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## Description of *Allograssiella floridana* gen. nov., spec. nov. from the southern United States living with *Pseudomyrmex* ants

(Zygentoma, Nicoletiidae)

Luis F. Mendes & Volker S. Schmid

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*Allograssiella floridana* gen. nov., spec. nov., a species of myrmecophilous Zygentoma belonging to a new genus of Nicoletiidae (Atelurinae) is described from the Florida Keys. It is the first silverfish known as an inquiline of Pseudomyrmecinae ants. The new genus seems particularly close to a group of probably primitive genera of Atelurinae known from the Neotropical and Afrotropical Regions, one of which extends to the southern Nearctic and to eastern North Africa; the only known fossil Atelurinae is also considered as part of the same lineage.

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### Introduction

The Zygentoma of the United States remain quite poorly investigated and only one species of Nicoletiidae (Atelurinae) was known till now from the whole country: *Grassiella wheeleri* (Escherich 1905, sub *Atelura*) described from Austin, Texas, as an inquiline of *Pachycondyla harpax* (Formicidae: Ponerinae) and later collected (Paclt 1974, if any, no host-ant reported) in Ponchatoula, Louisiana. Meanwhile, this same species was redescribed (Wygodzinsky 1958a, again with no reference to the precise biotope) from north-eastern Mexico, upon material obtained in the Monterrey area (Nuevo León).

We describe one new myrmecophilous silverfish from the Florida Keys living with *Pseudomyrmex gracilis* (Formicidae: Pseudomyrmecinae) and compare it with the probably most similar known genera. These correspond to a set of Atelurinae from South and Central America – extending northwards to

the southern USA (Texas and Louisiana) and to north-eastern Mexico – and from the Afrotropical Africa – extending north-eastwards to the Mediterranean Egypt (collected near Heluan, not far from Cairo). The only known fossil Atelurinae species, described from the Dominican Republic Oligocene amber (Mendes 1997a), is also part of this lineage.

The new Atelurinae species was found when breaking dead twigs containing ant colonies of *P. gracilis*. To confirm the myrmecophilous nature of the silverfish, two ant colonies were transferred together with all associated Atelurinae into artificial wooden nests covered with glass plates. Close-up video captures were made of one laboratory colony containing three silverfish on two days (2 h total observation time) using a Sony Handycam HDR-SR10E.

The types are deposited in the entomological collection of the Instituto de Investigação Científica Tropical / Jardim Botânico Tropical – Zoologia (CZ)

in Lisbon, Portugal and in the Bavarian State Collection of Zoology (Zoologische Staatssammlung München, ZSM) in Munich, Germany.

## Taxonomy

### *Allograssiella* gen. nov.

**Type species:** *A. floridana* sp. n.

**Etymology.** From the Greek *allos*: other, different; and from *Grassiella* Silvestri, 1898 an Atelurinae genus which shares many characteristics with *Allograssiella* gen. n.

## Description

**Female.** Small-size Atelurinae. Body ovoid and without hypodermal pigment. Thorax large, as long as wide, almost as long as half the body length. Scales typical, yellowish-gold, with abundant thin rays slightly surpassing the scales' border, present on the head, body and coxae of the legs; macrochaetae caramel-coloured. Head free, covered with scales and with scattered tiny cilia, the macrochaetae restricted to the frontal area and, as 1+1, to the ocular region. Antennae short, as usual, not attaining the posterior border of the thorax (not much longer than the pronotum), the apical articles with abundant thin cylindrical sensilla. Mandibles typical, asymmetrical, with the incisive and molar areas well developed, the former with acute teeth. Maxillae as usual, the lacinia almost of the same length as the galea, the latter with only one developed apical conule; prostheca without special features, slightly surpassing apical tooth of lacinia; maxillary palp without special features. Posterolateral angles of labium acute and pointing backward; labial palp typical, with rounded terminal article. Thorax as wide as long, without developed macrochaetae along the posterior border (only minute cilia exist). Legs without special characteristics, the tarsus of 4-articles, complete and without microtrichia; empodium unguiform, the lateral claws well developed and with round to subtriangular medium-size pulvilli. Urotergites scaly, with some tiny cilia along the posterior border, the setae and macrochaetae restricted to the infralateral and laterotergal areas; tergite X as usual, the posterior depression deep. Urosternites scaly, the macrochaetae restricted to one submedian and one lateral pair per sternite. Stylets on IV-IX, in six pairs, as usual the IX much bigger. No eversible vesicles, only the pseudovesicles VII present. Subgenital plate wide, elliptical; ovipositor spindle-shaped, some of the setae of the apical area of gonapophyses VIII straight and clearly stronger than the remaining ones. Cerci and terminal filament very short.

