



Two new species of soldier beetles (Coleoptera, Cantharidae), the first from the tribe Silini in Dominican amber

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Abstract

The Silinae is the most frequently observed subfamily of soldier beetles (Insecta, Coleoptera, Cantharidae) living today in Hispaniola (the Dominican Republic and Haiti). This subfamily also was recently found in Dominican amber with the discovery of the genus *Tytthonyx* (Silinae, Tytthonyxini). Here we describe and illustrate two new species of this subfamily—the first representatives of the tribe Silini and genus *Silis* in Dominican amber. *Silis* (*s. str.*) *hegnai* sp. nov. and *Silis* (*s. str.*) *curleri* sp. nov. are easily distinguishable from extinct species of *Silis* as well as those living in Hispaniola today.

Key words: soldier beetles, Cantharidae, *Silis*, new taxa, paleoentomology, Miocene, fossil resin

Introduction

Within the Cantharidae, the subfamily Silinae is widespread, with many genera found on all continents except Antarctica (Delkeskamp 1977; Kazantsev & Brancucci 2007). In Hispaniola, in both the Dominican Republic and Haiti, the subfamily Silinae is abundant and the species are placed in two tribes: Tytthonyxini and Silini (Perez-Gelabert 2008). The tribe Tytthonyxini has been the subject of much debate. It has characters in common with the subfamilies Malthininae and Silinae, but it was attributed to the latter subfamily (as *incertae sedis*) in major taxonomic revisions (Brancucci 1980; Wittmer 1991b, 1992; Ramsdale 2002). The tribe Silini has been less controversial. Within the Silini, four genera are present in Hispaniola: *Polemium* LeConte, 1851; *Silidiscodon* Leng & Mutchler, 1922; *Tylocerus* Dalman, 1823; and *Silis* Charpentier, 1825 (Perez-Gelabert 2008). *Silis* is widely distributed in Holarctic and is particularly common in the Neotropical region. However, it is likely that the genus is paraphyletic, and therefore that the species of the two regions belong to different genera with an unclear phylogenetic relationship. Approximately 200 species are present in Central and South America, including Antilles (Delkeskamp 1977; Constantin 2009, 2010, 2012, 2017). In Hispaniola, *Silis* is well represented and 17 species have been recorded: Twelve belong to the nominotypical subgenus and five to the subgenus *Hapalocrosilis* Pic, 1916 (Wittmer 1955, 1956, 1957, 1991a, 1998).

In the fossil record, representatives of the tribe Silini have been found in Baltic amber (Fanti & Pankowski 2018; Parisi & Fanti 2019; Kazantsev 2020), the Florissant Formation (Colorado, USA) and the argillaceous limestone of the Tertiary strata of Aix-en-Provence, France (Fanti 2017). There was also a recent discovery of the tribe Tytthonyxini in Dominican amber (Poinar & Fanti 2016; Fanti & Damgaard 2019). Although *Silis* is widespread today, the genus is only known in Eocene Baltic amber from one species (Parisi & Fanti 2019) and from three specimens determined at the generic level, *Silis* sp. (Klebs 1910; Bachofen-Echt 1949), as well as one species from Miocene Mexican amber (Wittmer 1963). Here we describe the first specimens of the tribe Silini and the genus *Silis* in Miocene Dominican fossil resin.

Materials and methods

The inclusions were found in amber from the Dominican Republic. They were discovered in the Cordillera Septentrional mining area near Santiago de Los Caballeros. The age of Dominican amber has been somewhat controversial, but it is usually referred to the Miocene, roughly 15-20 million years ago (Iturralde-Vinent & MacPhee 1996, 2019; Iturralde-Vinent 2001; Solórzano Kraemer 2007).

The specimens were pre-polished to evaluate the content, and then cut and shaped using a thin diamond blade. The final grinding was done manually. The specimens were then photographed using a Fujifilm XT2 camera with an external monitor. Post processing was done with Helicon Focus software to render the stacks, and the images were edited with Photoshop. The plates were created using PhotoImpact Viewer SE software. The specimens were donated to the Museum of Comparative Zoology at Harvard University in Cambridge, Massachusetts (USA).

