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THE OCCURRENCE OF TORRIDINCOLIDAE (COLEOPTERA: MYXOPHAGA) IN PARAGUAY AND A WORLD CHECKLIST OF SPECIES

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Abstract.- The occurrence of the beetle family Torridincolidae is reported from Paraguay. Adults, pupae and larvae were collected within the Atlantic Forest ecosystem from the vicinity of waterfalls in the Yvytyruzú Cordillera, Department Guairá. A checklist is given for all Torridincolidae species described to date.

Key words: *Torridincollidae, Myxophaga, Paraguay, new records, World checklist.*

Resumen.- La ocurrencia de la familia Torridincolidae se divulga de Paraguay. Se colectaron adultos, pupas y larvas en la ecosistema del Bosque Atlántico cerca de saltos de Cordillera del Yvytyruzú, departamento Guairá. Se da una checklist de todas las especies de Torridincolidae actualmente descrito.

Palabras clave: *Torridincollidae, Myxophaga, Paraguay, nuevos reportes, checklist mundial.*

Torridincolidae, commonly called torrent beetles, is a small, little-known family of aquatic beetles in the Suborder Myxophaga with 37 formally described species in seven genera (Braule-Pinto et al., 2011; Hajek et al., 2011; Vanin, 2011). They are largely restricted to the Southern Hemisphere although some species occur in Japan and China. All stages of the life cycle are aquatic, and most species occur in thin layers of water, especially in fast-flowing habitats such as waterfalls.

The literature on Torridincolidae is largely systematic and was well reviewed by Vanin (2011). Aquatic respiration in adults of most torridincolid species is via a plastron and larvae breathe via segmented trachael gills (Hin-

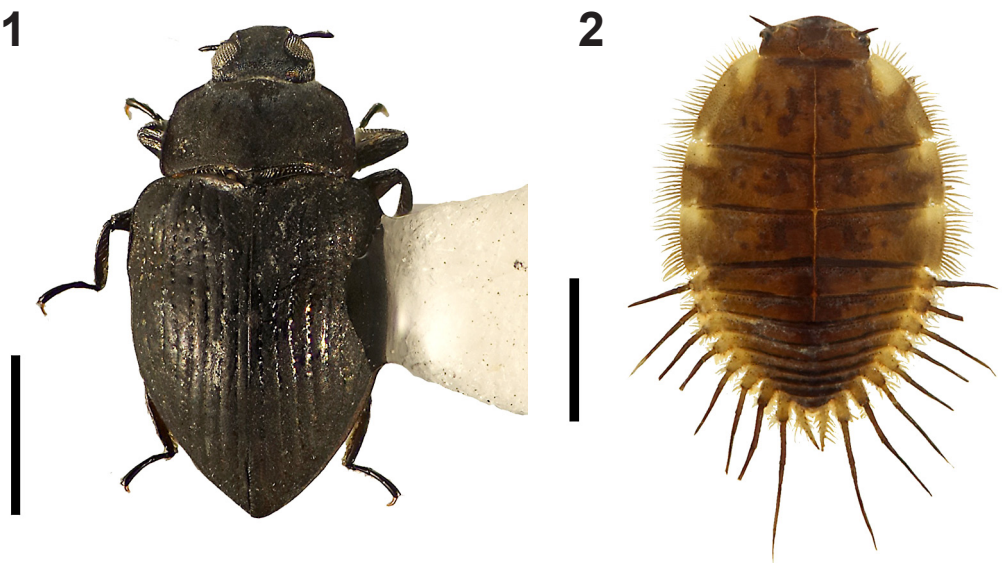

Figure 1-2. *Ytu* new species. 1) Adult. 2) Larva. Scale bar for each = 1 mm.

Nota

Figures 3-4. Salto Paí. 3) upper cascade. 4) Bedrock ledge inhabited by *Ytu* new species.

ton, 1967; Endrödy-Younga, 1997). The possible occurrence of the family in Paraguay was cited previously by Aguilar (2010) and Jäch & Balke (2008), but the specimens were thought to be lost. The location of those specimens is now known and their data are reported below.

