ENTOMOLOGICAL Communications

Entomological Communications, 6, 2024: ec06030
doi: 10.37486/2675-1305.ec06030
e-ISSN: 2675-1305
Open Access Full Text Article

Scientific Note

First record of *Hololepta* (*Leionota*) *reichii* (Marseul, 1853) (Coleoptera: Histeridae) in meliponaries of the state of Ceará (Brazil) and notes on the methods used to control this pest

Hiara M. Meneses[1], Epifânia E. de M. Rocha[1], Paloma Eleutério[1], Adriana A. Mota[2], Luiz W. Lima-Verde[1], Ana C. Dierings[3], Breno M. Freitas[1]

[1]Universidade Federal do Ceará, Fortaleza, CE, Brazil. [2]Universidade Federal do Paraná, Curitiba, PR, Brazil. [3]Universidade Federal do Paraná, Palotina, PR, Brazil.
Corresponding author: paloma_eleuterio@hotmail.com

Edited by: Ivan C. F. Martins

Received: March 11, 2024. Accepted: August 21, 2024. Published: November 25, 2024.

Abstract. Meliponaries are an alternative for the preservation of stingless bee species, in addition to producing raw material for the pharmaceutical and cosmetic industry. The presence of invaders that can cause damage to the integrity of productive areas is something that is frequently reported. The same happens in meliponaries, where bees can have many natural enemies, whether vertebrates or invertebrates. Updating new records and management methods are crucial to avoid major losses in production. The aim of this work is to report the first occurrence of the clown beetles, *Hololepta* (*Leionota*) *reichii* (Marseul, 1853) (Insecta: Coleoptera: Histeridae) in meliponaries of the state of Ceará, Brazil, and provide notes on the methods used to control it. A total of 109 individuals (40 females; 69 males) were collected between February and July 2022, placed in alcohol 70%, and subsequently identified. Measures such as the removal of decaying organic materials from nearby the colonies, added to frequent inspection, internal and external cleaning of the hive boxes after infestations, in addition to the elimination of beetles found in the hives, had a positive effect in reducing the records of attacks.

Keywords: new record, economic damage, predators, stingless bee.

Many are the natural enemies of stingless bees (Apidae: Meliponini) that can negatively impact the development and maintenance of colonies in rational breeding. However, the widely distributed clown beetles (Histeridae Gyllenhal, 1808) are not included in most lists, despite their destructive potential. In this group of beetles, *Hololepta* (*Leionota*) *reichii* (Marseul, 1853) (Insecta: Coleoptera: Histeridae) stands out, occurring in North America, Mexico, Central American countries, and South America, in French Guiana, Brazil and Argentina (Mazur 1984; Mazur 2011). So far, in Brazil, there were records of this species in the states of Amazonas (Colleto-Silva & Freire 2006); Paraná (Leonel & Leivas 2013); Goiás (Silva-Neto et al. 2019); Mato Grosso (Péche et al. 2019) and Espírito Santo (Carvalho et al. 2021). In this note, we are registering one more occurrence of *H. reichii* for Brazil and the first record for the state of Ceará, the economic losses in this case and the method we used to control the Histerid beetle.

The present records of the occurrence of clown beetles were conducted in a meliponary located in the municipality of Aquiraz, state of Ceará, Brazil (03°54'03" S, 38°23'27" W), at an altitude of 14.6 m above mean sea level. The local climate is tropical hot sub-humid Aw, in the Koppen classification, with an average annual rainfall of 1,379.9 mm, and an average annual temperature between 26° and 28° C (IPECE 2017). The site has a vegetation cover of wooded savannah (IBGE 2012) and managed areas with introduced plants, such as annatto (*Bixa orellana* Linnaeus), pitaya [*Hylocereus polyrhizus* (Weber) Britton & Rose] and *Aloysia virgata* (Ruiz & Pav.) Juss., which are intensively managed to provide trophic resources to bees.

A total of 109 individuals were collected between February and July 2022, a period that coincides with the rainy season. The samples were stored in 70% alcohol, until later identification and sexing at the Insect Taxonomy Laboratory of the Federal Rural University of Pernambuco (UFRPE), which occurred with the aid of the morphological descriptions proposed by Degallier et al. (2010) and was compared with material examined in collections. The beetles were identified as belonging to the subfamily Histerinae, the most abundant predatory species (Correa et al. 2020). Belonging to the tribe Hololeptini, the specimens were identified as the species *H.* (*L.*) *reichii*. The collections of the material examined for comparison are listed below:

CEMT - Coleção Zoológica da Universidade Federal de Mato Grosso, Setor de Entomologia, Cuiabá, Brasil (Dr. Fernando Zagury Vaz-de-Mello).

CERPE - Coleção Entomológica da Universidade Federal Rural de Pernambuco Recife, Brasil (Dr. Paschoal Grossi).

CESP - Coleção Entomológica do Setor Palotina, Universidade Federal do Paraná, Palotina, Brasil (Dr. Fernando Willyan Trevisan Leivas).

DZUP - Coleção Entomológica Pe. J. S. Moure, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brasil (Dra. Lúcia Massutti de Almeida).