Systematic treatment

Family Cantharidae Imhoff, 1856

Subfamily Silinae Mulsant, 1862

Tribe Silini Mulsant, 1862

Genus *Silis* Charpentier, 1825

Subgenus *Silis* Charpentier, 1825

Silis (Silis) hegnai FANTI & M. G. PANKOWSKI sp. nov.

(Figs. 1–2)

Description. Adult. Male winged, with large and elongated lateral lobes of the pronotum. Head and antennae blackish, pronotum and scutellum testaceous (probably yellow or red in life), elytra dark brown, legs brown. Body length: about 9.3 mm; elytra: 6.0 mm.

Head large, transverse, as wide as pronotum, slightly restricted and rounded behind the eyes, finely punctate and pubescent, partially covered by pronotum. Eyes sub-elliptical and strongly protruded, convex, inserted in upper and lateral part of head. Mandibles falciform. Maxillary palpi 4-segmented, palpomeres unequal in length with last palpomere strongly elongate and slightly securiform. Labial palps 3-segmented with last palpomere securiform. Antennae inserted in frons and away from eyes, reaching back to half of elytra, 11-segmented, filiform, all antennomeres wrinkled and covered with sparse setae; scape elongate, club-shaped; antennomere II (pedicel) short, approximately 1.5 times shorter than scape, thinner than scape and slightly thinner than the others; antennomere III slightly longer than second; antennomeres IV–VIII robust, slightly longer than antennomere III; antennomeres IX–X shorter than previous ones; antennomere XI filiform, oblong, with rounded apex. Pronotum almost as long as wide, surface undulating and thickened in the central disc, with semi-erect long setae and with small rugosity; margins and sides flat, anterior margin strongly rounded, posterior margin slightly rounded especially near the corners, sides with a kind of two lobes with a large groove in the middle of these. Scutellum triangular-shaped with pointed apex. Elytra wider than pronotum, elongate and reaching the last abdominal segments, parallel-sided, with slightly wrinkled microsculpture and some semi-erect setae, apex strongly rounded. Posterior wings almost completely covered by elytra. Metasternum sub-quadrate with undulating posterior margin; abdominal segments robust, transverse and pubescent; last tergite broad and rounded; last ventrite elongate, triangular-shaped and deeply divided forming two halves, with apex rounded. Legs slender and pubescent; coxae short and robust; trochanters robust with rounded apex; femora enlarged and almost straight; tibiae cylindrical, pro- and mesotibiae slightly shorter than pro- and mesofemora, metatibiae as long as metafemora, with an apical spur. Tarsal formula 5-5-5; first tarsomere very elongate; second tarsomere shorter than first; third tarsomere shorter and sturdier than tarsomere II; fourth tarsomere deeply bilobed at sides; fifth tarsomere elongate, slender and curved; proclaws with a small obtuse basal tooth, meso- and metaclaws simple without basal tooth. Female unknown.

Etymology. Species named after Dr. Thomas A. Hegna for his many contributions to paleontology and his selfless dedication to helping students succeed.

Holotype. Male, adult specimen in a Dominican amber piece: Catalog number MCZ:Ent:PALE-43616, in the Museum of Comparative Zoology (MCZ) at Harvard University.

Type locality. The Cordillera Septentrional mountain range in the Dominican Republic, from the “Los Bra-chos” mine in the mining area known as “La Cumbre.”

Type horizon. Late Early/Middle Miocene; 15–20 million years ago (mya), probably close to 16 mya. La Toca Formation.

