

***Epeoloides pilosula* (Cresson, 1878)**
[a cleptoparasite of *Macropis* oil bees]
(Hymenoptera: [Apoidea:] Apidae: Apinae: Osirini)

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SUMMARY

This distinctive cleptoparasite of *Macropis* oil bees was once widely distributed in the northern and eastern United States and southern Canada. A lack of records from the latter half of the 20th century led to speculation that this species was extinct until two male *Epeoloides pilosula* were collected in 2002 in Nova Scotia, northeast of its historical range. *Epeoloides* is entirely dependant on nesting aggregations of its host bees, multiple species of *Macropis*, which in turn are strict specialists of *Lysimachia* (yellow loosestrife), from which they obtain pollen and oil. Conservation of *Epeoloides pilosula* will require study and conservation of *Macropis* and *Lysimachia* species.

CONSERVATION STATUS

Red List Status: Critically Imperiled (possibly extirpated from the USA)

Other Rankings:

Canada – Species at Risk Act	None
Canada – provincial status:	None
Mexico	N/A
USA – Endangered Species Act:	None
USA – state legislation:	None
NatureServe:	N/A
IUCN Red List:	N/A

SPECIES PROFILE

DESCRIPTION

Epeoloides pilosula (Cresson) is a moderate-sized cleptoparasitic bee with a smooth, black, shining integument, short but densely plumose, erect pubescence, and a convex (emphorine-like) vertex. This distinctive bee differs from other similar bees in the following ways:

- the integument of *Epeoloides* is entirely black without the red and/or yellow markings of many nomadine cleptoparasites;
- *Epeoloides* lacks the striking bands and patches of appressed, very short hair (superficially resembling integumental maculations) typical of Epeolini (Nomadinae);
- *Epeoloides* possesses apical tergal bands of erect, densely plumose, white hair;
- the second of the three submarginal cells is much smaller than the first or third; and
- the marginal cell is separated from the wing margin and its apex is gradually bent away from the wing margin (the marginal cell touches the wing margin and has an apex that is on the wing margin or more abruptly truncate in most other similar bees).

Epeoloides females can readily be recognized as cleptoparasites as they lack specialized pollen-collecting hairs (i.e. scopae), and the abdomen is pointed posteriorly. Unlike most nomadine females, *Epeoloides* females lack a well-defined pseudopygidial area. Male *Epeoloides* have large eyes, which are strongly convergent above.

Mitchell (1962) and Sheffield et al. (2004) illustrated various structures, and the latter also provided a habitus drawing.

Epeoloides pilosula is the only member of the tribe Osirini in America north of Mexico and the only New World *Epeoloides* and can therefore be easily identified using keys in Mitchell (1962), Michener, McGinley, and Danforth (1994), and Michener (2000) based on the presence of tribal characters for Osirini and generic characters for *Epeoloides* (see also Roig-Alsina, 1989). A distinctive osirine character is the apex of the marginal cell gradually bending away from the wing margin, as described above.

TAXONOMIC STATUS

Epeoloides pilosula (Cresson, 1878; described in the genus *Nomada*) is the only species of the cleptoparasitic tribe Osirini (Apidae: Apinae) present in the United States and Canada and one of only two species of genus *Epeoloides* worldwide (Michener, 2000). The other *Epeoloides* species, the type species *Epeoloides coecutiens* (Fabricius, 1775; described in the genus *Apis*) from Europe, is also an obligate cleptoparasite of *Macropis*. Although a separate genus, *Viereckella*, was described for North American *Epeoloides*, the Nearctic and Palearctic *Epeoloides* species are closely related and therefore regarded as congeners. The genus *Epeoloides* comprises a Holarctic clade sister to the Neotropical osirine clade *Osirinus* + *Protosiris* + *Osiris* (Roig-Alsina, 1989). Within the latter clade, the derived genera *Osiris* and *Protosiris* occur north to northwestern Mexico (Sonora and Sinaloa; specimens in the Essig Museum of Entomology). *Parepeolus sensu* Michener (2000; including subgenus *Ecclitodes*) from temperate South America was resolved by Roig-Alsina (1989) as the basal lineage of Osirini. Thus, Roig-Alsina's (1989) phylogenetic studies place *Epeoloides* within Osirini, contradicting prior placement of *Epeoloides* in its own tribe, Epeoloidini, in subfamily Nomadinae. All Osirini are known or suspected to be cleptoparasites of oil-collecting bees, so this behavior can be considered a synapomorphy of the tribe.