**Male.** Unknown.

**Discussion.** *Allograssiella* enters a group of probably plesiomorphic genera of Atelurinae distributed through Africa, and Central and South America; one of them, *Grassiella* Silvestri, 1898, the only known to occur on both sides of the Atlantic and probably one of the most primitive in the group, extends to the southern Palearctic and to the southern Nearctic Regions.

In addition to the posterolaterally produced labium, the new genus differs from the related genera as follows:

*Atelurina*, with one known species from the Pernambuco State, eastern Brazil (Wygodzinsky 1943), has five pairs of abdominal stylets (V-IX) and two conules on the galea.

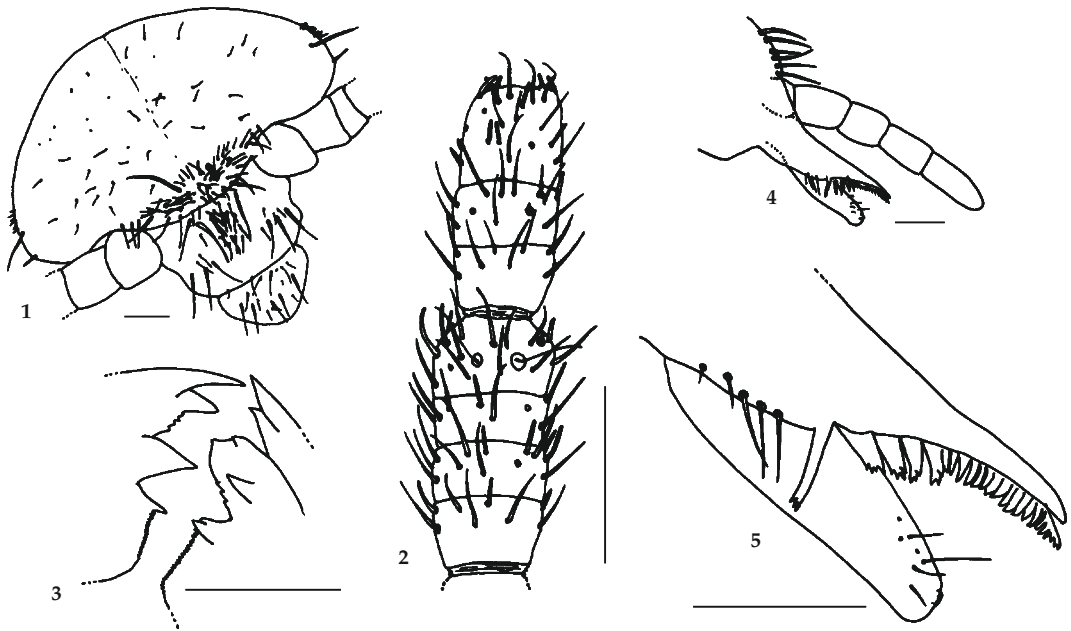
*Archeatelura* the only fossil known in the subfamily (Mendes 1997a with notes in Mendes 1997b), known from the Oligocene amber of the Dominican Republic, shows three pairs of vesicles (IV-VI); some of the morphological details of its only known species, *A. sturmi* Mendes, 1997, remain however untraceable (and so, impossible to compare with the recent genera) due to the condition of its small individuals, the deformation, and other difficulties inherent to the study of minute morphological features in these amber-preserved insects. These cases include the number of the apical conules on the galea, the details of the posterolateral areas of labium and the precise morphology of the praetarsus, which could, at least in part, also be diagnostic.