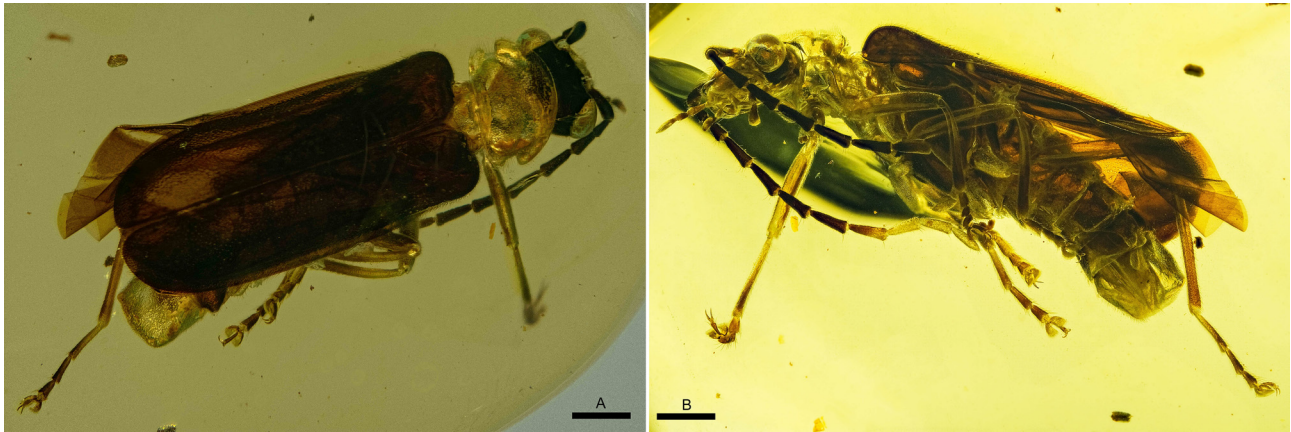


FIGURE 1. *Silis (Silis) hegnai* sp. nov. in Dominican amber. A: Holotype, dorsal view, scale bar = 1.0 mm. B: Holotype, ventral view, scale bar = 1.0 mm.

