

Colletine bees and their interactions with flowers of the polygalaceous genus *Monnina*

Abelhas da subfamília Colletinae e suas interações com flores de poligaláceas do gênero *Monnina*

Gabriel A. R. Melo

Received 09/19/2024 | Accepted 09/01/2025 | Published 10/01/2025 | Edited by Rodrigo Gonçalves

Abstract

Anecdotal observations of colletine bees visiting flowers of the genus *Monnina* Ruiz & Pav. (Polygalaceae) are presented. The colletine genera documented here as visitors of flowers of *Monnina* belong to the tribes Caupolicanini (*Caupolicana* Spinola), Colletini (*Colletes* Latreille, *Mourecotelles* Toro & Cabezas and *Rhynchocolletes* Moure), Dissoglossini (*Mydrosomella* Michener), Eulonchopriini (*Belopria* Moure), and Lonchopriini (*Biglossidia* Moure). It is expected that these observations stimulate further detailed studies of the floral biology of *Monnina* and of the interactions with their bees acting as visitors.

Keywords: Colletidae, floral biology, Neotropical, Polygalaceae

Resumo

São documentadas observações ocasionais de abelhas da subfamília Colletinae visitando flores do gênero *Monnina* Ruiz & Pav. (Polygalaceae). Os gêneros de Colletinae documentados aqui como visitantes de flores de *Monnina* pertencem às tribos Caupolicanini (*Caupolicana* Spinola), Colletini (*Colletes* Latreille, *Mourecotelles* Toro & Cabezas e *Rhynchocolletes* Moure), Dissoglossini (*Mydrosomella* Michener), Eulonchopriini (*Belopria* Moure) e Lonchopriini (*Biglossidia* Moure). Espera-se que essas observações estimulem estudos mais detalhados da biologia floral de *Monnina* e das interações com as abelhas que atuam como visitantes.

Palavras-chave: Biologia floral, Colletidae, Neotropical, Polygalaceae

Laboratório de Biologia Comparada de Hymenoptera, Universidade Federal do Paraná, Departamento de Zoologia, Caixa Postal 19020, CEP 81531-980, Curitiba, PR, Brazil. E-mail: garmelo@ufpr.br. ORCID: <https://orcid.org/0000-0001-9042-3899>

The bee subfamily Colletinae (sensu Melo & Gonçalves, 2005) contains a series of tribes mostly restricted to the Southern Hemisphere plus the two worldwide tribes Colletini and Hylaeini (Almeida et al., 2012; Melo, 2022). Many of its species are pollen specialists, visiting flowers of a restricted range of species belonging to a single plant genus, or to closely related genera of a single plant family (e.g. Schlindwein, 1998; Silveira & Martinez, 2009; Houston, 2020; Siriani-Oliveira et al., 2020).

In a recent paper dealing with the nesting biology of a newly described species of *Mourecotelles* found in Brazil, Ferrari et al. (2022) reported its preference for provisioning with pollen from Fabaceae and Polygalaceae, with the latter corresponding to two-thirds of the total pollen mass consumed by the bee larvae. This data was complemented with a record I had obtained several years before involving this colletine bee and flowers of *Monnina* Ruiz & Pav., a plant genus belonging to the Polygalaceae. The small piece of field evidence reinforced the findings resulting from the analyses of the pollen stored in the bee nests. In this contribution, I present other anecdotal observations on visits of colletine bees to flowers of *Monnina*, in addition to the one mentioned above, gathered along a period spanning more than two decades. Additional published records, as well as records found on iNaturalist (www.inaturalist.org), are also provided.

No plant exsiccates were prepared and the species of *Monnina* observed in Brazil were identified using Lüdtke et al. (2009), based on distribution, habitat, and some morphological features of the plants. The *Monnina* observed in Mexico was identified through comparisons with photographs available on iNaturalist. The bee specimens obtained during field work are deposited in the insect collection of the Departamento de Zoologia, Universidade Federal do Paraná (DZUP) and were identified using available keys (Balboa et al. 2017; Ferrari 2019) and by comparison with type material. Analyses of pollen grains on the bees were observed directly over a stereomicroscope. Pollen grains of *Monnina* are very distinct (Leite et al. 2015; Ferrari et al. 2022) and can be easily recognized, even at 100x magnification in a stereomicroscope.

