Redescription and revision of the Neotropical genus
Pseudoheptascelio Szabó (Hymenoptera, Platygastridae, Scelioninae), parasitoids of eggs of short-horned grasshoppers (Orthoptera, Acrididae)

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Abstract
The genus Pseudoheptascelio Szabó is redescribed and its species revised. We recognize four species: P. muesebecki Szabó, P. cornopis Masner, P. tico sp. n. and P. rex sp. n. The genus is found from Guatemala south to the Brazilian state of Rio Grande do Sul. The species P. cornopis is recorded as a parasitoid of the eggs of Cornops aquaticum (Bruner) on water hyacinth, Eichhornia crassipes (Mart.) Solms.

Keywords
Platygastridae, Platygastridea, Scelioninae, egg-parasitoid, Cornops, key, biological control, water hyacinth, Eichhornia
Introduction

The genus *Pseudoheptascelio* was described by Szabó (1966) from a single female collected in the state of Pará in northern Brazil. Masner (1972) subsequently erected *Tanaoscelio* for a single species collected in Trinidad and recorded as attacking the eggs of *Cornops longicorne* (Bruner) (Orthoptera: Acrididae, Leptysminae), a grasshopper that was being studied as a potential biological control agent for water hyacinth, *Eichhornia crassipes* (Mart.) Solms (Commelinaceae: Pontederiaceae). Masner (1976) later discovered an error in Szabó’s original description concerning the presence of a complete radial vein in the hind wing. In fact, the tubular portion of the vein is abbreviated and does not reach the costal margin of the wing. Therefore, Masner concluded that these two taxonomic concepts were equivalent.

*Pseudoheptascelio* is found only in the New World tropics, from Belize and Guatemala south to southeastern Brazil. The distribution of the only known host, *Cornops*, is very similar, although its range extends north along the coasts of Mexico (Adis et al. 2007). Developments in our understanding of this group of grasshoppers subsequent to the original description of *Tanaoscelio* (Roberts & Carbonell, 1979) suggest that the species identification of the host should be updated. *Cornops longicorne* is now considered to be a junior synonym of *C. frenatum* (Marschall). This latter species, however, is terrestrial and its host plants are unknown (Roberts and Carbonell 1979). The only semi-aquatic species attacking *Eichhornia* in Trinidad appears to be *C. aquaticum* (Bruner) (Roberts and Carbonell 1979, Adis et al. 2007).

Materials and methods

This work is based upon specimens in the following collections, with abbreviations used in the text: AEIC, American Entomological Institute, Gainesville, FL1; BMNH, The Natural History Museum, London, UK2; BPBM, Bernice P. Bishop Museum, Honolulu, HI3; CNCI, Canadian National Collection of Insects, Ottawa, Canada4; HNHM, Hungarian Natural History Museum, Budapest, Hungary5; MIZA, Museo del Instituto de Zoológía Agrícola, Maracay, Venezuela6; OSUC, C.A. Triplehorn Insect Collection, Ohio State University, Columbus, OH7; TAMU, Texas A&M University Insect Collection, College Station, TX8; USNM, National Museum of Natural History, Washington, DC9.

Abbreviations and morphological terms used in text: A1, A2, … A12: antennomere 1, 2, … 12; claval formula: distribution of the large, multiporous basiconic sensilla on the underside of apical antennomeres of the female, with the segment interval specified followed by the number of sensilla per segment (Bin, 1981); EH: eye height, length of compound eye measured parallel to dorsoventral midline of head; IOS: interocular space, minimal distance on frons between compound eyes; OD: ocellar diameter, greatest width of ocellus; OOL: ocellar ocellar line, the shortest distance from inner orbit and outer margin of lateral ocellus (Masner 1980); T1, T2, … T7: metasomal ter-
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gite 1, 2, ... 7; S1, S2, ... S7: metasomal sternite 1, 2, ... 7. Morphological terminology otherwise follows Masner (1980) and Mikó et al. (2007).