*Attatelura* with three known species from Argentina and Suriname (Wygodzinsky 1942), shows elongate antennae, seven pairs of abdominal stylets (III-IX), simple praetarsus (without pulvilli) and two to three conules on the galea.

*Grassiella*, amph-Atlantic, with more than 20 described species, and the only genus of this group known to extend to the Palearctic and Nearctic Regions, has (Silvestri 1898, and for the complete generic description, Silvestri 1912) vesicles on the abdominal segments IV-VI (as with *G. wheeleri*) or, at least, on VI, two conules on the galea, praetarsus (claws and empodium) with microtrichia, and simple claws, without pulvilli.

*Machadatelura* with one known species from the Republic of Congo (former Congo Kinshasa, Congo Brazzaville and French Congo), presents (Mendes 1998b) the head partially concealed by the anterior border of pronotum, two conules on the galea, four pairs of abdominal stylets (VI-IX), and simple praetarsus (without pulvilli).

*Mesonychographis* with one known species (Silvestri 1908) described from the "Kassai, Kongo" and redescribed from material from the same country (Congo Democratic Republic, former Zaire, before



**Figs 1-5.** *Allograssiella floridana* gen. n., sp. n. 1. Head, dorsal view. 2. Distal chain of antenna. 3. Mandibles. 4. Maxilla and maxillary palp. 5. Idem, apex of galea and lacinia. Scale bars: 0.1 mm.

that Congo Leopoldville and Belgian Congo) and from the Ivory Coast (Wygodzinsky 1958b), shows two pairs of vesicles (V-VI), two galea conules and an unique empodium, with a conspicuous dorsal crest of setae.

Finally, *Santhomesiella*, described from S. Tomé Island (São Tomé e Príncipe) (Mendes 1988) and reported also from the Cape Verde Islands (Mendes 1992) and from Guinea-Bissau (Mendes 1998a), with one described species, has five pairs of stylets (V-IX), four pairs of vesicular structures (IV-VI+VII) and tarsal claws without pulvilli.

***Allograssiella floridana* spec. nov.**

Figs 1-19

**Material examined.** Holotype: USA, Florida Keys (Overseas Hwy c. M.M.56), Marathon, Curry Hammock State Park, 24°44' N, 80°59' W, 14.04.2009, in an ant nest (label PS155), one female (CZ-5768); – Paratypes: Ibidem, 12.04.2009, within an ant nest (label PS136), one female (CZ-5767); USA, Florida (Overseas Hwy 1, M.M. 68.5), Long Key, Layton, 24°49' N, 80°48' W, 11.04.2009, in an ant nest (label PS128), three females (ZSM), coll. Volker Schmid. The host-species was always *Pseudomyrmex gracilis* (Formicidae: Pseudomyrmecinae).

