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## **Phylogeny and Revision of *Toechorychus* Townes (Hymenoptera, Ichneumonidae, Cryptinae), with descriptions of thirty-five new species**

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## Abstract

The Neotropical *Toechorychus* Townes is revised, cladistically defined, and diagnosed. A total of 40 species are recognized, 35 of which are described as new: *T. amapaeus* Tedesco, **sp. nov.**, *T. amazonensis* Tedesco, **sp. nov.**, *T. barticus* Tedesco, **sp. nov.**, *T. benius* Tedesco, **sp. nov.**, *T. bombuscarus* Tedesco, **sp. nov.**, *T. calius* Tedesco, **sp. nov.**, *T. callangus* Tedesco, **sp. nov.**, *T. catarinus* Tedesco, **sp. nov.**, *T. coaracius* Tedesco, **sp. nov.**, *T. darienus* Tedesco, **sp. nov.**, *T. fluminensis* Tedesco, **sp. nov.**, *T. guarapuavus* Tedesco, **sp. nov.**, *T. heredius* Tedesco, **sp. nov.**, *T. itapuensis* Tedesco, **sp. nov.**, *T. jatainus* Tedesco, **sp. nov.**, *T. kawus* Tedesco, **sp. nov.**, *T. linaresius* Tedesco, **sp. nov.**, *T. marcapatus* Tedesco, **sp. nov.**, *T. marowijnus* Tedesco, **sp. nov.**, *T. martinus* Tedesco, **sp. nov.**, *T. melgassus* Tedesco, **sp. nov.**, *T. morelus* Tedesco, **sp. nov.**, *T. napus* Tedesco, **sp. nov.**, *T. nourageus* Tedesco, **sp. nov.**, *T. ondensis* Tedesco, **sp. nov.**, *T. paramaribus* Tedesco, **sp. nov.**, *T. pirrus* Tedesco, **sp. nov.**, *T. sinopus* Tedesco, **sp. nov.**, *T. surinamus* Tedesco, **sp. nov.**, *T. taperinus* Tedesco, **sp. nov.**, *T. teutonius* Tedesco, **sp. nov.**, *T. tumazulus* Tedesco, **sp. nov.**, *T. vilhenus* Tedesco, **sp. nov.**, *T. vinhaticus* Tedesco, **sp. nov.**, *T. zulus* Tedesco, **sp. nov.** The other valid species are *T. abactus* (Cresson), *T. albimaculatus* (Taschenberg), *T. brevicaudis* (Szépligeti), *T. cassunungae* (Brauns), and *T. stramineus* (Taschenberg). *Toechorychus* can be recognized by the epicnemial carina usually not reaching more than 0.3 of the distance to subtegular ridge; dorsal valve of ovipositor with a subapical V-shaped sulcus; ovipositor with a subapical constriction; ovipositor sheath about 0.1 as long as hind tibia; and dorsal margin of pronotum swollen. A key and descriptions, including photographic illustrations and distribution maps, are provided to all valid species; a cladistic analysis of the genus is also performed. Seventy three new characters are proposed for the analysis of Cryptinae phylogeny. *Toechorychus* was recovered as a monophyletic group supported by 7–17 synapomorphies, closely related to *Lymeon* Förster and *Acerastes* Cushman. Two new synapomorphies are discovered for *Toechorychus*, a subapical V-shaped sulcus at the dorsal valve of the ovipositor, and a subapical constriction of the ovipositor present basad of the apical teeth of the ventral valve. Published host records were compiled and three new records are provided as follows: *T. albimaculatus* is a parasitoid of *Mischocyttarus drewseni* (Saussure) (Vespidae, Polistinae); *T. stramineus* is a parasitoid of *M. basimacula* (Cameron) and *T. heredius* **sp. nov.** is a parasitoid of *M. collarellus* Richards. A neotype is designated for *T. cassunungae*.

**Key words:** *Acerastes*, Cryptini, *Lymeon*, Lymeonina

## Introduction

Lymeonina is one of the 15 subtribes of Cryptini (Wahl 1999), comprising a predominantly Neotropical group of wasps currently with 19 genera and 164 valid species (Yu *et al.* 2005; Kasparian & Ruíz 2008; Tedesco & Aguiar 2009). It was proposed and delimited by Townes (1970) by the presence of features such as the corrugated transverse furrow at the base of propodeum, hind margin of metanotum and anterior margin of propodeum without opposing tooth-like projections, and the absence of teeth at the base of the first tergite. The subtribal arrangement of cryptine genera seems however to be highly artificial (Gauld 1984; Laurene *et al.* 2006) and the monophyly of the Lymeonina, as proposed by Townes, remains uncertain.

Lymeonines are, as far as is known, mostly idiobiont ectoparasitoids that attack pupae or prepupae of Lepidoptera and Hymenoptera. The only known exceptions are *Acerastes pertinax* (Cresson) and *Lymeon orbis* (Say) which attack spider egg sacs (Pratt 1945; Townes & Townes 1962). The subtribe is the most typically Neotropical group of Cryptinae, 18 of its 19 valid genera are exclusive to that region (compiled from Wahl 1999; Kasparian & Ruíz 2008; Tedesco & Aguiar 2009). However, despite its wide distribution (Porter 1980) there are very few reports about abundance, diversity, taxonomy, or biology of its genera.

*Toechorychus* was established by Townes (1946), based on *Mesostenus abactus* Cresson, from Mexico. It is a moderately large Neotropical genus, originally defined by the lacking epomia, swollen dorsal margin of pronotum, dorsal end of epicnemial carina opposite ventral 0.25 of hind margin of pronotum, very small areolet, ovipositor sheath about 0.1 as long as hind tibia, and ventral valve of ovipositor without distinct teeth. The monophyly and relationships of the genus have never been investigated, but it was placed in the Lymeonina by Townes (1970).

Previous taxonomic treatments of *Toechorychus* were mainly limited to isolated species descriptions, most of them produced before 1916. Yu *et al.* (2004) cataloged five species: *Toechorychus abactus* (Cresson, 1874), *T. albimaculatus* (Taschenberg 1876), *T. stramineus* (Taschenberg 1876), *T. cassunungae* (Brauns, 1905), and *T. brevicaudis* (Szépligeti 1916). The genus has been recorded in the literature from seven countries, Brazil, Guatemala, Guyana, Mexico, Paraguay, Peru, and Venezuela.

*Toechorychus* spp. are apparently parasitoids in nests of Vespidae and pupae of Lepidoptera, but host records were previously known only for three species: *T. abactus* and *T. cassunungae* are known to attack species of