Appendix 1 lists terms associated with identifiers in the Hymenoptera Anatomy Ontology (Yoder et al. 2010). Identifiers in the format HAO_XXXXXXX represent concepts in the HAO version 2011-07-14 and are provided to enable readers to confirm their understanding of the concepts being referenced. To find out more about a given concept use the identifier as a search term at http://glossary.hymao.org. The identifier can also be used as a URI (universal resource identifier) by appending the identifier to 'http://purl.obolibrary.org/obo' (e.g. http://purl.obolibrary.org/obo/HAO_0000124). URLs in the format http://purl.org/net/hao/HAO_0123456 resolve to the HAO's community-based resource that includes additional images, notes, and other metadata.

In the Material Examined section the numbers prefixed with “OSUC” are unique identifiers for the individual specimens. The label data for all specimens have been georeferenced and recorded in the Hymenoptera On-Line database, and details on the data associated with these specimens can be accessed at the following link, hol.osu.edu, and entering the identifier in the form. Note the space between the acronym and the number.

Data associated with the genus *Pseudoheptascelio* can be accessed at http://hol.osu.edu/index.html?id=548. The generic and species descriptions were generated using a database application, vSysLab, designed to facilitate the production of a taxon by character data matrix, and to integrate those data with the existing taxonomic and specimen-level database. Data may be exported in both text format and as input files for other applications. The text output for descriptions is in the format of "Character: Character state (s)". Images and measurements were made using AutoMontage and Cartograph extended-focus software, using JVC KY-F75U digital camera, Leica Z16 APOA microscope, and 1X objective lens. A standard set of images is provided for each species: dorsal habitus, lateral habitus, dorsal and lateral views of the head and mesosoma, and anterior view of head. Images are archived at Morphbank (www.morphbank.net) and in Specimage (specimage.osu.edu), the image database at The Ohio State University.

The electronic version of the paper contains hyperlinks to external resources. Insofar as possible, the external information conforms to standards developed and maintained through the organization Biodiversity Information Standards (Taxonomic Database Working Group). All new species have been prospectively registered with Zoobank (Polaszek et al. 2005, www.zoobank.org), and other taxonomic names, where appropriate, have been retrospectively registered. The external hyperlinks are explicitly cited in the endnotes so that users of the printed version of this article have access to the same resources. Life sciences identifiers, LSIDs, may be resolved at the specified URLs or at lsid.tdwg.org.

This work is conducted as part of the Platygastroidea Planetary Biodiversity Inventory. The authors made equal contributions.
Taxonomy

_Pseudoheptascelio_ Szabó, 1966: 166 (original description. Type: _Pseudoheptascelio muesebecki_ Szabó, by monotypy and original designation); Masner, 1976: 18 (description, key to species); De Santis, 1980: 315 (catalog of species of Brazil); Johnson, 1992: 467 (catalog of world species); Loiácono & Margaría, 2002: 558 (catalog of Brazilian species).

 urn:lsid:zoobank.org:act:50643EC2-1EF4-496D-937B-8FBFDC9F9B8E
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 http://species-id.net/wiki/Pseudoheptascelio


Description. Body length: 4.09–5.45 mm (n=81).


may be separated from the vast majority of these species by the presence of short, hook-like axillular projections on the mesoscutellum, the medially produced metascutellum, the densely setose anterior margins of both the mesopleuron and metapleuron (Figs 2, 12, 18, 24), the rigid unflexed metasoma (Figs 1, 11, 17, 23), well-developed notauli (Figs 4, 14, 20, 26), the absence of fanlike striae arising from the base of the mandible (Figs 6, 15, 21, 27), and the broadly interrupted occipital carina (Figs 4, 14, 20, 26).

At least one Neotropical species of *Scelio* has axillular points and a projecting metascutellum. *Pseudoheptascelio* may be distinguished from this by the posteriorly declivous mesoscutellum, distinct notauli, the presence of dense pilosity on the anterior margins of the meso- and metapleuron, the subclavate male antenna (Fig. 9), the elongate T2–T6 (clearly longer than wide), and the smooth transition of the lateral margins of T5–T7 and subclavate antenna in the male (Fig. 8).