1. Brazil, Santa Catarina, Araranguá, 28°57'S 49°25'W. *Monnina cardiocarpa* A. St-Hil. & Moq. and *Monnina cuneata* A. St-Hil. & Moq.

In a collecting trip to the site on November 17th, 2002, while searching for solitary bee nests and accompanied by Isabel Alves dos Santos, Antonio Aguiar and Jerome Rozen Jr., we collected two females of *Belopria* sp.1 (scopae of both females filled with *Monnina* pollen) and one female of *Colletes sexangulus* Ferrari (scopae filled with *Monnina* pollen). The plants were growing on the sand soils in a paleodune. No detailed observations regarding the plants or the behavior of visiting bees, nor any photographs, were taken. The site was visited again five years later, on November 20th, 2007, this time accompanied by Danielle Parizotto and Aline Martins, when five females and one male of *Colletes sexangulus* (three females with scopae filled with *Monnina* pollen) were collected. Again, no details about the plants and the bees were taken. Two species of *Monnina* have been reported for this region, *Monnina cardiocarpa* and *M. cuneata*. The pollen found in the scopae of females collected in 2002 was compatible with both species, while that from 2007 appeared to be exclusively from *M. cuneata*.

2. Brazil, Paraná, Piraquara, 25°27'S 49°06'W. *Monnina tristaniana* A. St-Hil. & Moq.

The site was visited for the first time on March 6th, 2005, accompanied by Antonio Aguiar, when one female and six males of *Colletes sexangulus* were collected while visiting flowers of *Monnina tristaniana* growing on the edge of a marsh. On this occasion, no detailed observations of the plants and their visiting bees, nor any photographs, were taken. After 17 years, the site was visited again in November 15th, 2022, when many plants of *Monnina* were in bloom. For this species, its inflorescences stand out above the level of the surrounding plants and can be easily spotted and visited by the bees (Fig. 1). I went back a week later (22nd), this time accompanied by Marcos Fianco, who was responsible for taking macrophotographs of the bees on the flowers (Fig. 2). In these two visits in 2022, I found three females and three males of *Colletes sexangulus* (one female with a large amount of