Shepard and Aguilar have been surveying the aquatic byrrhoid beetles of Paraguay for several years and in 2010 published a preliminary report which included taxonomic keys, geographic distribution and habitat notes for the known taxa. This paper was the first to deal with the aquatic beetle fauna of Paraguay. The torridincolid specimens discussed here were found in February 2011 during their continuing survey work. The collections, including larvae, pupae and adults (Figs. 1–2), represent an undescribed member of the *Ytu zeus* Reichardt species group. The species was collected at two localities by Shepard and Barr, both in the Yvytyruzú Cordillera in Departamento Guairá: Salto Paí, Arroyo Tacuara, 3.7 km SSW of Melgarejo, S25º44.916' W56º15.231', elevation 221 m; and Salto Suizo, Arroyo Libertad, 6 km SSE of Melgarejo, S25º46.299' W56º 13.575', elevation 243 m.

The specimens from Salto Paí were collected in a series of cascades separated by deep plunge pools (Figs. 3–4). The specimens were on massive sandstone outcroppings and were covered by a relatively thin layer of swift water. The specimens from Salto Suizo were collected from the surface of a boulder, below the plunge pool (Fig. 5), over which flowed a thin layer of fast water. All specimens are currently housed at Essig Museum of Entomology, University of California, Berkeley, where they are being studied and described.

These two collections represent the farthest west that members of the *Ytu zeus* species group have been collected in the Atlantic Forest ecosystem. *Ytu brutus* Spangler, another member of the *Ytu zeus* species group, occurs farther west, but in the Amazon basin near the Brazilian/Bolivian border outside of the Atlantic Forest ecosystem (Spangler, 1980). Because both Paraguayan locations are in remnants of the Interior Atlantic Forest, we expect to find additional populations, and perhaps additional species, when more of this ecosystem is surveyed in Paraguay. The presence of these two populations further bolsters the case for the conservation and protection of this unique, endangered ecosystem, as advocated in Galindo-Leal & Câmara (2003). Over time more and more river systems are threatened by the construction of hydroelectric dams (Fahey and Langhammer, 2003) and by the loss of forests in river basins due to soybean farming.

The four specimens that were thought to be lost are now known to be in the Naturhistorische Museum Wien, in Vienna, Austria. The

collection data is: PARAGUAY: Paraguari, Sapucay, IV 1994, Ulf Drechsel. They are also members of *Ytu* (Manfred Jäch, pers. comm.) but they have not yet been examined to determine if they are the same species as the one reported above.

An updated world checklist of the Torridincolidae is provided as follows:

CHECKLIST OF TORRIDINCOLIDAE OF THE WORLD

Family: **Torridincolidae** Steffan, 1964: 199

Subfamily: **Deleveinae** Endrödy-Younga, 1997:317[1]

Genus: ***Delevea*** Reichardt, 1976: 209

1. *Delevea bertrandi* Reichardt, 1976: 209 (TYPE SPECIES) .....South Africa.
2. *Delevea namibensis* Endrödy-Younga, 1997: 320 .....South Africa.

Genus: ***Satonius*** Endrödy-Younga, 1997: 317
Revision of the genus: Hájek & Fikáček (2008).

1. *Satonius kurosawai* (Satô, 1982): 279 (TYPE SPECIES) .....Japan.
   = *Delevea kurosawai* Satô, 1982: 279 (original description).
   = *Satonius kurosawai* (Satô, 1982); (Endrödy-Younga (1997: 318) (new combination, redescription);

   Beutel (1998: 54) (description of larva); Hayashi (2007: 77) (faunistics, photographs of imago and larva); Hayashi & Kadowaki (2007: 149) (faunistics, photograph of imago); Hayashi (2008: 61) (faunistics, photographs of pupa); Hájek & Fikáček (2008: 662) (adult diagnosis and bionomic and description of the larvae);

[1]A phylogenetic analysis by Beutel (1998/99) questions the validity of the subfamily Deleveinae, but no taxonomic alternative was proposed.

Figure 5. Salto Suizo, waterfall and arroyo upstream from boulder where Ytu new species was collected.

