






A new case of gynandromorphism in the *Halictus simplex* species group (Hymenoptera: Halictidae)

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Introduction

Gynandromorphism is a condition in which an individual exhibits both male and female phenotypic traits. Among Hymenoptera, bees (Anthophila) account for numerous documented cases, with gynanders identified across six of the seven global bee families (Michez et al, 2009). Within the Halictidae, several cases have been documented (Andrewes, 1946; Hohndorf, 1931; Krichilsky et al, 2020; Leclercq, 1953; Popov, 1937; Saunders, 1901; Wcislo et al, 2004). Further discoveries of gynanders in this family can provide valuable insights into associating male and female characteristics, particularly within taxonomically challenging groups such as *Halictus* (*Monilapis*) Cockerell.

Results and Discussion

One *Halictus* Latreille gynander specimen collected in Gallinara (Italy) on July 20th, 1983, was found in the entomological collection of the University of Mons, Belgium. This specimen is placed within the subgenus *Monilapis* based on its convex gena (Fig. 1c) and the prominent punctation with shiny interspaces on the propodeum laterally (Fig. 1d). The species is part of the *Halictus simplex* species group, in which species delineation is only possible in males. This specimen has the particularity to be a gynander with a mosaic pattern, i.e. with features distributed randomly across the body. Most tissues of the specimen exhibit female characteristics (Fig. 1a,f), while male morphological features are limited to the left antenna and to the genae, which are both convex (i.e. a male feature in the *Halictus simplex* group).

Although the structure and length of the right antenna are typical of that of a female, with 12 properly developed articles, an emerging atrophied 13th segment can be observed, this segment being partially fused to the 12th (Fig. 1b). Furthermore, while the hind legs exhibit female structural traits, including well-developed scopa, they display a coloration typical of males (Fig. 1e).

Over the past 123 years, only three instances of gynandromorphy have been documented in the genus *Halictus*, including in the *simplex* group (Blüthgen, 1923; Leclercq, 1953; Popov, 1937; Saunders, 1901). Further discovery of gynanders in this genus could be valuable opportunities for identifying new diagnostic criteria for delineating species. In the studied case, the distinct coloration and morphology of this specimen's legs also offer insights into *Halictus* development, indicating that the coloration and structure of legs occur as separate developmental pathways at the embryonic level. The synthesis of all variations observed in cases of gynandromorphism and teratogenesis will serve as a foundation for future research aimed at uncovering the embryological and molecular mechanisms underlying these phenomena.

Material

https://data.canadensys.net/micropublications/resource?r=specimen_37

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Fig. 1. Studied gynander belonging to the *Halictus simplex* group (specimen HY-HA.0006). **a)** Habitus in oblique view. **b)** Frontal view. **c)** Head in lateral view. **d)** Propodeum in dorsal view. **e)** Mid and hind left legs in posterior view. **f)** Typical male (red) and female (dark green) characters. The light green structures show mixed male and female characteristics.