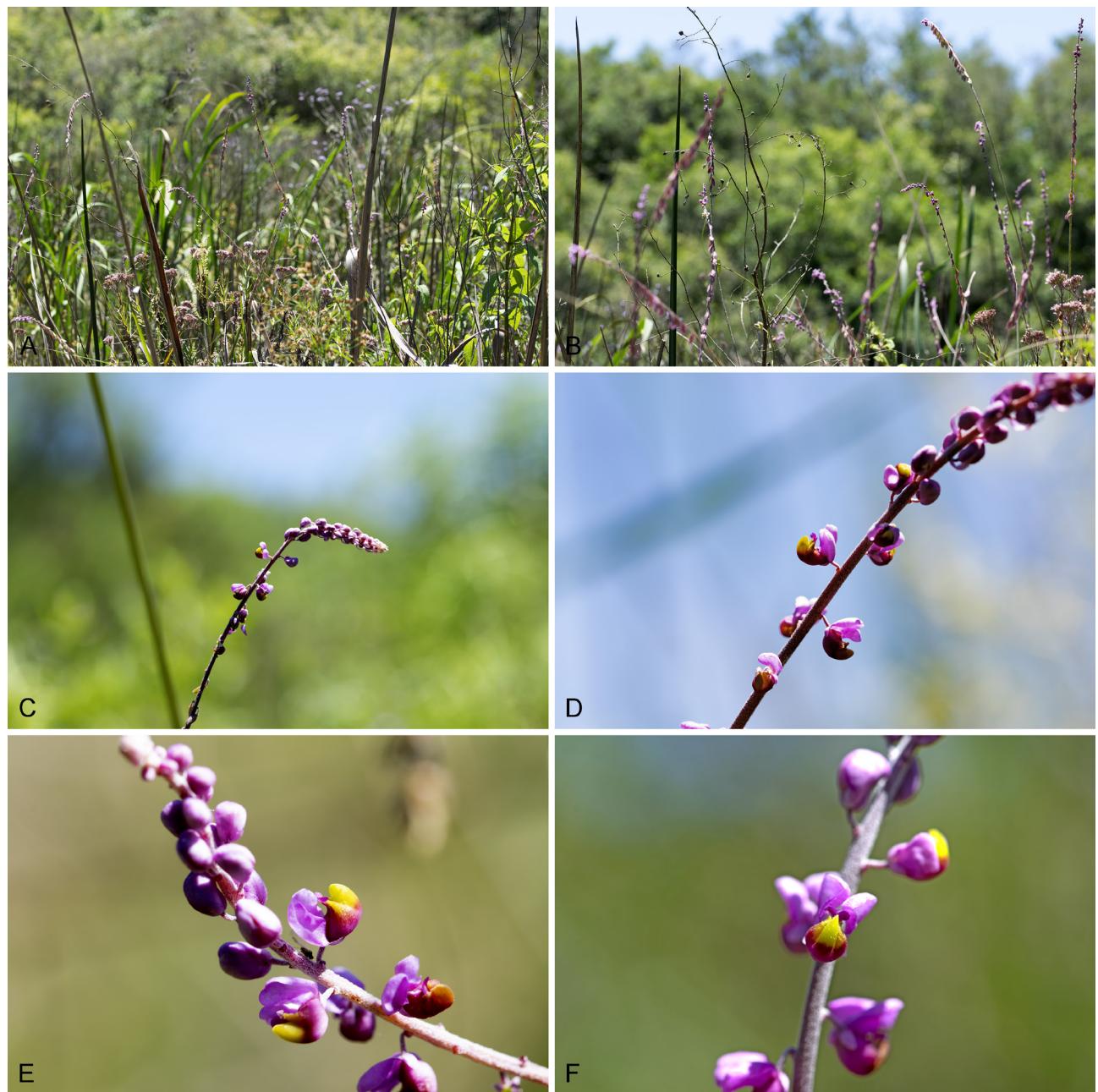


Figure 1. Flowering plants of *Monnieria tristaniana* (Brazil, Paraná, Piraquara, 25°27'S 49°06'W). A-B, Inflorescences. C-D, Detail of the inflorescences. E-F, Details of the flowers

Monnieria pollen mixed with a very fine pollen grain, and another with practically only *Monnieria* pollen), two females of *Colletes* aff. *imbricatus* Ferrari (one of the females had its scopa filled with two types of pollen grains, one small and more numerous and the larger *Monnieria* pollen in lesser quantity), three females of

Mydrosomella cleia Graf & Urban and two females of *Belopria* sp.2 (one female had its scopa filled almost entirely with a small pollen grain, while the second one had a larger amount of the small pollen grain and, in lesser quantity, the larger *Monnieria* pollen).

3. Brazil, Paraná, Palmas, 26°33'S 51°36'W.
Monnina tristaniana A. St-Hil. & Moq.

During a collecting trip to the plateau of Palmas, in the southern portion of the state of Paraná, near the border with the state of Santa Catarina, carried out in September 2009, and accompanied by Kelli Ramos and Vitor Kanamura, a few plants of *Monnina* growing in a marsh had their flower visitors collected. We spent a single morning (September 18th) at this site, and the following species were sampled: *Belopria* sp.2 (two females, five males; one of the females had its scopae filled with *Monnina* pollen), *Colletes sexangulus* (four females, two males; two females had their scopae filled with *Monnina* pollen), and *Mourecoctelles brasiliensis* Ferrari & Melo (one female, one male; some *Monnina* pollen grains were present in the female scopae). No detailed observations of the plants or any photographs were taken. The record involving *M. brasiliensis* was mentioned in Ferrari et al. (2022: 225).

4. Mexico, Chiapas, San Cristobal de las Casas, 16°42'N 92°41'W. *Monnina xalapensis* Kunth

During a field trip to Mexico in 2013, accompanied by Bruno Bueno da Rosa, we came across a large stand of *Monnina* plants in bloom on the outskirts of San Cristobal de las Casas, in Chiapas. The site was discovered on August 14th, when one female of *Rhynchocolletes solari* (Balboa & Ayala) was found visiting the flowers of this *Monnina* species. This bee species was originally described as a *Colletes* (see Balboa et al. 2017) and it is here newly combined in *Rhynchocolletes* (taxonomic details will be presented in a forthcoming contribution). Six days later, on the 20th, we visited the site again and were able to collect a second female. The specimen collected on the 14th had its scopae filled with two types of pollen grains, one very small and more numerous, and in lesser quantity the larger *Monnina* pollen. Only photographs of the blooming plants and of the inflorescences were taken (Fig. 3).