Hájek et al.(2011: 56) (faunistics, description of wing polymorphy).

2. *Satonius fui* Hájek, Yoshitomi, Fikáček, Hayashi & Jia, 2011: 52.....China.
3. *Satonius jaechi* Hájek, Yoshitomi, Fikáček, Hayashi & Jia, 2011: 53.....China.
4. *Satonius schoenmanni* Hájek & Fikáček, 2008: 663 .....China.
5. *Satonius stysi* Hájek & Fikáček, 2008: 663 .....China.
6. *Satonius wangi* Hájek & Fikáček, 2008: 665 .....China.

Subfamily: **Torridincolinae** Steffan, 1964
(Endrödy-Younga 1997)
= Ptyopterinae Abdullah, 1974
(syn. Endrödy-Younga 1997)

Genus: ***Claudiella*** Reichardt & Vanin, 1976: 212

1. *Claudiella ingens* Reichardt & Vanin, 1976: 214 (TYPE SPECIES).....Brazil.

Genus: ***Iapir*** Py-Daniel, Fonseca & Barbosa, 1993: 671
= *Hintonia* Reichardt, 1973:125 (nomen nova; praeocc. Fraser Brunner 1949 in Pisces), (= *Ptyopteryx* Reichardt & Costa, 1967) (praeocc. Kolenati, 1848)

1. *Iapir borgmeieri* (Reichardt & Vanin, 1976): 216 ..... Brazil.
   = *Ptyopteryx borgmeieri* Reichardt & Vanin, 1976.
2. *Iapir britskii* (Reichardt & Costa, 1967): 14 (TYPE SPECIES) ..... Brazil.
   = *Ptyopteryx britskii* Reichardt & Costa, 1967.
3. *Iapir castalia* Reichardt, 1973: 131 .....Brazil.
4. *Iapir quadridentatus* Braule-Pinto, Fonseca & Hamada, 2011: 48 .....Brazil.
5. *Iapir trombetensis* (Fonseca, Py-Daniel & Barbosa, 1991): 293..... Brazil.
   = *Hintonia trombetensis* Fonseca, Py-Daniel & Barbosa, 1991.

Genus: ***Incoltorrida*** Steffan, 1973: 634

1. *Incoltorrida madagassica* Steffan, 1973: 635 (TYPE SPECIES) .....Madagascar.

Genus: ***Torridincola*** Steffan, 1964: 193

1. *Torridincola rhodesica* Steffan, 1964: 194 (TYPE SPECIES) .....Zimbabwe.
2. *Torridincola congolesica* Steffan, 1973: 639 ..... Congo-Kinshasa.
3. *Torridincola natalesica* Steffan, 1973: 642 ....South Africa.

Genus: ***Ytu*** Reichardt, 1973: 131
Revision of the genus: Reichardt & Vanin (1977).

1. *Ytu zeus* Reichardt, 1973: 137 (TYPE SPECIES) ..... Brazil.
2. *Ytu angra* Reichardt & Vanin, 1977: 131 ....Brazil.
3. *Ytu artemis* Reichardt, 1973: 143 .....Brazil.
4. *Ytu athena* Reichardt, 1973: 139 ..... Brazil.
5. *Ytu brutus* Spangler, 1980: 145..... Brazil.
6. *Ytu cleideae* Vanin, 1991: 573 ..... Brazil.
7. *Ytu cupidus* Reichardt, 1973: 146.....Brazil.
8. *Ytu cuyaba* Reichardt & Vanin, 1977: 127 ....Brazil.
9. *Ytu demeter* Reichardt, 1973: 142 ..... Brazil.
10. *Ytu godoyi* Reichardt & Vanin, 1977: 129..... ..... Brazil.
11. *Ytu hephaestus* Reichardt, 1973: 138..... Brazil.
12. *Ytu itati* Reichardt & Vanin, 1977: 132.. Brazil.
13. *Ytu mirandus* Reichardt & Vanin, 1977: 126... ..... Brazil.
14. *Ytu mirim* Reichardt & Vanin, 1977: 125 .... Brazil.
15. *Ytu morpheus* Reichardt, 1973: 145..... Brazil.
16. *Ytu phebo* Reichardt, 1973: 140..... Brazil.
17. *Ytu reichardti* Vanin, 1978: 1 ..... Brazil.
18. *Ytu yaguar* Reichardt & Vanin, 1977: 130..... ..... Brazil.
19. *Ytu ysypo* Reichardt & Vanin, 1977: 126..... ..... Brazil.
20. *Ytu* n. sp. of *zeus* species group .....Paraguay.