**Key to species**

1. T2–T3 reticulate (Figs 5, 13, 19), without distinct longitudinal rugulae; mesosoma black; T6 longer than wide basally ................................................... 2
   – T2–T3 with distinct longitudinal rugulae (Fig. 25); mesosoma often with reddish portions (Figs 23–26); basal width of T6 greater than its length ..... 3
2. Occiput without microsculpture within foveolae, appearing shining; length of T5 1.3–1.8 × its maximum width (Fig. 16) ......................... *P. muesebecki*
   – Occiput with dense fine microsculpture within foveolae, appearing matte (Fig. 10); length of T5 1.6–2.2 × its maximum width (Fig. 7) ..... *P. cornopis*
3. Head and mesosoma without coriaceous microsculpture, appearing shining; metascutellum short, subquadrate (Fig. 20) ......................... *P. rex*
   – Head and mesosoma with distinct superimposed coriaceous microsculpture, giving body overall matte appearance; metascutellum distinctly longer than wide (Fig. 26) ..................................................... *P. tico*

*Pseudoheptascelio cornopis* (Masner)

urn:lsid:zoobank.org:act:270062C9-88EC-4138-8ADF-284DF6B24F93
urn:lsid:biosci.ohio-state.edu:osuc_concepts:5132
http://species-id.net/wiki/Pseudoheptascelio_cornopis
Figures 1–10; Morphbank

*Tanaoscelio cornopis* Masner, 1972: 1214 (original description).


Setation of pronotal depression: moderately to densely setose. Setation of netrion: moderately to densely setose (Fig. 2). Sculpture of midlobe of mesoscutum: foveate to areolate anteriorly, sculpture effaced, sparser posteriorly (Figs 4, 10). Number of trabecula across transscutal articulation: 7–8, widely spaced. Shape of metascutellum: short, shallowly cleft medially (Fig. 4). Sculpture of mesopleural depression: almost entirely sculptured, with transverse rugulae and interspersed irregular fovea.

Figures 1–6.30 *Pseudoheptascelio cornopis* (Masner), female (OSUC 186250) 1 Lateral habitus 2 Head and mesosoma, lateral view 3 Dorsal habitus 4 Head and mesosoma, dorsal view 5 Metasoma, dorsal view 6 Head, anterior view. Scale bars in millimeters.
Sculpture of T2–T3: irregularly reticulate, without longitudinal orientation. Length/width of female T5: 1.61–2.22 mm (n=12). Length/width of female T6: 1.10–1.50 mm (n=11). Sculpture of T6: with reticulate microsculpture only. Apex of male T7: pointed laterally, shallowly excavate or straight medially (Fig. 8).

**Diagnosis.** *Pseudoheptascelio cornopis* is distinguished from *P. muesebecki* by the densely and finely sculptured vertex and the more elongate T5 (length/width 1.6–2.2).

**Link to Distribution Map.** [http://hol.osu.edu/map-full.html?id=5132](http://hol.osu.edu/map-full.html?id=5132)

**Associations.** Data from specimen labels: emerged from egg of *Cornops* Scudder: [Orthoptera: Acrididae]; solitary egg parasitoid of *Cornops* Scudder: [Orthoptera: Acrididae]; unspecified association *Cornops frenatum* (Marschall): [Orthoptera: Acrididae]; emerged from egg of *Cornops longicorne* (Brunner): [Orthoptera: Acrididae]; solitary egg parasitoid of *Cornops longicorne* (Brunner): [Orthoptera: Acrididae]; emerged from egg on *Eichhornia crassipes* (Mart.): [Liliales: Pontederiaceae]; solitary egg parasitoid ex *Eichhornia crassipes* (Mart.): [Liliales: Pontederiaceae]; unspecified association *Eichhornia crassipes* (Mart.): [Liliales: Pontederiaceae]