Figure 2. Bees visiting flowers of *Monnina tristaniana* (Brazil, Paraná, Piraquara, 25°27'S 49°06'W). A, Female of *Colletes sexangulus*. B, Female of *Mydrosomella cleia*. C-D, Females of *Belopria* sp.2



Figure 3. Flowering plants of *Monnieria xalapensis* (Mexico, Chiapas, San Cristobal de las Casas, 16°42'N 92°41'W). A, Blooming plant. B-C, Detail of the inflorescences. D-E, Detail of the flowers

Previous records of colletine bees on flowers of *Monnieria* were published by Schlindwein (1998), who reported three species of *Colletes* (Colletini), *Cephalocolletes rugata* Urban and one species of *Sarocolletes* (Eulonchopriini) visiting *Monnieria cuneata*, in addition to *Xylocopa ciliata* Burmeister, *Apis mellifera* Linnaeus and an unidentified species of *Megachile* (Leptorachis). Also, Pinheiro et al. (2008) recorded four unidentified species of colletine bees in flowers of *Monnieria oblongifolia* Arechav., belonging to the genera *Caupolicana* (Caupolicanini), *Colletes*, *Cephalocolletes* and *Sarocolletes*, as well as *Apis mellifera*, *Xylocopa augusti* Lepeletier, one unidentified

species of *Augochlorodes*, and two of *Megachile* (Leptorachis).

On iNaturalist (<https://www.inaturalist.org>), there are several records of both females and males of *Caupolicana niveofasciata* Friese visiting flowers of an unidentified species of *Monnieria* in Ecuador (observations 105340038, 14192674, 68075553, 45588159, 190011158, 190829417, 173154172, 189890874). There are also additional records of a male *Colletes* (observation 40784036) and of what seems a female *Biglossidia* (Lonchopriini) (observation 50548539) visiting flowers of *Monnieria dictyocarpa* Griseb., in Argentina.

Table 1. Species of colletine bees recorded here as visitors of flowers of the genus *Monnina* (Polygalaceae)

Bee Tribe	Bee Species	Monnina species	Female scopae with <i>Monnina</i> pollen
Colletini	<i>Colletes aff. imbricatus</i>	<i>M. tristaniana</i>	Yes
	<i>Colletes sexangulus</i>	<i>M. cardiocarpa</i>	Yes
		<i>M. cuneata</i>	Yes
		<i>M. tristaniana</i>	Yes
	<i>Mourecoctelles brasiliensis</i>	<i>M. tristaniana</i>	Yes
	<i>Rhynchocolletes solari</i>	<i>M. xalapensis</i>	Yes
Dissoglossini	<i>Mydrosomella cleia</i>	<i>M. tristaniana</i>	No
Eulonchopriini	<i>Belopria</i> sp.1	<i>M. cardiocarpa</i>	Yes
		<i>M. cuneata</i>	Yes
	<i>Belopria</i> sp.2	<i>M. tristaniana</i>	Yes

Judging from the observations gathered here, it seems that many colletine bees have a close relationship with the polygalaceous genus *Monnina*. These bees belong to five different tribes (Table 1): Caupolicanini (*Caupolicana* Spinola), Colletini (*Colletes* Latreille, *Mourecoctelles* Toro & Cabezas and *Rhynchocolletes* Moura), Dissoglossini (*Mydrosomella* Michener), Eulonchopriini (*Belopria* Moura), and Lonchopriini (*Biglossidia* Moura) (see Melo (2022) for a summary of the higher-level classification for the Colletinae). Such widespread behavior suggests that these bees might have exerted selective pressure on the evolution of *Monnina* and were involved in shaping their current flower morphology. *Monnina* has around 150 species, found from Argentina to southern United States, with the highest diversity in the Andean region (Freire-Fierro et al. 2023). This pattern of higher richness in the Andean region coincides with that exhibited by the colletine lineages found in South America, especially the tribes Caupolicanini, Colletini, Eulonchopriini and Lonchopriini (Moure et al. 2022).

There are many details of the relationship between colletine bees and *Monnina* flowers that require further investigation. For example, it is not clear how these bees move the flower pieces to access the nectar

and the pollen. Judging from the photographs taken, it seems that they insert their mouthparts and forelegs between the allae and lower the keel, as described by Westerkamp & Weber (1999). Indeed, all colletine bees found on flowers of *Monnina* belong to species having a medium to large body size, suggesting that access to the resources requires strength to move the flower parts. It is hoped that the anecdotal data presented here will stimulate detailed studies of the floral biology of *Monnina* and of the behavior of their visiting colletine bees.

