Figs 10-11)

Etymology

The epithet of this new species means "globe-shaped", "globular", "spheric".

Material

Holotype, "474A" (Hammana – Mdeyrij outcrop), sex unknown; complete specimen is included in a thin irregular piece of homogenous amber (5 mm long and 3 mm wide) with one crack crossing the anterior half of the dorsum of the specimen. The integument of the specimen is not clearly visible because of a "milky" deposit. The piece of amber was embedded in Canada balsam between two quadrangular microscope cover slides.

Description

Body 1.1 mm long, 0.6 mm wide, about ? 0.4 mm high. Short oval, strongly convex at elytra and rather convex ventrally; chestnut dark brownish with brownish to reddish appendages; dorsum with some luster; dorsum with long, sparse and suberect hairs 1.5-2.0 times as long as distance between their insertions, hairs on elytra somewhat longer and becoming more conspicuous (yellowish to whitish); underside with shorter and less conspicuous hairs (not clearly visible because of "milky" cover). Punctation of integument not clearly visible because of milky cover, although on some parts of elytra are very large and sparse punctures with somewhat smoothed interspaces.

Head apparently somewhat longer than wide and flattened dorsally, somewhat declined ventrally, with very large eyes, distance between them nearly as great as width of individual eye; eyes very coarsely faceted. Mouthparts not visible clearly, although ultimate maxillary palpomere elongate and cylindrical. Antennae moderately long, about 1 and 1/3 as long as head wide at eyes; preapical antennomeres gradually increasing and ultimate antennomere largest (about twice as long as two previous ones combined). Pronotum subhexagonal (taking into consideration sublateral folds in the anterior part), transverse (about 1.5 times as wide as long), rather vaulted along the middle and moderately steeply sloping at widely subexplate sides, its anterior edge strongly convex and somewhat projecting anteriorly, posterior edge scarcely emarginate at sides of scutellum, anterior angles widely rounded, posterior angles nearly with indistinct top. Scutellum large, transverse and subtrapezoid. Elytra about 1.3 times as long as wide combined, strongly convex at disk and rather steeply sloping and slightly subexplanate along lateral edges, rather widening behind well raised shoulders till the

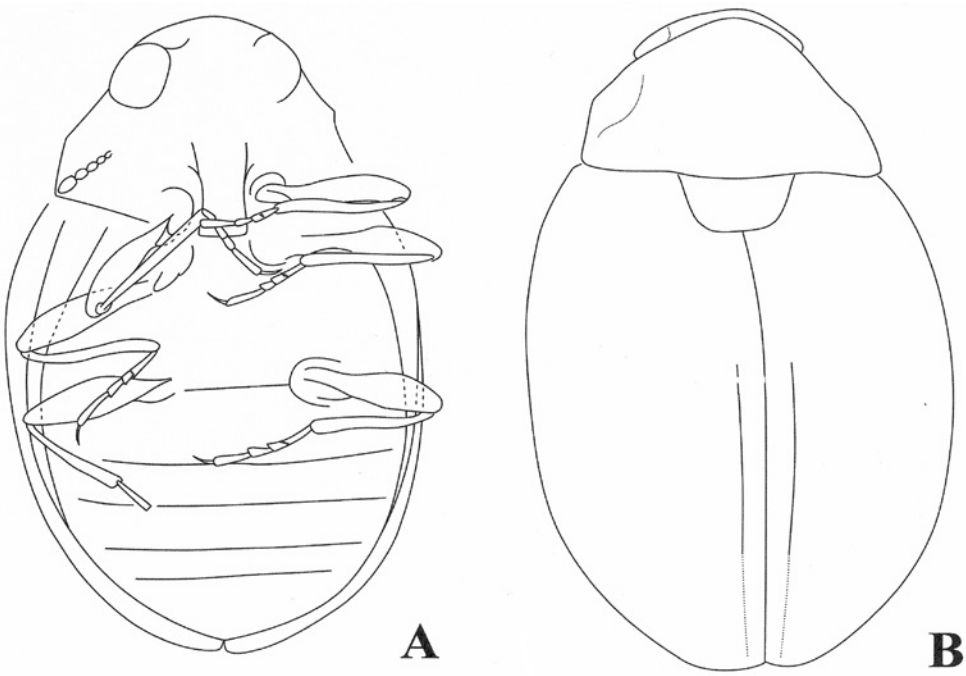

Figure 10. *Atetrameropsis subglobosa* gen. et sp. n. (Latridiidae, Tetrameropsinae), holotype. (A) Body, ventral view. (B) Idem, dorsal view. Length of specimen = 1.1 mm.