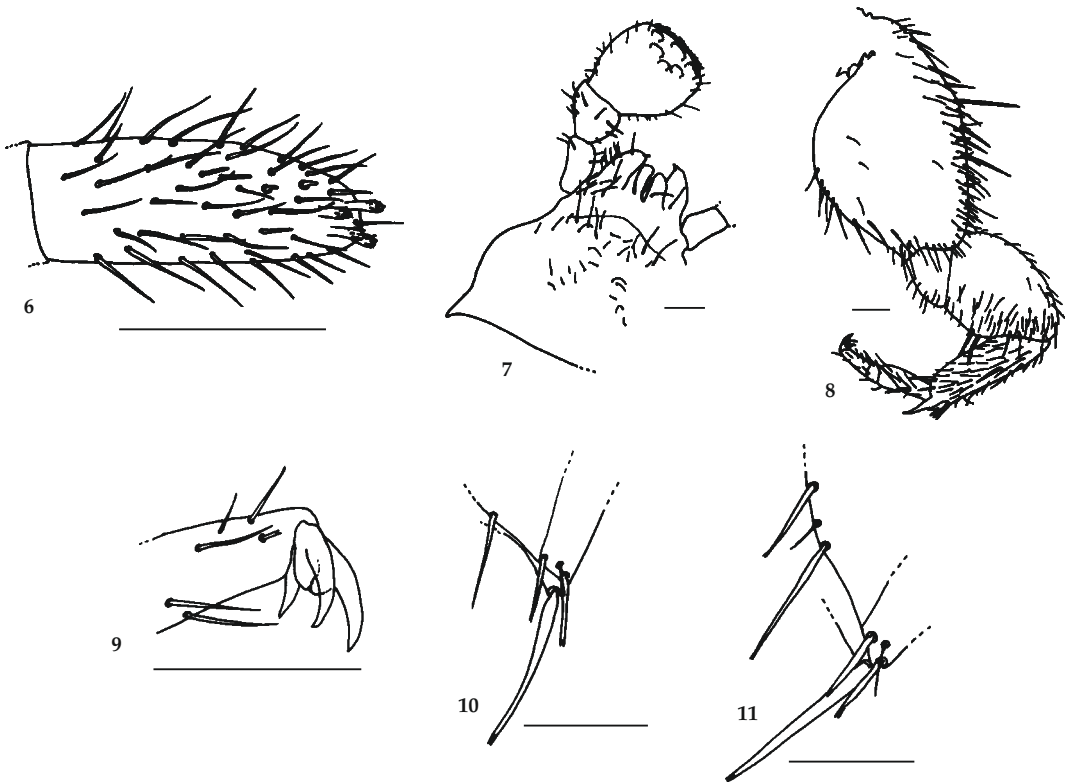
**Etymology.** The new species is named after its geographical origin, Florida.

**Description**

Body length: 3.6-5.2 mm; thorax length: 1.5-2.0 mm; thorax width: 1.5-2.0 mm; length of antenna: 1.3-1.5 mm; length of cerci: 0.2-0.3 mm; total body length: maximum of 5.4 mm. Scales as in the genus description, golden-yellowish, multi-radiate, the rays thin, poorly surpassing the scale border.

Head wider than long, scaly, with scattered tiny cilia, 1+1 macrochaetae on the ocular region, the remaining restricted to the frontal area (Fig. 1). Antennae without peculiar features, with 15-16 articles when complete, the most distal ones divided in three to four subunits and with abundant thin sensilla, as in Fig. 2. Mandibles asymmetrical, with developed incisive and molar areas, as in the generic description and as in Fig. 3. Maxilla with the prostheca slightly longer than the tooth of the lacinia, the galea almost of the same length and with only one apical conule (Figs 4, 5); maxillary palp delicate (Figs 4, 6), its distal article cylindrical, about three times longer than wide and 1.5 times longer than the preceding, with numerous sensillae. Labium (Fig. 7) with the posterolateral angles produced in conspicuous triangular acute points oriented backward; labial palp typical, its terminal article rounded and with the six usual papillae.

Nota large, with the posterior border almost straight, scaly, with macrochaetae along the lateral