Acknowledgements

All colleagues mentioned in the text are thanked for their support during field work. Ricardo Ayala is thanked for his support during the trip to Mexico. I also thank Marcos Fianco for taking the macrophotographs of the bees on the *Monnina* flowers. Financial support has been received through research scholarships from CNPq.

Conflicts of interest

The author declares no conflict of interest.

References

Almeida, E.A.B., Pie, M.R., Brady, S.G., Danforth, B.N. (2012). Biogeography and diversification of colletid bees (Hymenoptera: Colletidae): Emerging patterns from the Southern end of the world. *Journal of Biogeography*, 39, 526–544.

Balboa, C., Hinojosa-Díaz, I., Ayala, R. (2017). New dark species of the bee genus *Colletes* (Hymenoptera, Colletidae) from Mexico and Guatemala. *Zootaxa* 4320 (3), 401–425.

Ferrari, R.R. (2019). A revision of *Colletes* Latreille (Hymenoptera: Colletidae: Colletinae) from Brazil, Paraguay and Uruguay. *Zootaxa* 4606 (1), 1–91.

Ferrari, R.R., Buschini, M.L.T., Diniz, M.E.R., Zhu, C.-D., Melo, G.A.R. (2022). Discovery of *Mourecotelles* (Hymenoptera, Apidae, Colletinae) in Brazil: nesting biology and pollen preferences of a remarkable new species of the genus. *Journal of Hymenoptera Research* 89, 211–231.

Freire-Fierro, A., Forest, F., Devey, D.S., Pastore, J.F.B., Horn, J.W., Ge, X.-J., Wang, Z., Xiao, T.-W., Bien, W.F. (2023). *Monnina* (Polygalaceae), a New World monophyletic genus full of contrasts. *Botanical Journal of the Linnean Society* 203 (3), 227–252.

Houston, T.F. (2020). Nesting biology of the Australian solitary bee *Paracolletes crassipes* Smith (Hymenoptera: Colletidae) accords with that of the Diphaglossinae. *Records of the Western Australian Museum* 35, 53–62.

Leite, W.P., Aguiar-Dias, A.C.A., Fierro-Freire, A., Mendonça, C.B.F., Gonçalves-Esteves, V. (2015). Pollen diversity in Brazilian species of *Monnina* (Polygalaceae). *Phytotaxa* 220 (2), 117–126.

Lüdtke, R., Souza-Chies, T.T., Miotto, S.T.S. (2009). O gênero *Monnina* (Polygalaceae) na Região Sul do Brasil. *Acta Botanica Brasilica* 23 (1), 175–195.

Melo, G.A.R. (2022). A revised classification for the neopasiphaeine line, with the description of new species of the bee tribe Lonchopriini (Apidae, Colletinae). *Acta Biologica Paranaense* 51, e86600, 1–14.

Melo, G.A.R., Gonçalves, R.B. (2005). Higher-level bee classifications (Hymenoptera, Apoidea, Apidae sensu lato). *Revista Brasileira de Zoologia* 22 (1), 153–159.

Moure, J.S., Urban, D., Melo, G.A.R. (Orgs.). (2022). Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region - online version. Available at <https://www.moure.cria.org.br/catalogue>. Accessed Sep/16/2024.

Pinheiro, M., Abrão, B.E., Harter-Marques, B., Miotto, S.T.S. (2008). Floral resources used by insects in a grassland community in southern Brazil. *Brazilian Journal of Botany* 31, 469–489.

Schlindwein, C. (1998). Frequent oligolecty characterizing a diverse bee-plant community in a xerophytic bushland of subtropical Brazil. *Studies on the Neotropical Fauna and Environment* 33, 46–59.

Silveira, F.A., Martinez, R.B. (2009). A new species of *Mydrosoma* Smith with a key to Brazilian species of the genus and a discussion on the classification of the Dissoglossini (Hymenoptera: Colletidae). *Zootaxa* 2105, 32–42.

Siriani-Oliveira, S., Cerceau, I., Schlindwein, C. (2020). Specialised protagonists in a plant-pollinator interaction: the pollination of *Blumenbachia insignis* (Loasaceae). *Plant Biology* 22 (2), 167–176.

Westerkamp, C., Weber, A. (1999). Keel flowers of the Polygalaceae and Fabaceae: a functional comparison. *Botanical Journal of the Linnean Society* 129, 207–221.

.