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LITERATURE

Aguilar Julio, C. A. 2010. Methods for Catching Beetles. Naturalia Scientific Collection. Montevideo, Uruguay. 303 pp.

Abdullah, M. 1974. Notes on Sphaeriformia Abdullah, particularly Torridincolidae Steffan (Col. Myxophaga). Annales de la Société Entomologique de France, 10(4): 959-962.

Beutel, R. G. 1998. Torridincolidae: II. Description of the larva of *Satonius kurosawai* (Satô, 1982) (Coleoptera). Pp. 53-59, in: Jäch M. A. & L. Ji (eds.). Water Beetles of China, Vol. II. Zoologisch-Botanische Gesellschaft in Österreich and Wiener, Coleopterologenverein, Wien. 371 pp.

Beutel, R. G. 1998/99. Phylogentic analysis of Myxophaga (Coleoptera) with a redescription of *Lepicerus horni* (Lepiceridae). Zoologischer Anzeiger, 237: 291-308.

Braule-Pinto, V. A., C. R.V. da Fonseca & N. Hamada. 2011. *Iapir quadridentatus* sp. nov., a new torridincolid beetle from Brazil (Coleoptera: Myxophaga: Torridincolidae). Zootaxa, 3031: 47-53.

Endrödy-Younga, S. 1977. Active extraction of water-dissolved oxygen and descriptions of new taxa of Torridincolidae (Coleoptera: Myxophaga). Annals of the Transvaal Museum, 36(24): 313-332.

Fahey, C. & P. F. Langhammer. 2003. The effects of dams on biodiversity in the Atlantic Forest. Pp. 413–425, in: Galinda-Leal, C. and I. G. Câmara (eds.). The Atlantic Forest of South America: Biodiversity Status, Threats, and Outlook. Island Press, Washington. 488 pp.

Fonseca, C. R. V. da, V. Py-Daniel & U. C. Barbosa. 1991. A new species of *Hintonia* Reichardt 1973 from Amazon Basin, Brazil (Coleoptera: Torridincolidae). Revista Brasileira de Entomologia, 35(2): 293-300.

Fraser-Brunner, A. 1949. A classification of the fishes of the family Myctophidae. Proceedings of the Zoological Society of London, 118(pt. 4): 1019-1106.

Galinda-Leal, C. & I. G. Câmara. 2003. The Atlantic Forest of South America: Biodiversity Status, Threats, and Outlook. Island Press. Washington. 488 pp.

Hájek, J. & M. Fikáček. 2008. A review of the genus *Satonius* (Coleoptera: Myxophaga: Torridincolidae): taxonomic revision, larval morphology, notes on wing polymorphism, and phylogenetic implications. Acta Entomologica Musei Nationalis Pragae, 48(2): 655-676.

Hájek, J., H. Yoshitomi, M. Fikáček, M. Hayashi & F.-L. Jia. 2011. Two new species of *Satonius* Endrödy-Younga from China and notes on the wing polymorphism of *S. kurosawai Satô* (Coleoptera: Myxophaga: Torridincolidae). Zootaxa, 3016:51-62.

Hayashi, M. 2007. Distributional records and ecological notes on aquatic Coleoptera of Shimane Prefecture. Bulletin of the Hoshizaki Green Foundation, 10: 77-113.

Hayashi, M. & H. Kadowaki. 2007. Records on aquatic Coleoptera from rivers in and around Mt. Daisen, Tottori Prefecture,

Japan. Bulletin of the Hoshizaki Green Foundation, 10: 149-168.

Hayashi, M. 2008. Distributional records and ecological notes on aquatic Coleoptera of Shimane Prefecture, part II. Bulletin of the Hoshizaki Green Foundation, 11: 61-91.