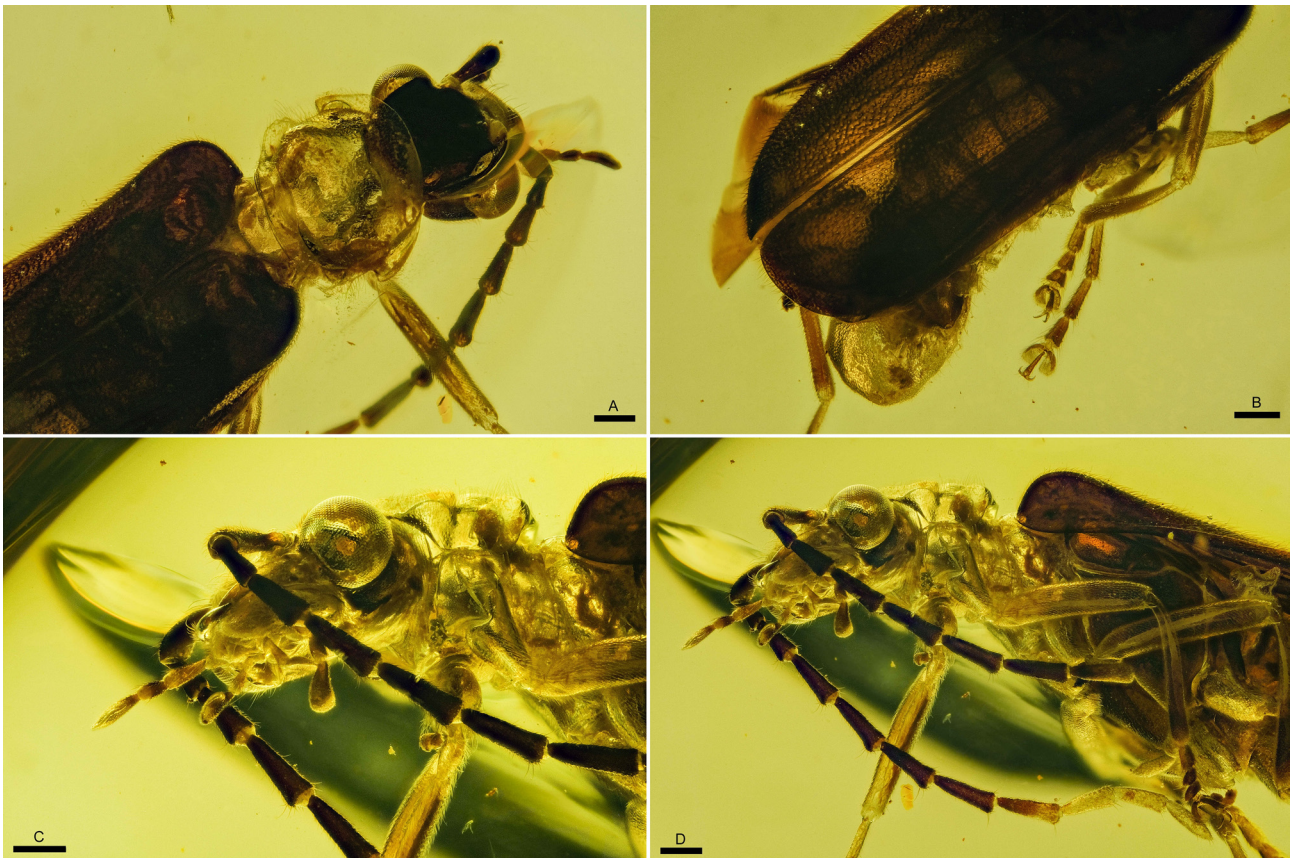


FIGURE 2. *Silis (Silis) hegnai* sp. nov. in Dominican amber. A: Holotype, detail of head, and pronotum, scale bar = 0.5 mm. B: Holotype, detail of elytral apex, scale bar = 0.5 mm. C: Holotype, detail of head and palps, scale bar = 0.5 mm. D: Holotype, detail of antennae, scale bar = 0.5 mm.

Syninclusions. Detritus and plant remains, a few air bubbles, an unidentified insect and an insect leg.

Systematic placement. The last maxillary palpomere securiform, the pronotum with lateral lobes/ apophyses, the abdomen with only eight visible urites, the elongated elytra, and meso- and metatarsal claws simple and without basal tooth, place this new species in the subfamily Silinae and the genus *Silis* (Brancucci 1980; Ramsdale 2002; Constantin 2009, 2017). Its large size and the lateral margin of its pronotum without a minute glandular tuberosity also place *Silis hegnai* **sp. nov.** in the nominotypical subgenus *Silis* (Constantin 2009).

Differential diagnosis. *Silis flavofemorata* Wittmer, 1991 from the Dominican Republic is morphologically similar—albeit only vaguely—to *Silis hegnai* **sp. nov.** The new species shows a kind of broad concavity between the two lateral lobes that is not present in *Silis flavofemorata* (Wittmer 1991a). Furthermore, *S. flavofemorata* is smaller in size: 6–7 mm (Wittmer 1991a). The only other *Silis* found in Miocene deposits is *Silis chiapasensis* Wittmer, 1963 from Mexican (Chiapas) amber (Wittmer 1963). *S. chiapasensis* differs from *Silis hegnai* **sp. nov.** by the former species' more transverse pronotum and the presence of a spine on each side, as well as for its considerably smaller body size than *Silis hegnai* **sp. nov.**

Remarks. The amber piece is extremely transparent, measures 20.7 x 15.6 x 6.2 mm and weighs 1.08 grams. The inclusion is complete and perfectly visible.

Silis (Silis) curleri* FANTI & M. G. PANKOWSKI **sp. nov.*

(Figs. 3–4)

Description. Adult. Male winged, with elongated lateral lobes and spines of pronotum. Head, elytra and antennae brown-dark brown; pronotum and legs brown. Body length: about 6.4 mm; elytra: 5.0 mm.



FIGURE 3. *Silis (Silis) curleri* **sp. nov.** in Dominican amber. A: Holotype, dorsal view, scale bar = 1.0 mm. B: Holotype, dorsal view (black/white), scale bar = 1.0 mm.