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BMNH(E)#790244–790245 (BMNH); OSUC 186160–186162 (CNCI); OSUC 248318 (USNM). Other material: (9 females, 2 males) BOLIVIA: 7 females, 1 male, OSUC 186242, 186245–186250, 186253 (CNCI). BRAZIL: 1 female, 1 male, OSUC 186241 (CNCI); OSUC 131887 (OSUC). GUYANA: 1 female, OSUC 215796 (BPBM). Allotype: TRINIDAD AND TOBAGO: 1 male, BMNH(E)#790243 (BMNH). VENEZUELA: 1 female, OSUC 221615 (MIZA).

Comments. In the brief key to species Masner (1976) stated that the stigmal vein (r-rs) is embedded in a milky spot, forming a pseudostigma. The species P. muesebecki, in contrast, was characterized as having the area around the stigmal vein transparent. We find that there is considerable variability in the development of the pseudostigma and that it is present in all specimens of Pseudoheptascelio.

Pseudoheptascelio muesebecki Szabó
urn:lsid:zoobank.org:act:E3EF612E-195C-45DD-86BA-14EB72125754
urn:lsid:biosci.ohio-state.edu:osuc_concepts:5133
http://species-id.net/wiki/Pseudoheptascelio_muesebecki
Figures 11–16; Morphbank¹²

Pseudoheptascelio muesebecki Szabó, 1966: 167 (original description); Masner, 1976: 18 (type information).


Setation of pronotal depression: moderately to densely setose (Fig. 12). Setation of netrion: moderately to densely setose. Sculpture of midlobe of mesoscutum: foveate to areolate throughout; foveate to areolate anteriorly, or sculpture effaced, sparser posteriorly (Fig. 14). Number of trabecula across transscutal articulation: 7–8, widely spaced. Shape of metascutellum: short, shallowly cleft medially (Fig. 14). Sculpture of mesopleural depression: almost entirely sculptured, with transverse rugulae and interspersed irregular fovea.

Sculpture of T2–T3: irregularly reticulate, without longitudinal orientation. Length/width of female T5: 1.26–1.80 mm (n=15). Length/width of female T6: 1.05–1.53 mm (n=15). Sculpture of T6: with reticulate microsculpture only.

Diagnosis. This species is very similar to P. cornopis, and it may be distinguished by the less elongate T5 and the coarse areolate sculpture on the vertex.

Link to Distribution Map.¹³ [http://hol.osu.edu/map-full.html?id=5133]

Associations. No data available.

Material Examined. Holotype, female: BRAZIL: PA, Belém, no date, E. Horváth, HNHM 0015 (deposited in HNHM). Other material: (14 females) BOLIVIA: 1 fe-

female, OSUC 186244 (CNCI). **BRAZIL**: 9 females, OSUC 186233–186240 (CNCI); OSUC 58878 (OSUC). **ECUADOR**: 1 female, OSUC 186208 (CNCI). **PARAGUAY**: 2 females, OSUC 176024, 176033 (OSUC). **TRINIDAD AND TOBAGO**: 1 female, OSUC 186163 (CNCI).


Setation of pronotal depression: glabrous or sparsely setose. Setation of netrion: moderately to densely setose. Sculpture of midlobe of mesoscutum: foveate to areolate throughout (Fig. 20). Number of trabecula across transscutal articulation: 7–8, widely spaced. Shape of metascutellum: short, shallowly cleft medially (Fig. 20). Sculpture of mesopleural depression: foveolate anteriorly, transversely rugulose ventrally, with large smooth area dorsally surrounding mesopleural pit.

Sculpture of T2–T3: reticulate, with distinct longitudinal orientation. Length/width of female T5: 0.89–1.72 mm (n=20). Length/width of female T6: 0.81–1.26 mm (n=20). Sculpture of T6: with shallow foveolae impressed on reticulate background microsculpture. Apex of male T7: pointed laterally, shallowly excavate or straight medially.