Hinton, H. E. 1967. On the spiracles of larvae of the Suborder Myxophaga (Coleoptera). Australian Journal of Zoology, 15: 955-959.

Jäch, M. A. & M. Balke. 2008. Global diversity of water beetles (Coleoptera) in freshwater. Hydrobiologia, 595: 419-442.

Kolenati, F. A. 1848. Genera et species Trichopterorum. 1. Heteropalpoidea, Pragae. 141-296 pp.

Mesa, A. & C. S. Fontanetti. 1985. The chromosomes of a primitive species of beetle: *Ytu zeus* (Coleoptera, Myxophaga, Torridincolidae). Proceedings of the Academy of Natural Sciences of Philadelphia, 137(2): 102-105.

Pinto, V. A. B., C. R. V. da Fonseca & N. Hamada. 2011. *Iapir quadridentatus* sp. nov., a new torridincolid beetle from Brazil (Coleoptera: Myxophaga: Torridincolidae). Zootaxa, 3031: 47-53.

Py-Daniel, V., C. R. V. da Fonseca & U. C. Barbosa. 1993. *Iapir* nom. n. para Hintonia Reichardt, 1973 (Coleoptera, Torridincolidae). Revista Brasileira de Entomologia, 37(4): 671.

Reichardt, H. & C. Costa. 1967. *Ptyopteryx britskii*, a new Neotropical genus and species of the hitherto Ethiopian Torridincolidae (Coleoptera, Myxophaga). Papéis Avulsos de Zoologia, São Paulo, 21: 13-19.

Reichardt, H. 1973. A critical study of the suborder Myxophaga, with a taxonomic revision of the Brazilian Torridincolidae and Hydroscaphidae (Coleoptera). Arquivos de Zoologia, São Paulo, 24 (2): 73-162.

Reichardt, H. & S. A. Vanin. 1976. Two new Torridincolidae from Serra do Cipo, Minas Gerais, Brazil (Coleoptera, Myxophaga). Studia Entomologica, 19(1-4): 211-218.

Reichardt, H. & S. A. Vanin. 1977. The torridincolid genus *Ytu* (Coleoptera, Myxophaga). Papeis Avulsos Zoologia, São Paulo, 31(7): 119-140.

Satô, M. 1982. Discovery of Torridincolidae (Coleoptera) in Japan. Annotationes Zoologicae Japonenses, 55(4): 276-283.

Shepard, W. D. & C. A. Aguilar Julio. 2010. Estudio preliminary de las familias de escarabajos acuáticos Dryopidae, Elmidae, Lutrochidae, y Psephenidae conocidos de Paraguay (Coleoptera: Byrrhoidea). Boletín del Museo Nacional de Historia Natural del Paraguay, 16(1): 30-42.

Spangler, P. J. 1980. A new species of *Ytu* from Brazil (Coleoptera: Torridincolidae). The Coleopterists Bulletin, 34(2): 145-158.

Steffan, A.W. 1964. Torridincolidae, coleopterorum nova familia e regione aethiopica. Entomologische Zeitschrift, 74 (17): 193-200.

Vanin, S. A. 1978. *Ytu reichardti*, a new torricolid from Serra do Cipó, Minas Gerais, Brazil (Coleoptera, Myxophaga, Torridincolidae). Revista Brasileira de Entomologia, 22(1): 1-4.

Vanin, S. A. 1991. *Ytu cleideae*, a new species of torridincolid from Mato Grosso, Brazil (Coleoptera, Torridincolidae). Revista Brasileira de Entomologia, 35(3): 573-576.

Vanin, S. A. & C. Costa. 2001. Description of immature stages of *Claudiella ingens* Reichardt & Vanin, 1976 and comparative notes on other Torridincolidae (Coleoptera, Torridincolidae). Aquatic Insects, 23(1): 1-10.

Vanin, S. A. 2011. Torridincolidae. Torrent

Beetles. Version 27 February 2011. http://tolweb.org/Torridincolidae/ in The Tree of Life Web Project. http://tolweb.org/.