



Revision of the Neotropical subgenera *Coelioxys* (*Platycoelioxys*) Mitchell and *C. (Rhinocoelioxys)* Mitchell (Hymenoptera; Megachilidae) with the description of one new species

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Abstract

Two Neotropical subgenera of *Coelioxys* Latreille are revised. The monotypic *C. (Platycoelioxys)* Mitchell and *C. (Rhinocoelioxys)* Mitchell has seven valid species; six of them (*C. agilis* Smith, *C. barbata* Schwarz & Michener, *C. clypearis* Friese, *C. nasidens* Friese, *C. paraguayensis* Schrottky and *C. zapoteca* Cresson) previously described, and one, *C. platygnatha* Rocha-Filho & Packer n. sp. is new from Amazonas State, Brazil. *Coelioxys nasidens*, previously considered a junior synonym of *C. clypeata* Smith, is resurrected. *Coelioxys crassiceps* Friese and *C. excisa* Friese are synonymized under *C. agilis*, and *C. rostrata* Friese is synonymized under *C. paraguayensis*. Nine names (*C. clypeata*, *C. leucochrysea* Cockerell, *C. angustivalva* Holmberg, *C. doelloi* Holmberg, *C. blabera* Holmberg, *C. mesopotamica* Holmberg, *C. bilobata* Friese, *C. bilobata schenki* Friese and *C. bullaticeps* Friese) are synonymized with *C. zapoteca*. In the latter species the shape of the apical margin of the clypeus of the female varies widely and, though intermediates occur among all forms, the DNA barcode sequences for the different forms are very similar. One species formerly considered as *incertae sedis*, *C. clypearis*, and one belonging to the subgenus *C. (Cyrtocoelioxys)* Mitchell, *C. barbata*, are both assigned to the subgenus *C. (Rhinocoelioxys)*. Keys for both sexes of *C. (Rhinocoelioxys)*, distribution maps, host and floral records, redescriptions of species and the description of a new species are provided. In the subgenus *C. (Platycoelioxys)*, only one species, *C. alatiformis* Friese, is recognized with two junior synonyms: *C. crassiceps* Friese syn. nov. and *C. spatuliventer* Cockerell.

Key words: South America, cleptoparasite, cuckoo bees, Apoidea, Megachilini

(*Glyptocoelioxys*) sp., det. T. Griswold". **Madre de Dios**. 1 male (SEMC). "PERU: Madre de Dios, Pakitza Bio. Stn., Reserved Zone, Manu National Park, 317 m, 11°56'4"S, 71°17'0"W, 16 OCT 2000, R. Brooks, PERU1B00 008, ex: wet area near stream". "SM0256138, KUNHM-ENT". 1 male (SEMC). Idem, except "0256646". 1 male (SEMC). Idem, except "0256197". **TRINIDAD & TOBAGO**. **Arima**. 1 female (AMNH). "W.I., Trinidad: Arima Valley, St. Andrews Trace, July 16, 1981, R. Mendez". "*Coelioxys spatuliventer* Ckll., T Griswold det.89". "*Coelioxys (Platycoelioxys) alatiformis* Friese, det. J.S. Ascher". "AMNH_ENT, AMNH_ENT 00013654". **Saint George**. 1 female (BMNH). "TRINIDAD, Guanapo Rd., on *Bidens*". "T.B. Mitchell, Feb. 17. 1966". "*Coelioxys spatuliventer* Ckll., det. Mitch."