FIGURE 4. *Silis (Silis) curleri* sp. nov. in Dominican amber. AB: Holotype, ventral views, scale bars = 1.0 mm. C: Holotype, detail of head, pronotum, and elytra (humeral zone), scale bar = 1.0 mm. D: Holotype, detail of head, pronotum (ventral view), and metasternum, scale bar = 1.0 mm.

Head large, transverse, narrower than pronotum, narrow and rounded behind the eyes, almost smooth and finely pubescent, partially covered by pronotum. Eyes roundish and strongly protruded, convex, inserted in the upper and lateral part of the head occupying the major part of the sides. Mandibles falciform, slender. Maxillary palpi 4-segmented, palpomeres unequal in length with the last palpomere strongly securiform. Labial palps 3-segmented. Antennae inserted in the frons and away from the eyes, long, almost reaching the elytral apex, 11-segmented, filiform, all antennomeres wrinkled and covered with sparse setae; scape elongate, club-shaped; antennomere II (pedicel) short, approximately 1.2 times shorter than scape, robust; antennomere III very slightly shorter than second; antennomeres IV-IX filiform, longer than antennomere III and approximately as long as scape; antennomere XI filiform, oblong, with rounded apex. Pronotum transverse, surface almost flat, with long, erect setae and with small rugosity; anterior margin strongly rounded, posterior margin almost straight, sides with two lobes, anterior lobe elongate and arcuate and thinner apically with the tip rounded, posterior lobe very broad, spine inserted under the posterior

lobe and curved and very long and thin apically, groove between the two lobes narrow and rounded. Scutellum triangular-shaped with truncated or slightly rounded apex. Elytra almost as wide as pronotum, elongate, leaving the last abdominal segment uncovered, parallel-sided, with slightly wrinkled microsculpture and semi-erect setae, apex strongly rounded. Posterior wings almost completely covered by elytra. Metasternum sub-quadrate with posterior margin almost straight; abdominal segments robust, transverse and pubescent; last tergite broad with a central groove; last ventrite elongate, triangular-shaped and deeply divided forming two halves, with apex rounded. Legs long, slender and pubescent; coxae short and robust; trochanters elongate with rounded apex; femora enlarged and almost straight; tibiae cylindrical, protibiae shorter than profemora, mesotibiae as long as mesofemora, metatibiae slightly longer than metafemora. Tarsal formula 5-5-5; first tarsomere robust, elongate; second tarsomere shorter than first; third tarsomere triangular-shaped; fourth tarsomere deeply bilobed at the sides; fifth tarsomere elongate, slender and curved; claws simple without basal tooth. Female unknown.

Etymology. Species named after Dr. Gregory R. Curler for his numerous contributions to entomology and his great generosity in sharing his knowledge with students.

Holotype. Male, adult specimen in a Dominican amber piece: Catalog number MCZ:Ent:PALE-43617, in the Museum of Comparative Zoology (MCZ) at Harvard University.

Type locality. The Cordillera Septentrional mountain range in the Dominican Republic, from the “Montearachi” mine in the “Los Cacaos” mining area.

Type horizon. Late Early/Middle Miocene; 15–20 million years ago (mya), probably close to 16 mya. La Toca Formation.

Syninclusions. Detritus and plant remains, air bubbles, a spider, some unidentified dipterans and a coleopteran.

Systematic placement. The securiform last maxillary palpomere, the pronotum with lateral lobes/apophyses, the abdomen with only eight visible urites, the elongated elytra, and meso- and metatarsal claws simple and without basal tooth place this new species in the subfamily Silinae and the genus *Silis* (Brancucci 1980; Ramsdale 2002; Constantin 2009, 2017). The lateral margin of the pronotum without minute glandular tuberosity also places *Silis curleri* **sp. nov.** in the nominotypical subgenus *Silis* (Constantin 2009).