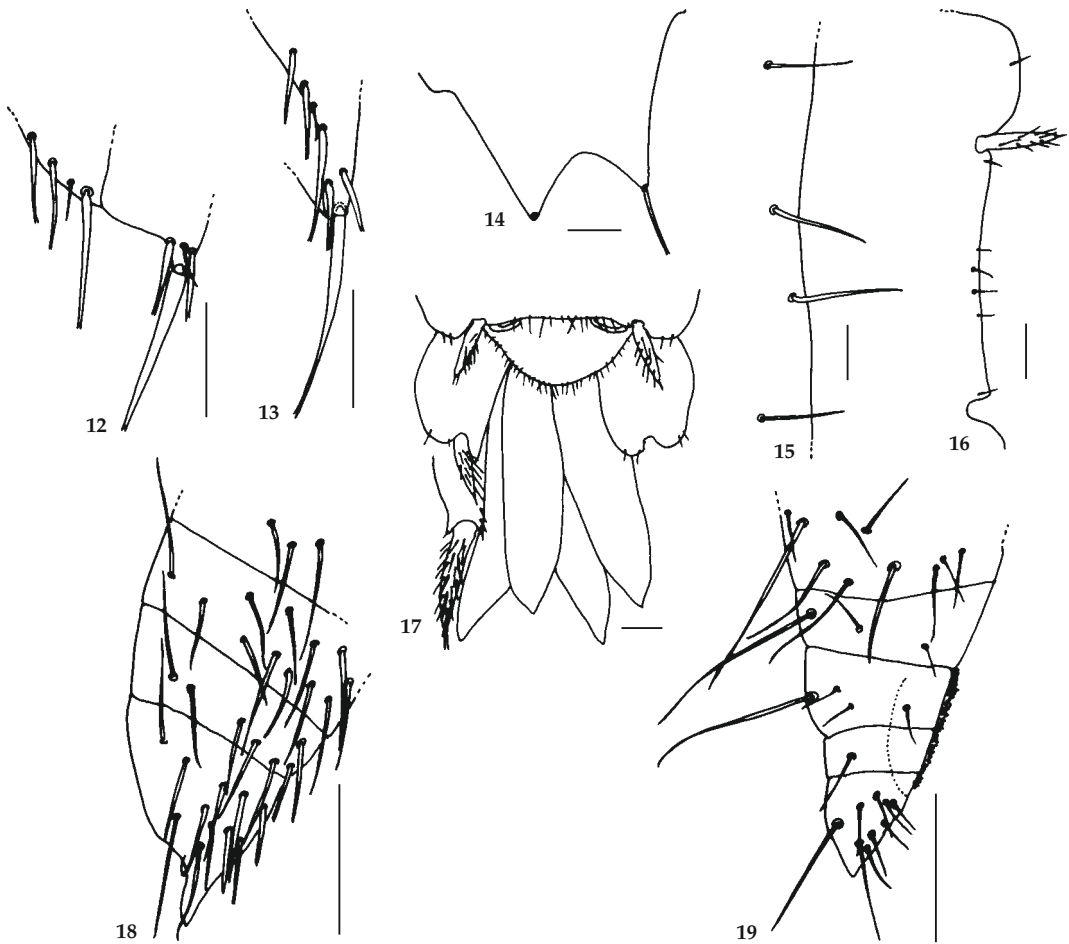
**Figs 6-11.** *Allograssiella floridana* gen. n., sp. n. 6. Maxillary palp, apical article. 7. Labium and labial palp. 8. PI. 9. Idem, detail of praetarsus. 10. Infralateral area and laterotergite of urotergite I. 11. Idem, of urotergite III. Scale bars: 0.1 mm.

margins only (the most posterolateral one, longer and stronger in each notal plate); very thin and minute setulae are distributed evenly over on the disc and arranged as an irregular row along the posterior border of all the nota. Legs robust (Fig. 8), with scaly outer coxae and with a few spiniform macrochaetae on the femora and tibiae; tarsus with four articles, the praetarsus (Fig. 9) smooth, without microtrichia; claws with a not very developed, round to almost triangular, pulvilli (attaining  $\frac{1}{3}$ - $\frac{1}{2}$  of the claw length), the empodium unguiform, smaller and more delicate than the lateral claws.

Urotergites scaly, with one macrochaeta and a few setae restricted to the infralateral and laterotergal areas (in ventral position), the posterior border with some minute cilia as on the nota, their number decreasing from I to IX (22, 20, 20, 18, 16, 14, 14, 14, 8). Extreme lateral area of urotergites I-II (Fig. 10) with one macrochaeta, two outer setae and one smaller seta, the III (Fig. 11) and V-VIII similar but with two macrochaetae, the IV identical but with three (Fig. 12); urotergite IX (Fig. 13) with the posterola-

teral angles clearly though not strongly produced, with one long posterolateral macrochaeta plus five to six ventral outer setae. Urotergite X (Fig. 14) at base wider than long, with a deep rounded posterior notch and with 1+1 strong, long, posterolateral macrochaetae.