FZRG - Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brasil (Dr. Luciano de Azevedo Moura).

The meliponary where *H. reichii* was found has eight species of meliponines raised rationally in wooden hives arranged in collective shelters, with up to 118 boxes per structure. The models and sizes of the hives varied according to the species, but with a predominance of those developed by the National Institute of Amazonian Research (INPA) (Carvalho-Zilse et al. 2005). Hives of five bee species had invasions by clown beetles recorded: *Melipona flavolineata* (Friese, 1900), *Melipona subnitida* (Ducke, 1910), *Melipona fasciculata* (Smith, 1854), *Scaptotrigona depilis* (Moure, 1942) and *Frieseomelitta varia* (Lepeletier, 1836). During routine colony inspection, we recorded the invasions by means of notes and occasional photographs. In addition to the occurrences in rational hives, we also recorded an episode of infestation in a colony of the species *S. depilis* kept in a natural wooden trunk in one of the shelters.

The signs of *H. reichii* invasion in the colonies were: low bee population; open or destroyed brood cells (Fig. 1); pieces of bees in larval and pupal stages outside the brood cells (Fig. 2); dead adult bees decapitated and/or with empty abdomen (without internal organs) (Fig. 2). The feeding behavior of the beetle is in accordance with that described by Coletto-Silva & Freire (2006) and Carvalho et al. (2021) in stingless bee colonies. It is important to emphasize that this is the first record of predation by *H. reichii* of adult bees in meliponaries in the state of Ceará.

Figure 1. A. *Melipona fasciculata* brood cells destroyed after *Hololepta reichii* invasion. B. Massive invasion of *Hololepta reichii* in a colony of *Melipona flavolineata*.

In most observations, *H. reichii* specimens were on the lid, in the gaps and corners of the hive, and hidden under the food pots (Fig. 1). In the case of the natural trunk hive, the individuals were hidden under splinters and loose pieces of wood, which made it difficult to visualize at first.

Based on a behavioral study of these beetles (*in situ*), observations and description by Carvalho et al. (2021), the management we applied on the area to reduce their population, as well as the damage they cause to the colonies were: (1) inspection and cleaning of the hives, avoiding leaving exposed or damaged brood; (2) elimination of beetle specimens found in the colonies and near the shelters; and (3) removal of decomposing organic matter from the vicinity of the meliponine shelters.

Figure 2. A. Immature worker of *Melipona flavolineata* outside her brood cell missing internal organs after invasion by *Hololepta reichii* in the colony. B. Dead adult *Melipona flavolineata* workers after *Hololepta reichii* attack in the colony. C Adult *Melipona fasciculata* workers decapitated after *Hololepta reichii* attack in the colony.

Two weeks after initiating management control the number of *H. reichii* individuals seen in the area decreased dramatically. We found a few individuals sporadically trying to enter some hives, however, there was no further loss of colonies. Materials with fermented pollen, in the process of fermentation, or with bee feces, attracted large numbers of beetles, even outside hives. This happens because clown beetles are usually found in places with the presence of living organic matter, so products from microbial action are attractive to this histerid beetles (Aballay et al. 2013; Kovarik & Caterino 2016).

Figure 3. Specimens of *Hololepta reichii* in meliponine colonies. A. Hidden between the layers of the box B. trying to enter the colony; C. between the lid and the rational colony module; D. in the inner corner of the hive, next to the garbage bin.

Forty-one meliponine colonies were attacked during the observation period, most of them *Melipona* (Tab. 1). The maximum amount of *H. reichii* found in a single colony was twenty-four individuals in a *M. flavolineata* colony. The impact on the breeding stock was the loss of 3% of the colonies, with a financial value of U$ 1,620.00 (Tab. 1). The loss of these colonies was identified through the death of most of the workers and the absence or death of the queen. Queens were found with empty abdomens after the attack, however the remains of physiogastric females were not identified in most hives due to the large number of dead bees and material mixed with the cadavers. In smaller farms, the attack of these beetles can mean higher losses, while the densification of colonies in professional meliponaries, such as the one studied, can be an attractant, facilitating infestations of beetles of this species.

Table 1. Financial losses for a commercial meliponary due to infestation by *Hololepta reichii* in 2022, Aquiraz, Ceará, Brazil.

Species	Attacked colonies	Dead colonies	Value per colony lost ($)	Total value lost ($)
Melipona flavolineata	20	12	77.00	924.00
Melipona subnitida	12	10	58.00	580.00
Melipona fasciculata	5	0	-	0.00
Scaptotrigona aff. *depilis*	3	1	58.00	58.00
Frieseomelitta varia	1	1	58.00	58.00
Total	**41**	**24**	**-**	**1,620.00**

This is the first record of *H. reichii* attack on stingless bees in Ceará, increasing to five species the records of meliponines attacked by this Histerid beetle in Brazil. It is important to consider that attacks like this may become more frequent, as meliponaries with many colonies expand across the country. Thus, further studies on the biology and behavior of this predator are necessary to develop faster and more effective measures to prevent or control similar infestations, avoiding new losses. Studies such as this one increase the relevance of the impact that predatory beetles can have on meliponine populations, in addition to accounting for the financial losses attributed to infestations in a commercial meliponary.