Diagnosis. This species shares the short female T6 (Fig. 22) and, in many specimens, the red mesosoma with *P. tico*. It may be distinguished by the short metascutellum (Fig. 20) and the absence of coriaceous microsculpture on the head and mesosoma.

Etymology. The specific epithet is Latin for king and should be treated as a noun in apposition.

Link to Distribution Map. [http://hol.osu.edu/map-full.html?id=242983]

Associations. Data from specimen labels: collected on *Trichocentrum panamensis* Rolfe: [Orchidales: Orchidaceae]

Figures 17–22. *Pseudoheptascelio rex*, sp. n., holotype female (OSUC 186230) 17 Lateral habitus 18 Head and mesosoma, lateral view 19 Dorsal habitus 20 Head and mesosoma, dorsal view 21 Head, anterior view 22 Apex of metasoma, dorsal view. Scale bars in millimeters.

OSUC 186203–186207, 186209–186229, 186231 (CNCI); OSUC 58879 (OSUC).  
**FRENCH GUIANA**: 2 females, OSUC 186202, 287926 (CNCI).  
**GUYANA**: 1 male, OSUC 215795 (BPBM).  
**NICARAGUA**: 1 male, OSUC 320737 (TAMU).  
**PANAMA**: 9 females, OSUC 186199–186200 (CNCI); OSUC 248311–248317 (USNM).  
**PERU**: 1 female, OSUC 186232 (CNCI).
*Pseudoheptascelio tico* Johnson & Musetti, sp. n.
urn:lsid:zoobank.org:act:23DBB9A2-4F23-4F7E-AFC8-38A2906EE95E
urn:lsid:biosci.ohio-state.edu:osuc_concepts:242982
http://species-id.net/wiki/Pseudoheptascelio_tico
Figures 23–28; Morphbank


Setation of pronotal depression: glabrous or sparsely setose (Fig. 24). Setation of metanotum: glabrous or sparsely setose. Sculpture of midlobe of mesoscutum: foveate to areolate throughout (Fig. 26). Number of trabecula across transscutal articulation: 9–11, closely spaced. Shape of metascutellum: distinctly elongate, deeply cleft medially. Sculpture of mesopleural depression: irregularly foveolate, transverse rugulae very weakly indicated.

Sculpture of T2–T3: reticulate, with distinct longitudinal orientation. Length/width of female T5: 0.97–1.16 mm (n=13). Length/width of female T6: 0.93–1.13 mm (n=13). Sculpture of T6: with shallow foveolae impressed on reticulate background microsculpture. Apex of male T7: weakly pointed laterally, distinctly sinuous medially.

**Diagnosis.** This species should only be confused with red specimens of *P. rex*. It may be distinguished by the well-developed coriaceous microsculpture on the head and mesosoma, and the elongate, deeply cleft metascutellum (Fig. 26).

**Etymology.** The specific epithet is a colloquial term for a Costa Rican, reflecting the origin of most of the specimens we have seen. It should be treated as a noun in apposition.

**Link to Distribution Map.** [http://hol.osu.edu/map-full.html?id=242982]

**Associations.** No data available.


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References


Endnotes

1 http://biocol.org/urn:lsid:biocol.org:col:1008
2 http://biocol.org/urn:lsid:biocol.org:col:1009
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10 http://www.morphbank.net/?id=644094
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29 doi:10.1371/journal.pone.0015991
30 http://www.morphbank.net/?id=644067
31 http://www.morphbank.net/?id=644072
32 http://www.morphbank.net/?id=644091
33 http://www.morphbank.net/?id=644092
34 http://www.morphbank.net/?id=644093
## Appendix 1

Correspondence between anatomical terms used and the Hymenoptera Anatomy Ontology. Identifiers may be resolved by appending them to the following URL: http://purl.obolibrary.org/obo/

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stenite  
submedian carina  
sulcus  
tegula  
tergite  
tibia  
torulus  
transscutal articulation  
transverse pronotal carina  
trochantellus  
tyloid  
vein  
venation  
vertex  
vertical epomial carina  
wing