

Ignotingidae fam. nov. (Insecta: Heteroptera: Tingoidea), the earliest lace bugs from the upper Mesozoic of eastern China

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Abstract

An extinct new family of lace bugs, Ignotingidae, with one new genus and species, *Ignotingis mirifica*, is described from the Laiyang Formation (terminal Jurassic or basal Cretaceous) in Laiyang, Shandong, China. The homology of hemelytral veins in Tingoidea and the position of the superfamily within Cimicomorpha are discussed.

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1. Introduction

The lace bug family Tingidae Laporte, 1833 comprises about 250 extant genera and 2600 species of small phytophagous bugs living on angiosperms (mainly on woody dicots, some feeding on tree roots or making flower galls) and mosses and distributed worldwide (Schuh and Slater, 1995). A closely related Neotropical group with two described extant genera and five species of eyeless, coleopteroid, flightless myrmecophilous inquilines was established as the family Vianaididae Kormilev, 1955, but later often treated as a subfamily of Tingidae s.l.; flying macropterous vianaidids are known but not yet formally described (Schuh and Slater, 1995). Two subfamilies, Cantacaderinae Stål, 1873 (with tribes Cantacaderini and Phatnomatini) and Tinginae (with three tribes), are usually recognized within the Tingidae s.s. (Froeschner, 1996). Recently it was proposed to split the former subfamily because

it is paraphyletic, and to raise Cantacaderini to full family status and Phatnomatini to a subfamily of the Tingidae (Lis, 1999), but this classification is not widely accepted and not referred to further herein.

Some 20 genera (ten of them extinct) and more than 30 species of Tingidae s.s. have been recorded from the Cenozoic, about ten of these species from Baltic amber (Golub and Popov, 1999, 2002; Wappler, 2003). Two extinct genera of macropterous Vianaididae are known from Late Cretaceous New Jersey amber (Golub and Popov, 2000, 2003). The oldest tingoids, found in Early Cretaceous deposits of Mongolia (Bon-Tsagaan Group, Aptian?) and Transbaikalia (Baissa locality, Zaza Formation, dated as Berriasian–Hauterivian), were assigned to the genera *Golmonia* Popov, 1989 (Golmoniini, possibly deserving subfamily rank) and *Sinaldocader* Popov, 1989 (Phatnomatini; Popov, 1989).

A rich entomofauna from the Laiyang Formation, Shandong, eastern China is dated as latest Jurassic (late Tithonian) or earliest Cretaceous (Berriasian) (Zhang, 1992, 1999, 2000; Zhang and Zhang, 2003; Zhang and Rasnitsyn, 2004) and is similar to the faunas known from the Yixian and Zaza formations (Zhang and Rasnitsyn, 2004). Thousands of insect fossils

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represent 14 orders, and owing to the excellent preservation even tiny specimens may be studied in considerable detail (Hong and Wang, 1990), although the systematic positions of many taxa need to be reassessed. The most abundant species are those living in or near water at least when immature, such as the beetle *Coptoclava longipoda* Ping, 1928 and the midge *Chironomaptera gregaria* Grabau, 1923.

True bugs are very common in the Laiyang assemblage. Extremely numerous is the shore bug *Mesolygaeus laiyangensis* Ping, 1928 belonging to an extinct subfamily Enicocorinae Popov, 1980 (= Mesolygaeidae Zhang, 1989, 1991; Hong and Wang, 1990) of the family Saldidae (Shcherbakov and Popov, 2002); its very long tarsi indicate that it inhabited swamps near the ancient Laiyang lake, or floating plants, like primitive groups of extant Gerromorpha. Other waterside inhabitants are velvety shore bugs (Ochteridae). Water bugs are represented by the backswimmer *Clypostemma xyphiale* Popov, 1964 (Notonectidae) and several corixid species. Terrestrial bugs are quite diverse, including various coreoids in the broadest sense, pentatomoids, mirid- and anthocorid-like forms. One of the most important finds is a series of bizarre long-legged lace bugs that can be placed in neither the Tingidae nor the Vianaididae. They are described below in a family of their own. This is the earliest fossil record of the superfamily Tingoidea.