middle and then gently narrowing to subtruncate apices, adsutural lines well expressed at least in distal 2/3. Prosternum medially vaulted, its length before procoxae about 1/3 as long as metaventrite; process very wide, truncate at apex and far projecting beyond posterior edge of procoxae. Distance between mesocoxae slightly greater and that between metacoxae about 2.5 times as great as that between procoxae. Metaventrite slightly depressed in the middle and rectilinear posterior edge positioned between metacoxae. Abdominal ventrite 1 about as long as ventrites 2 and 3 combined, ventrites 2 and 3 subequal in length and each of them somewhat longer than ventrite 4, hypopygidium longest and widely rounded at apex. Epipleura of elytra very narrow, apparently elevated laterally and gradually narrowing posteriorly.

Trochanters of elongate type and extended. Tibiae very thin and longer than femora, sparsely covered with long setae. Femora about three times as wide as corresponding tibiae. Tarsi 4-segmented, tarsomeres 1 longest and slightly longer than tarsomere 4, tarsomeres 2 and 3 shorter; claws narrow, very long and slightly curved (nearly half as long as tarsomere 2).

Taxonomic notes

1. The subfamily Aphytocerinae Kirejtshuk, **subfam. n.** is proposed for the single genus *Aphytocerus* Zherichin, 1977 (type genus) known from the Upper Cretaceous

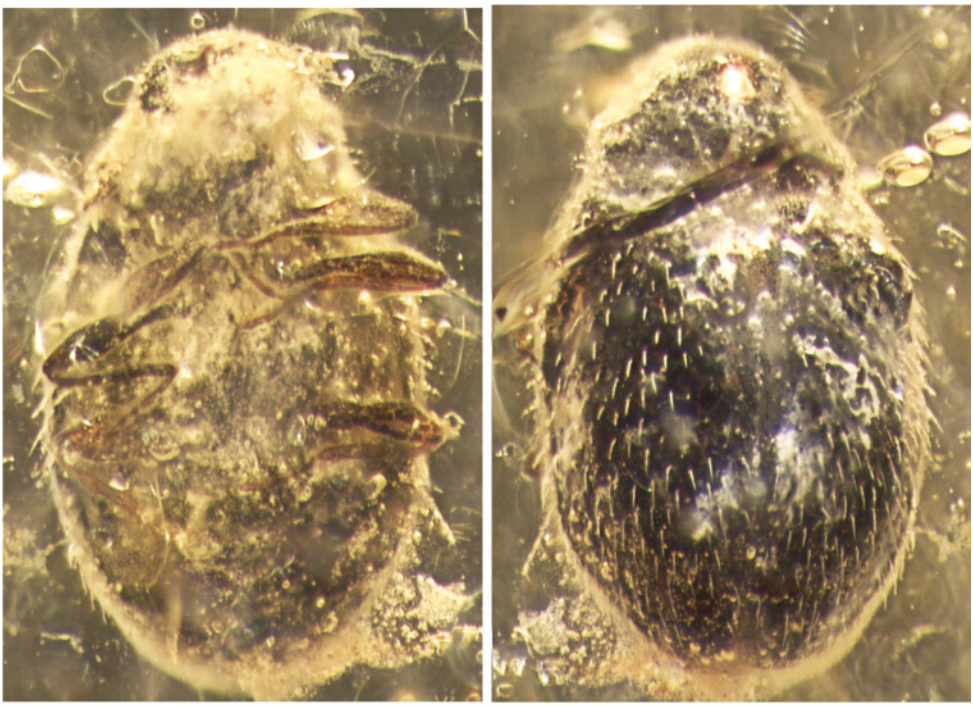

Figure 11. *Atetrameropsis subglobosa* gen. et sp. n. (Latridiidae, Tetrameropsinae), holotype. (A) Body, ventral view. (B) Idem, dorsal view. Length of specimen = 1.1 mm. This figure is published in color in the online version.