The following nominal species were treated by Mitchell (1962) and subsequent authors as synonyms of *Epeoloides pilosula* (Cresson): *Nomia compacta* Provancher, 1888; *Viereckella ceanothina* Cockerell, 1907; *Epeoloides nearcticus* Ducke, 1909. *Viereckella obscura* Swenk, 1907, was treated as a valid species by Hurd (1979) but is probably an additional synonym (Michener, 2000; Sheffield et al., 2004).

LIFE HISTORY

Epeoloides pilosula has not been reared from *Macropis* (Melittidae: Melittinae: Macropidini) nests but is generally accepted to be an obligate cleptoparasite of *Macropis* species based on the well known association between *E. coecutiens* and *Macropis* hosts in Europe (Pekkarinen, 2003; Bogusch, 2003, 2005) and extensive circumstantial evidence such as frequent historical co-occurrence of *Macropis* and *Epeoloides* in and near patches of *Lysimachia* spp. (yellow or fringed loosestrife; Primulaceae). *Epeoloides pilosula* can be inferred to parasitize multiple *Macropis* species (as does *E. coecutiens* in Europe; see Bogusch, 2005), and its host range quite possibly includes all four North American species. *Macropis nuda* (Provancher) is almost certainly a host of *Epeoloides pilosula*, as this is the only *Macropis* species known from much of the Canadian range of *Epeoloides* (see Sheffield et al., 2004). Other species of *Macropis* are likely additional hosts of *Epeoloides* in the USA, as *Epeoloides* is recorded south to Georgia where *Macropis ciliata* Patton and *M. steironematis* Robertson occur but not *M. nuda*. *Epeoloides pilosula* has also been collected together with *Macropis patellata* Patton at Plummer's Island, Maryland, and elsewhere.

The known flight season of *E. pilosula* is from June to July (Mitchell, 1962), corresponding with peak nesting activity of *Macropis* and peak bloom of its host plant, *Lysimachia*.

Epeoloides pilosula visits a variety of plants for nectar (Mitchell, 1962, listed four floral records), but ultimately depends upon populations of *Lysimachia*, since the *Macropis* hosts of *Epeoloides* are strict *Lysimachia* specialists. *Macropis* females gather both pollen and floral oils from *Lysimachia* species such as *L. terrestris* and *L. ciliata*.

DISTRIBUTION

Epeoloides pilosula is known historically from much of eastern and central North America south to Georgia and northwest to Montana and Saskatchewan, including the vicinity of major cities such as New York City (e.g., Flatbush in Brooklyn, Kings County, New York, in 1894 and 1896; Palisades, New Jersey in 1918 and 1920), Washington, D.C. (Plummers Island, Maryland, 1905-1917), and Boston (Needham: 1921-1927). Mitchell (1962) and Hurd (1979) recorded *Epeoloides pilosula* from the following states and provinces (dates listed in parentheses are the most recent specimens from each area examined [new information]): Massachusetts (Needham: 1921-1927), Connecticut (South Meriden: 1911), Wisconsin (Dane County: 1910), Michigan (Paw Paw Lake: 1906), Ohio, New York (Springlake, Cayuga Co.: 1918, Tuxedo: 1928, Yaphank: 1930, Yonkers: 1935), Virginia, North Carolina, Georgia, North Dakota (Fargo: 1913), Nebraska, and Québec. Sheffield et al. (2004) published additional

Canadian records from Ontario (One Sided [=Oneside] Lake: 1960), Manitoba (Aweme: 1916), and Saskatchewan (Wallwort: 1942, Wood Mountain: 1955). Additional records are from Montana (International Peace Garden, Turtle Mountain: 1958), Illinois (Savannah: 1917), New Jersey (Plainfield: 1927), Pennsylvania, Maryland, West Virginia, and Virginia (new information). Note that of these collections all post-1935 records are from southern Canada from western Ontario to Saskatchewan, and from nearby Montana.

According to Michener (2000), “The American species, *Epeoloides pilosula* (Cresson) seems not to have been collected since 1942; it is possibly extinct, although its presumed host, *Macropis*, remains widespread but localized to patches of its required flower, *Lysimachia* (Primulaceae).” Subsequently, Sheffield et al. (2004) reported their rediscovery of *Epeoloides* in Nova Scotia, and published Canadian records from the 1950’s and one from 1960 (cited above).