2. Systematic palaeontology

Order: Heteroptera Latreille, 1810

Infraorder: Cimicomorpha Leston, Pendergrast and Southwood, 1954

Superfamily: Tingoidea Laporte, 1833

Family: Ignotingidae fam. nov.

Diagnosis. Body not dorsoventrally depressed; head and thorax coarsely punctate. Antennae very long, four-segmented, third segment longest, second much longer than first. Head rather large, vertical, hypognathous (rostrum inserted on ventral surface of head), shorter than wide, without protruding mandibular plates or prominent bucculae. Rostrum thick and moderately long, directed caudally but not appressed to body venter, movable at base. Pronotum with areolate dorsal projection and paranota, expanded onto mesonotum leaving scutellum free. Thoracic sternal laminae absent. Hemelytron: corium and clavus areolate between strong veins; corium continued up to hemelytral apex, with several cells; no costal fracture; R+M strongest vein; clavus large, triangular, commissura clavi long; posterior claval vein submarginal; membrane (zone of hemelytral overlap) not areolate, long and narrow. Rotatory hind coxae more widely separated than mid and fore ones. Legs very long; all tibiae with small apical fossula spongiosa; tarsi short, three-segmented. Second–third abdominal sternites fused. Pygophore symmetrical, parameres directed dorsocaudad. Lacinate ovipositor not concealed by paratergites. (For comparison see “Discussion” below).

Ignotingis gen. nov.

Derivation of name. Latin, *ignotus*, unknown, and the extant genus *Tingis* (gender feminine).

Species included. The type species only.

Diagnosis. Small bugs with very long, slender antennae and legs (not unlike Berytidae). Body not dorsoventrally depressed (thorax excluding pronotal projection as high as long). Head and thorax heavily punctate, dorsum areolate. Antennae originate near lower eye margin, first segment stoutest and shortest, second nearly twice as long as the first, slightly thickened apically, third most slender and longer than three remaining combined, fourth slender, slightly fusiform, longer than second. Head much shorter than high, weakly arcuately produced in front of eyes, without antennal tubercles or other projections, its upper surface declivous; ocelli not traceable; eyes rather small, ovoid, protruding, not far from posterior head margin; head narrowed behind eyes. Rostrum reaching base of abdomen, four-segmented: first–second segments quite wide, third–fourth much narrower, short and more sclerotized, first elongate, second longest, longer than third and fourth combined. Pronotum with moderately narrow collar, rounded lateral margins and nearly straight posterior margin, covering mesonotum (except for small triangular scutellum), with a high, crest-like dorsomedial projection (semicircular in profile) and rather narrow paranota (maybe deflected dorsad or swollen). Hemelytra macropterous, with raised main veins, narrow precostal area (“costal area” of authors; for the vein homology and nomenclature see below), no stenocostal area, three large costal cells along anterior margin from base up to apex of hemelytron (in so-called “subcostal area”), three discal cells (inner smallest) in addition to oblong basal cell (four latter cells together correspond to “discoidal area”) and two narrow cubital cells, which together correspond to proximal extension of “sutural area” [anterior cubital cell between CuA and CuP (= claval furrow) and posterior cubital cell between CuP and Pcu (= 1A of authors)]; C (“hypocostal vein”) terminating just beyond apex of distal costal cell; “discoidal area” beyond claval apex wider than “subcostal” one; clavus one-third length of hemelytron; areolation irregular, extended up to base of distal costal cell and three-quarters of distal discal cell. Fore and mid coxae rounded triangular, narrowly separated, hind coxae rotatory, set apart for more than their diameter. Femora slightly clavate distally. All tibiae long, with apices almost twice as wide as bases, apices (ventral to insertion of tarsus) truncate, slightly oblique and concave, and marked with golden tinge, representing a pad of modified setae (fossula spongiosa); tarsi almost invariably preserved nearly at right angles or even at an acute angle to the tibia; tibial modification is more obvious in males; first tarsal segment shortest, third longest. Abdomen not reaching hemelytral apices (in some male specimens extended post-mortem), its sternites short, more sclerotized in their anterior zone, second–eighth (males) or second–seventh (females) nearly equally developed, fifth widest; second and third not separated by dark intersegmental line. Pygophore broad and short, barrel-shaped, parameres

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