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References

- Alfken, J.D. (1928) Eine neue Kegelbienen aus Tunis. *Konowia*, 7, 193–196.
- Andena, S.R., Bego, L.R. & Mechi, M.R. (2005) A comunidade de abelhas (Hymenoptera, Apoidea) de uma área de cerrado (Corumbataí-SP) e suas visitas às flores. *Revista Brasileira de Zoociências*, 7, 55–91.
- Ascher, J.S. & Pickering, J. (2014) *Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila)*. Available from: http://www.discoverlife.org/mp/20q?guide=Apoidea_species (Accessed 01 Oct 2014)
- Baker, J.R. (1975) Taxonomy of five Nearctic subgenera of *Coelioxys* (Hymenoptera: Megachilidae). *The University of Kansas Science Bulletin*, 50, 649–730.
- Baker, J.R., Kuhn, E.D. & Bambara, S.B. (1985) Nests and immature stages of leafcutter bees (Hymenoptera, Megachilidae). *Journal of the Kansas Entomological Society*, 58, 290–313.
- Cockerell, T.D.A. (1914) Bees from Ecuador and Peru. *Journal of the New York Entomological Society*, 22, 306–328.
- Cockerell, T.D.A. (1923) Some bees from British Guiana. *Annals & Magazine of Natural History*, 11, 442–459. <http://dx.doi.org/10.1080/00222932308632869>
- Cockerell, T.D.A. (1927) Megachilid bees from Bolivia collected by the Mulford Biological Expedition, 1921–22. *Proceedings of the United States National Museum*, 71, 1–22. <http://dx.doi.org/10.5479/si.00963801.71-2684.1>
- Cresson, E.T. (1878) Descriptions of new North American Hymenoptera in the collection of the American Entomological Society. *Transactions of the American Entomological Society*, 7, 61–136.
- Cresson, E.T. (1916) The Cresson types of Hymenoptera. *Memoirs of the American Entomological Society*, 1, 1–141.
- DIVA-GIS (2014) DIVA-GIS program, Version 7.5. Available from: <http://www.diva-gis.org/> (accessed on 13 March 2015)
- EOL (2014) Encyclopedia of Life. Available from: <http://www.eol.org> (Accessed 13 Feb 2014)
- Friese, H. (1921) Über die Kegelbienen (*Coelioxys*) Brasiliens. *Zoologische Jahrbücher. Abteilung für Systematik, Ökologie und Geographie der Tiere*, 44, 421–486.
- Gazola, A.L. & Garófalo, C.A. (2009) Trap-nesting bees (Hymenoptera: Apoidea) in forest fragments of the state of São Paulo, Brazil. *Genetics and Molecular Research*, 8, 607–622. <http://dx.doi.org/10.4238/vol8-2kerr016>
- Gibbs, J. (2011) Revision of the metallic *Lasioglossum (Dialictus)* of eastern North America (Hymenoptera: Halictidae: Halictini). *Zootaxa*, 3073, 1–216.
- Gonzalez, V.H., Ospina, M., Palacios, E. & Trujillo, E. (2007) Nesting habitats and rates of cell parasitism in some bee species