THREATS

Loss or reduction of *Macropis* nest aggregations is likely the most general threat to *Epeoloides*. *Macropis* species depend upon *Lysimachia* species for pollen and floral oils, so *Macropis* populations are vulnerable to loss or reduction of *Lysimachia* populations. Although *Lysimachia* flowers can still be found at many sites, most populations located recently in New York are small, and *Macropis* has been found only at relatively natural sites, not in association with *Lysimachia* growing along roadside ditches. However, in Nova Scotia *Macropis nuda* has been collected on *Lysimachia* growing in small patches along roadsides and in larger “weedy” patches growing in recently cleared areas (Sheffield, in litt., 2005), and in the Czech Republic five of nine study sites for *Epeoloides coecutiens* were anthropogenous (Bogusch, 2005). Certain *Lysimachia* species are endangered at least in parts of their range (e.g., *Lysimachia radicans* (Creeping Loosetrife) is listed as endangered in Illinois). The status of associated specialist bees is unknown.

Lysimachia patches are vulnerable to loss and degradation of appropriate habitat, which includes swamps, and stream, pond, and lake margins. Specific threats include clearing of native vegetation along lake margins, especially vacation home frontage, and drainage resulting in drying and loss of *Lysimachia* populations through succession. Another threat is usurpation of *Lysimachia* habitat by invasive weeds such as *Phragmites* and *Lythrum* (purple loosetrife, Lythraceae; not closely related to yellow loosetrife despite their homonymous names) as has been observed in the case of *Lythrum* at Six Mile Creek in Ithaca, New York (new information). Pollution may contribute to replacement of native *Lysimachia* by invasive competitors. Many streamside sites have undoubtedly been lost due to channelization. Due to their occurrence in and near wetlands, *Macropis* and *Epeoloides* may also be more vulnerable than other bees to insecticides applied to control mosquitoes. Applications of broad-spectrum DDT and other organophosphates in the 1940’s and 1950’s may correspond to the period of decline for *Epeoloides*. Near eradication of the beaver across much of North America after European settlement must have drastically decreased available wetland margin habitat for *Lysimachia*, likely resulting in decreased in populations of *Macropis* and *Epeoloides*.

The drastic decline of *Epeoloides* in North America is evidently due to a cause specific to this continent, as the European *Epeoloides coecutiens* remains locally numerous in central Europe and has apparently extended its range north in recent times to Finland and the Baltics (Pekkarinen et al., 2003) although localized populations in certain areas have been recognized as potentially vulnerable (Westrich, 1989; Falk, 1991).

CONSERVATION STATUS

Epeoloides pilosula is probably the bee species most worthy of listing as an endangered species in Canada and, along with *Bombus franklini*, in the United States, based on the absence of records since the 1950's despite numerous records from the early 20th century. This is a conspicuous, readily identified bee and would not be overlooked if specimens were field collected or found in collections by a competent student of bees. The determined and undetermined drawers in most major North American bee collections have already been checked for this species, so the absence of recent records is genuine and not an artifact of neglect. The genuine rarity of *Epeoloides* in the USA is supported by the inability of well-known bee specialists and active general collectors to find this species in recent decades. By contrast, many obscure, non-specialist succeeded in collecting *Epeoloides* in the late 19th and early 20th Century. Canada may be the last stronghold of this species, as the only post-1960 record is from Middleton, Kings County, Nova Scotia in 2002.

CONSERVATION NEEDS

Epeoloides is dependent for its survival upon nest aggregations of its *Macropis* hosts, often located in south-facing sandy banks near wet *Lysimachia* habitat (see Bogusch, 2005). *Macropis* nests sites are restricted in occurrence and perennial (e.g., the nest site of *Macropis nuda* at Huyck Preserve, Rensselaerville, New York, studied by Rozen and Jacobson, 1980, was still active in 2004). Therefore, it would be helpful to locate these to ensure their protection and to facilitate multi-year surveys for *Epeoloides*. Control of invasive plants such as *Lythrum* would undoubtedly benefit *Lysimachia* at many sites. Surveys of the past and present distribution and conservation status of *Lysimachia* are needed. Maintenance of native vegetation along pond, lake, and stream margins is essential.