Taimyr amber, which differs from the subfamily Cerophytinae sensu str. by having a smaller body-size, the head retracted into the prothoracic segment, 10-segmented antennae, extremely large eyes with emarginate anterior edges (distance between their underside edges is clearly less than the transverse diameter of the eyes). See also Zherichin (1977) Kirejtshuk and Azar (2008) and Chang et al. (2011a).

2. The new genus *Baissopsis* Kirejtshuk, gen. n. (type species *Baissophytum amplus* Chang, Kirejtshuk et Ren, 2011) differs from all genera of the family Cerophytidae in the narrowly separated metacoxae (not conjoining) and diffuse fine punctation between longitudinal striae of elytra. Besides, this new genus is characterized by the comparatively robust body and expressed femoral plates in median part of the metacoxae. It is also distinct from *Baissophytum* Chang, Kirejtshuk et Ren, 2011 in the transverse pronotum, wider elytra (less than twice as long as wide combined) and moderately separated mesocoxae. *Etymology*: The generic name is formed from the name of the locality with outcrop of origin of the specimen (Baissa – Buryatya, Transbaikalia, Russia) and Greek "ὄψις" (resembling a (specified) thing).
3. The family Lasiosynidae Kirejtshuk, Chang, Ren et Shih, 2010 was proposed for some Jurassic genera with some characters similar to those in Ptilodactylidae and

others reminiscent of those in Eulichadidae Crowson, 1973, as well as characters shared with other byrrhoids (see more details in Kirejtshuk et al., 2010). Further study of Mesozoic and Cenozoic fossil representatives of this group showed a certain trend in variation of the diagnostic characters, and in particular a disappearance of the metakatepisternal sutures in later fossil members (Yan et al., 2012) to a completely eulichadid habitus in a specimen from the Oligocene of Biamo (Primorsky Kray; Russian Far East) that lack the mentioned sutures (Kirejtshuk and Yan, in preparation). Thus, this diagnostic character that is used also for discrimination of recent Ptilodactylidae and Eulichadidae looses its significance in fossils. At the moment, the group of comparably large fossil species with mostly eulichadid appearances can best be united with recent members of Eulichadidae. Moreover, because true Ptilodactylinae already existed in the Lower Cretaceous (see above), divergence of both Eulichadidae and Ptilodactylidae seemed to happen before the Cretaceous. However the genera *Lasiosyne* Tan, Ren et Shih, 2007 and *Bupredactyla* Kirejtshuk, Chang, Ren et Shih, 2010 with the slender and apparently more convex body, pronotum narrowed at base (not characteristic of either Ptilodactylidae and Eulichadidae) and the necked and rather prognathous head not so declined ventrally as in other eulichadids (and, therefore, rather different from many groups of both mentioned families) are quite distinct among these two groups and among byrrhoids in general. The more or less clear emargination at base of the lateral elytral edge (similar to that in buprestids) seem to be more characteristic of these two genera than most eulichadids. Thus, these two genera could be included in the separate subfamily Lasiosyninae **stat. n.**, while the rest of the Mesozoic genera of this group (*Mesodascilla* Martynov, 1926; *Tarsomegamerus* Zhang, 2005; *Brachysyne* Tan et Ren, 2009; *Anacapitis* Yan, 2009; *Parelateriformius* Yan et Wang, 2010 and *Cretasyne* Yan, Wang et Zhang, 2013 initially regarded in Lasiosynidae) would be better tentatively to regard as members of the subfamily Eulichadinae **sensu n.**, although they or part of them could be joined in a separate extinct subfamily or tribe after further study. The species of the genera *Artematopodites* Ponomarenko, 1990; *Dzeregia* Ponomarenko, 1985 and *Glaphyropteroides* Handlirsch, 1906 known only by separate elytra and recently included in the "family" Lasiosynidae (Yan et al., 2013) should be regarded without family attribution as Elateriformia incertae sedis because the type of elytra, which is characteristic of these three genera, could be expected in different family groups of both superfamilies Elateroidea and Byrrhoidea Latreille, 1804.