Urosternites scaly, I without macrochaetae but with one isolated minute median seta; II-III with 1+1 submedian quite close macrochaetae (their distance ca  $\frac{1}{2}$  of their length) and 1+1 lateral thinner and smaller setae; IV (Fig. 15) with 1+1 wider apart submedian delicate macrochaetae, their distance as their length, 1+1 setae on the inner angle of the stylet insertion and 1+1 lateral strong setae, plus some isolated cilia; V-VI similar (Fig. 16), but the distance between the median macrochaetae as 2-2.5 times the length of the irrespective setae; urosternite VII (Fig. 17) with about 10 delicate macrochaetae along the median area, the subgenital plate at base clearly wider than long, elliptical, and with a fringe of delicate short setae. Six pairs of abdominal stylets (IV-IX) present, IX much stronger and longer than



**Figs 12-19.** *Allograssiella floridana* gen. n., sp. n. 12. Infralateral area and laterotergite of urotergite IV. 13. Idem, IX. 14. Urotergite X. 15. Urosternite IV. 16. Urosternite VI. 17. Posterior ventral abdomen. 18. Anterior gonapophyses, distal area. 19. Posterior gonapophyses, distal area. Scale bars: 0.1 mm.

the remaining. No eversible vesicles, only the pseudovesicles VII present. Ovipositor (Fig. 17) spindle-shaped and slightly surpassing level of the stylets IX without apical spine, the gonapophyses (Figs 18, 19) with seven to eight divisions, the VIII with some of the most distal setae straight and very strong.

Cerci very short with some outer distal delicate spines, the paracercum also very short, apically damaged.

**Notes.** The new species is immediately distinguishable from the other Atelurinae previously known from North American (as registered, *Grassiella wheeleri*) by the characteristics reported for the genera, namely the presence of only one reduced conule on the galea, the praetarsus, mainly by the presence

of pulvilli and by the lack of microtrichia, and the lack of eversible vesicles – only the pseudovesicles VII are present. Moreover, *A. floridana* is the only *Zygentoma* hitherto known to live with ants of the subfamily Pseudomyrmecinae.

#### Confirmation of true myrmecophily

Shortly after colony transfer, all the specimens of *A. floridana* were with the ants in the chambers of the artificial nests. Henceforward, they were never seen outside the nests. Within the nests, they mostly stayed near the ants and their brood. They moved around very fast, quickly avoiding almost every physical contact with their hosts, nevertheless

sometimes crawling beneath the (two or three times larger) ants without being noticed. The ants mostly ignored their inquilines; occasionally, however, an ant noticed one of them and chased after it, but never got to interact with the silverfish because the latter always quickly evaded, leaving the ant excited for a few seconds. The only noteworthy interactions between the silverfish and the ants were the following: (1) a silverfish inspecting the body of an ant, mostly the tarsus of the hind leg, rarely the gaster or even the head; inspecting the latter might be related with the second interaction; (2) a silverfish reaching for (and probably contacting) the mouth region of two ants currently engaged in trophallaxis (i. e. transfer of liquid food between each other); the latter behaviour was not observed as frequently as inspection of an ant tarsus but it might represent the way the silverfish get food, as also found in other inquilines (Hölldobler & Wilson 1990). The silverfish seemed to ignore the ant brood; at most they walked over it. Among each other we observed no interactions besides occasional chasing which always lasted less than one second.

From these observations, we conclude that this silverfish is a true myrmecophile, living as a (possibly obligatory) inquiline within colonies of *P. gracilis*. There remain some interesting questions to be studied, e. g. how the silverfish interact socially, how they disperse to new ant colonies, and what they actually do when inspecting the tarsal regions of the ants.

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