RESEARCH NEEDS

An obvious priority for research is to locate a viable population of *Epeoloides pilosula* in association with a *Macropis* nest site. This would allow for life history studies and initiation of land use practices designed to maintain and enhance populations of *Lysimachia*, *Macropis*, and *Epeoloides*. Surveys for *Lysimachia* and *Macropis* in Nova Scotia, and in the northern Great Plains and adjacent areas (e.g., southcentral Canada from western Ontario to Saskatchewan, Montana) would be particularly worthwhile as these are the only areas where *Epeoloides* is known to have persisted subsequent to 1935. Data on the occurrence of *Macropis* species and *Lysimachia* hosts across North America would be valuable even if *Epeoloides* is not found, as certain *Macropis* species (e.g., *M. patellata*, *M. ciliata*, *M. steironematis*) and certain *Lysimachia* species are local, perhaps declining, and worthy of consideration as species of special concern. Additional life

history and population studies of the relatively numerous European *Epeoloides* species would be useful pending discovery of viable populations of the Nearctic species.

RESOURCES

CONTACTS

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REFERENCES

- Bogusch, P. 2003. Hosts, foraging behavior and distribution of six species of cleptoparasitic bees of the subfamily Anthophorinae (Hymenoptera: Apidae). *Acta Societatis Zoologicae Bohemicae* 67:65-70.
- Bogusch, P. 2005. Biology of the cleptoparasitic bee *Epeoloides coecutiens* (Hymenoptera: Apidae: Osirini). *Journal of the Kansas Entomological Society* 78:1-12.
- Cane, J. H., G. C. Eickwort, F. R. Wesley, and J. Spielholz. 1983. Foraging, grooming, and mate-seeking behaviors of *Macropis nuda* (Hymenoptera, Melittidae) and use of *Lysimachia ciliata* (Primulaceae) oils in larval provisions and cell linings. *American Midland Naturalist* 110: 257-264.
- Celary, W. 2004. A comparative study on the biology of *Macropis fulvipes* (Fabricius, 1804) and *Macropis europaea* Warncke, 1973 (Hymenoptera: Apoidea: Melittidae). *Folia Biologica* (Cracow) 52: 81-85.
- Falk, 1991. *A review of the scarce and threatened bees, wasps and ants of Great Britain*. Peterborough, UK: Joint Nature Conservation Committee, Nature Conservancy Council. 344 pp.
- Hurd Jr., P. D. 1979. Superfamily Apoidea, pp. 1741-2209 in K. V. Krombein, P. D. Hurd, Jr., D. R. Smith, and B. D. Burks, eds., *Catalog of Hymenoptera in America north of Mexico*, Vol. 2. Washington, D.C.: Smithsonian Institution Press.
- Malyshev, S. I. 1929. The nesting habits of *Macropis* Pz. *Eos* 5: 97-109.
- Michener, C.D. 2000. *The Bees of the World*. Baltimore, MD: Johns Hopkins University Press.
- Michener, C.D., R. J. McGinley, and B. N. Danforth. 1994. *The Bee Genera of North and Central America*. Washington, D.C.: Smithsonian Institution Press.

Mitchell, T. B. 1962. Bees of the eastern United States. Volume II. *North Carolina Agricultural Experiment Station Technical Bulletin No. 152*. 557 pp.

Pekkarinen, A., O. Berg, I. Calabuig, L.-?. Janson, and J. Luig. 2003. Distribution and co-existence of the *Macropis* species and their cleptoparasite *Epeoloides coecutiens* (Fabr.) in NW Europe (Hymenoptera: Apoidea, Melittidae and Apidae). *Entomologica Fennica* 14: 53-59.

Roig-Alsina, A. 1989. The tribe Osirini, its scope, classification, and revisions of the genera *Parepeolus* and *Osirinus*. *University of Kansas Science Bulletin* 54: 1-23.

Rozen, J. G., Jr., and N. R. Jacobson. 1980. Biology and immature stages of *Macropis nuda*, including comparisons to related bees. *American Museum Novitates* no. 2702: 1-11.

Sheffield, C. S., S. M. Rigby, R. F. Smith, and P. G. Kevan. 2004. The rare cleptoparasitic bee *Epeoloides pilosula* (Hymenoptera: Apoidea: Apidae) discovered in Nova Scotia, Canada, with distributional notes. *Journal of the Kansas Entomological Society* 77: 161-164.

Westrich, P. 1989. *Die Wildbienen Baden-Wurttembergs: Allgemeiner Teil*, pp. 1-431; *Spezieller Teil: Die Gattungen Und Arten*, pp. 437-972. Stuttgart, Germany: Eugene Ulmer.

WEBSITES

Epeoloides pilosula has no significant web presence.

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