4. The synonymy *Anacapitis* and *Brachysyne* was proposed by Kirejtshuk et al. (2010), however the further study of additional specimens of probable *Mesodascilla jakobsoni* Martynov, 1926 (the holotype of this species seems to be lost) confirmed its rather considerable similarity with the species included in the two first taxa, and, therefore, the relation between all of them or synonymy should be re-estimated after designation of the neotype for *M. jakobsoni* and redescription of it. The main differences between *Mesodascilla* and the mentioned "genera" consist in somewhat different outline of their head and pronotum (Kirejtshuk in preparation).

Recently the genus *Cretasyne* was proposed for two species from Liaoning (Yixian Formation) of Inner Mongolia which are very similar to species of three mentioned genera, demonstrating, however, somewhat more widened tarsi. Finally, genus *Mesaplus* Hong, 1983 described in Triaplidae Ponomarenko, 1977 (Hong, 1983) seems to be very similar to the mentioned taxa (unless to *Tarsomegamerus* and *Parelateriformis*). Therefore, the correct systematic position of all species included in these five taxa could be clarified after redescription of the type species of *Mesodascilla* and *Mesaplus*.

5. The original descriptions and drawings of *Tarsomegamerus* and *Parelateriformis* (both from the Middle Jurassic of Daohugou) in the publications where they were proposed (Zhang, 2005; Yan and Wang, 2010) are quite different, although the pictures of imprints of the holotypes accompanying these descriptions demonstrate an essential similarity of them. Besides, the descriptions of the different species of the "genus" *Parelateriformis* show a complete syndrome of characters for *Tarsomegamerus* which can be summarized from the original pictures of the holotype of *Tarsomegamerus mesozoicus* Zhang, 2005 (type species of the genus) in the paper of Zhang (2005) and the pictures of this specimen on the WEB-site <http://www.zin.ru/animalia/Coleoptera/eng/tarsom_g.htm> or <http://www.zin.ru/animalia/Coleoptera/rus/tarsom_g.htm> by published by Kirejtshuk (2010). Thus, the new diagnosis of the genus *Tarsomegamerus* Zhang, 2005 (= *Parelateriformius* Yan et Wang, 2010, **syn. n.**):

Body elongate oval and medium-sized or large (within 10 and 30 mm); integument with subuniform and very coarse sculpture, extremely densely punctured; pubescence fine and short or not visible; head (sub) prognathous and partly retracted into prothorax; mandibles moderately large and arcuate at outer edge; eyes moderately large both dorsally and ventrally; labrum moderately short and transverse; antennae rather long 11-segmented, (sub)filiform to (sub)serrate; pronotum somewhat transverse, widest at base, not or slightly narrower than elytral base, crenulate along base, anterior angles rounded and not projecting anteriorly, posterior angles sharp and extending lateroposteriorly; elytra with subacute apices and 11 striae with adsutural striae complete; ultimate labial and maxillary palpomeres medium-sized; mentum moderately large and subquadrangular; gular sutures distinct and rather widely separated; prosternum markedly longer than procoxae with process moderately narrow and not far extending on mesoventrite; procoxae widely transverse and open posteriorly; mesocoxae moderately to narrowly separated; metacoxae transverse with femoral plates slightly to moderately developed only in median part of coxae; tarsi five-segmented with widely lobed at least tarsomeres 2 and 3 (or 1-4, 2-4 or 1-3).

This genus is distinct from other Mesozoic members of the subfamily in the very widened tarsi and from the recent one, i.e. *Eulichas* Jacobson, 1913 (including *Furticulichas* Jäch, 1995) and *Stenocolus* Leconte, 1853 in the expressed katepisternal sutures of the metaventrite, more regular striae on elytra and comparatively long prosternum.

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