Differential diagnosis. A living species present in Haiti, *Silis debililimbata* Wittmer, 1991, appears extremely similar to *Silis curleri* **sp. nov.**, both for its similar body size and the shape of its pronotum (Wittmer 1991a). *Silis curleri* **sp. nov.**, however, has a slightly longer and thinner anterior lobe, and a slightly shorter, stockier and more curved posterior spine, as well as a broader concavity at the posterior margin near the spine. The only *Silis* found so far in Miocene deposits is *Silis chiapasensis* Wittmer, 1963 from Mexican (Chiapas) amber (Wittmer 1963). It differs from the new species by its more transverse pronotum and the different shape of its lobes and spines, as well as its smaller body size.

Remarks. The amber piece is transparent, measures 46.4 x 29.2 x 13.8 mm and weighs 10.558 grams. The inclusion is easily visible, and only the beetle’s right antenna is missing.

Discussion

The genus *Silis* is quite widespread. It is also exceptionally variable, so *Silis* can sometimes be difficult to distinguish from related genera such as *Polemium* in South America (Constantin 2009). Furthermore, in the Neotropical region, the genus is distinctly thermophilic, with few species living at high altitudes on mountains. Meanwhile, it is hygrophilous in Europe, and frequently found on mountains in California (Parisi & Fanti 2019). Studies of fauna found in Dominican and Mexican (Chiapas) amber indicate a forest environment, possibly in a mangrove region, in coastal areas (Solorzano Kraemer 2007; Poinar 2010), as it still is in the Caribbean today. In fact, most of the species living today in Central and South America prefer these warm coastal forests. However, *Silis* remains a problematic genus with several European and Oriental species, originally described in this genus, that have been transferred to other genera, such as *Asiosilis*, *Podosilis*, *Hoosilis*, *Sphaerarthrum* and *Mimopolemium* (Geiser 2013). Furthermore, the New World species currently classified in *Silis* are quite different from the type species *Silis ruficollis* (Fabricius, 1775) from Europe, West Siberia and Kazakhstan (Kazantsev & Brancucci 2007), and *S. ruficollis* might eventually remain as the only real *Silis*. Indeed, after a reassessment of the New World species, they will probably have to be transferred to separate genera. The biodiversity of *Silis* in Central-South America would suggest that this area is the

center of radiation of this genus and that diversification probably took place during the Cretaceous, while its presence in California has been suggested as resulting from a Trans-Beringian Pliocene spread of temperate-cold species (Parisi & Fanti 2019). It is difficult to explain its ancient presence in Europe (in Baltic amber) when today relatively few species live there. This could be the result of a progressive extinction in Europe caused by post-Eocene climatic cooling (Parisi & Fanti 2019), with *Silis* from Europe moving to the eastern Palearctic and subsequently to North America. It's clear that more fossils from other periods and places are needed to explain these possible two centers of radiation: one in Central-South America and the other in Europe.

The presence of *Silis* and the subfamily Silinae in Baltic amber also suggests an older origin than once thought (Brancucci 1980), one that could perhaps reach back to the Cretaceous (Fanti 2017). Because Dominican amber is from the Miocene, complete biogeographic and evolutionary reconstructions concerning the origin of the genus and the subfamily Silinae in Dominican amber are not possible. However, the discovery of *Silis* in Dominican amber is still very useful for understanding the evolution in the Caribbean. It can help with biogeographical reconstructions of Hispaniola and the Caribbean islands (Fanti & Damgaard 2019). In fact, the genera *Tytthonyx*, *Silis* and perhaps *Caccodes* have been found in Dominican amber (Wu 1997; Fanti & Damgaard 2019). It means, in the Miocene, about 16 million years ago, the composition of cantharids on the island at the generic level was almost already defined and complete, and *Silis* was already well differentiated. Only a few genera living today have not yet been found in Dominican amber, such as *Silidiscodon*, *Tylocerus* and *Polemius* (Perez-Gelabert 2008). That's not surprising, as these genera are scarce on Hispaniola and the Caribbean islands today.

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