- of the genera *Ancyloscelis*, *Centris* and *Euglossa* (Hymenoptera: Apidae) from Colombia. *Boletín del Museo de Entomología de la Universidad del Valle*, 8, 23–29.
- Gonzalez, V.H., Griswold, T., Praz, C.J. & Danforth, B.N. (2012) Phylogeny of the bee family Megachilidae (Hymenoptera: Apoidea) based on adult morphology. *Systematic Entomology*, 37, 261–286.
<http://dx.doi.org/10.1111/j.1365-3113.2012.00620.x>
- Holmberg, E.L. (1916) Las especies argentinas de *Coelioxys*. *Anales del Museo Nacional de Historia Natural de Buenos Aires*, 28, 541–591.
- Holmberg, E.L. (1918) Suplemento I a las especies argentinas de *Coelioxys*. *Physis (Buenos Aires)*, 4, 145–165.
- Iwata, K. (1976) *Evolution of Instinct: Comparative Ethology of Hymenoptera*. Amerind Publishing Company, New Delhi, India, xi + 535 pp.
- Michener, C.D. (1954) Bees of Panamá. *Bulletin of the American Museum of Natural History*, 104, 1–176.
- Michener, C.D. (2007) *The Bees of the World*. 2nd edition. The John Hopkins University Press, Baltimore, US, 953 pp.
- Mitchell, T.B. (1973) *A subgeneric revision of the genus Coelioxys of the Western Hemisphere (Hymenoptera: Megachilidae)*. Department of Entomology, North Carolina State University, Raleigh, 129 pp.
- Moure, J.S. (1951) Notas sinonímicas sobre algunas espécies de *Coelioxys* (Hymenopt. - Apoidea). *Dusenya*, 2, 373–418.
- Moure, J.S., Melo, G.A.R. & Dalmolin, A. (2012) Megachilini Latreille, 1802. In: Moure, J.S., Urban, D. & Melo, G.A.R. (Eds). *Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region - online version*. Available from: <http://www.moure.cria.org.br/catalogue> (Accessed 22 Nov 2012)
- Ratnasingham, S. & Hebert, P.D.N. (2007) BOLD: the barcoding of life data system (www.barcodinglife.org). *Molecular Ecology Notes*, 7, 355–364.
<http://dx.doi.org/10.1111/j.1471-8286.2007.01678.x>
- Ratnasingham, S. & Hebert, P.D.N. (2013) A DNA-based registry for all animal species: the barcode index number (BIN) system. *PLoS One*, 8, e66213.
<http://dx.doi.org/10.1371/journal.pone.0066213>
- Ramírez-Arriaga, E., Cuadriello-Aguilar, J.I. & Hernández, E.M. (1996) Nest structure and parasite of *Euglossa atrovoneta* Dressler (Apidae: Bombinae: Euglossini) at Unión Juárez, Chiapas, México. *Journal of the Kansas Entomological Society*, 69, 144–152.
- Rozen, J.G. & Kamel, S.M. (2007) Investigations on the biologies and immature stages of the cleptoparasitic bee genera *Radoszkowskiana* and *Coelioxys* and their hosts in the genus *Megachile* (Hymenoptera: Apoidea: Megachilidae: Megachilini). *American Museum Novitates*, 3573, 1–43.
[http://dx.doi.org/10.1206/0003-0082\(2007\)3573\[1:IOTBAI\]2.0.CO;2](http://dx.doi.org/10.1206/0003-0082(2007)3573[1:IOTBAI]2.0.CO;2)
- Scheuchl, E. (1996) *Illustrierte Bestimmungstabellen der Wildbienen Deutschlands und Österreichs, Band II: Megachilidae - Melittidae*. Eigenverlag Erwin Scheuchl, Velden, Germany, 116 pp.
- Schrottky, C. (1909) Himenópteros de Catamarca. *Anales de la Sociedad Científica Argentina*, 68, 233–272.
- Schwarz, H.F. & Michener, C.D. (1954) *Coelioxys barbata*. In: Michener, C.D. Bees of Panamá. *Bulletin of the American Museum of Natural History*, 104, pp. 104–105.
- Schwarz, N. (2001) Revision der Gattung *Radoszkowskiana* Popov 1955 und ein Beitrag zur Kenntnis der Gattung *Coelioxys* Latreille 1809 (Hymenoptera: Apidae: Megachilinae). *Linzer biologische Beiträge*, 33, 1267–1286.
- Scott, V.L., Kelley, S.T. & Strickler, K. (2000) Reproductive biology of two *Coelioxys* cleptoparasites in relation to their *Megachile* hosts (Hymenoptera: Megachilidae). *Annals of the Entomological Society of America*, 93, 941–948.
[http://dx.doi.org/10.1603/0013-8746\(2000\)093\[0941:RBOTCC\]2.0.CO;2](http://dx.doi.org/10.1603/0013-8746(2000)093[0941:RBOTCC]2.0.CO;2)
- Sheffield, C.S., Hebert, P.D.N., Kevan, P.G. & Packer, L. (2009) DNA barcoding a regional bee (Hymenoptera: Apoidea) fauna and its potential for ecological studies. *Molecular Ecology Resources*, 9, 196–207.
<http://dx.doi.org/10.1111/j.1755-0998.2009.02645.x>
- Smith, F. (1879) *Descriptions of New Species of Hymenoptera in the Collection of the British Museum*. British Museum (Natural History), London, UK, xxi + 240 pp.
- Torretta, J.P., Durante, S.P., Colombo, M.G. & Basilio, A.M. (2012) Nesting biology of the leafcutting bee *Megachile (Pseudocentron) gomphrenoides* (Hymenoptera: Megachilidae) in an agro-ecosystem. *Apidologie*, 43, 624–633.
<http://dx.doi.org/10.1007/s13592-012-0137-x>
- Vinson, S.B., Frankie, G. & Rao, A. (2011) Field behavior of parasitic *Coelioxys chichimeca* (Hymenoptera: Megachilidae) toward the host bee *Centris bicornuta* (Hymenoptera: Apidae). *Apidologie*, 42, 117–127.
<http://dx.doi.org/10.1051/apido/2010041>
- Voith, J. (1997) *Coelioxys mandibularis* Nyl. as a cuckoo bee of *Osmia villosa* (Schck.) (Hymenoptera, Apiformes, Megachilidae). *Nachrichtenblatt der Bayerischen Entomologen*, 46, 20–25.
- Westrich, P. (1990) *Die Wildbienen Baden-Württembergs*. Band. 1, 2. Eugen Ulmer Verlag, Stuttgart, Germany, 972 pp.
- Woiski, T.D. (2009) *Estrutura da comunidade de vespas e abelhas solitárias em um fragmento urbano de Floresta Ombrófila Mista*. M.Sc. Dissertation. Universidade Federal do Paraná, Curitiba, 31 pp.
- Zillikens, A. & Steiner, J. (2004) Nest architecture, life cycle and cleptoparasite of the Neotropical leaf-cutting bee *Megachile (Chrysosarus) pseudanthidioides* Moure (Hymenoptera: Megachilidae). *Journal of the Kansas Entomological Society*, 77, 193–202.
<http://dx.doi.org/10.2317/0310.29.1>