Acknowledgments

AAM thanks to FACEPE (Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco) for financial support and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico). PE thanks to CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior). ACD thanks LAPCOL (Laboratorio de Pesquisa em Coleoptera) and CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior). BMF thanks CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) for Research Productivity Fellowships. All authors thank the beekeeper in Aquiraz, Ceará, Brazil.

Funding Information

AAM: FACEPE (Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco) financial support (Process number: IBPG-0545-2.04/21) and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) (Process 140194/2023-1). PE: CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior). ACD: CAPES (Process number: 88882.382396/2019-01). BMF: CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) Research Productivity Fellowships (#308358/2019-8).

Authors' Contributions

HMM: Conceptualization, Data curation, Investigation, Visualization, Methodology, Writing - original draft; EMMR: Data curation, Writing -review & editing; PE: Data curation, Writing -review & editing; AAM: Investigation, Writing -review & editing; LWLV: Writing - review & editing; ACD: Investigation, Writing -review & editing; BMF: Supervision, Validation, Writing - review & editing.

Conflict of Interest Statement

The authors declare no competing interests.

References

Aballay, F.; Arriagada, G.; Flores, G.; Centeno, N. (2013) An illustrated key to and diagnoses of the species of Histeridae (Coleoptera) associated with decaying carcasses in Argentina. *ZooKeys*, 261: 61-84. doi: https://doi.org/10.3897/zookeys.261.4226

Carvalho, A. F.; Leivas, F. W. T.; Souza, T. B. (2021) Feeding habits and behavior of a bee killer: *Hololepta reichii* (Coleoptera, Histeridae). *Neotropical Entomology*, 50(2): 317-320. doi: https://doi.org/10.1007/s13744-020-00818-2

Carvalho-Zilse, G. A.; Nunes-Silva, C. G.; Zilse, N.; Silva, A. C.; Boas, H. C. V.; Laray, J. P. B.; Freire, D. C. B.; Kerr, W. E. (2005) Criação de abelhas sem ferrão. Iniciativas Promissoras 2: Projeto Manejo dos Recursos Naturais da Várzea. Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renováveis Pro Várzea/IBAMA. Brasília: Edições IBAMA.

Coletto-Silva, A.; Freire, D. C. B. (2006) Hololepta *(Leionota) reichii* Marseul (Coleoptera, Histeridae), un nuevo enemigo natural para la meliponicultura en la Amazonía Central, Brasil. *Revista Brasileira de Zoologia*, 23(2): 588-591. doi: https://doi.org/10.1590/S0101-81752006000200036

Correa, R. C.; Leivas, F. W.; Moura, D. P.; Almeida, L. M. (2020) Necrophilous Histeridae (Insecta: Coleoptera): What do we know after 200 years? *The Coleopterists Bulletin*, 74(2): 375-383. doi: https://doi.org/10.1649/0010-065X-74.2.375

Degallier, N.; Arriagada, G.; Brûlé, S.; Touroult, J.; Dalens, P. H.; Poirier, E. (2010) Coleoptera Histeridae de Guyane française. VI. Mise à jour du catalogue et contribution à la connaissance des Hololeptini. *Contribution à l'étude des Coléoptères de Guyane*, 2: 62-75.

Leonel, F. L. L.; Leivas, F. W. T. (2023) Biodiversity of histerid beetles (Coleoptera: Histeridae) from Brazil. I. Southern region. *Insecta Mundi*, 992: 1-25. https://digitalcommons.unl.edu/insectamundi/1487/

IBGE (Instituto Brasileiro de Geografia e Estatística) (2012) *Manual técnico da vegetação brasileira: sistema fitogeográfico, inventário das formações florestais campestres, técnicas e manejo das coleções botânicas, procedimentos para mapeamentos*, 2nd ed., Rio de Janeiro.

IPECE (Instituto de Pesquisa e Estratégia Econômica do Ceará) (2017) *Perfil Básico Municipal*. Fortaleza-CE, 2017. https://www.ipece.ce.gov.br/perfilmunicipal. Access on: vii.2024

Kovarik, P. W.; Caterino, M. S. (2016) Histeridae. In: Beutel, R. G.; Leschen, R. A. B. (Eds.), *Handbook of Zoology Part 38, Coleoptera, Beetles Vol. 1: Morphology and Systematics (Archostemata, Adephaga, Myxophaga, Polyphaga partim)*, pp. 281-314. Berlin: Walter de Gruyter.

Mazur, S. (1984) *A world catalogue of Histeridae*. Polskie Pismo Entomologiczne. Vol. 54, No. 3-4, 379 pp. Poland.

Mazur, S. (2011) *A concise catalogue of the Histeridae (Insecta: Coleoptera)*. Warzaw University of Life Sciences: SGGW Press.

Péche, W. E. S.; Mello A. M. F.; Oliveira J. R.; Carvalho R. W. (2019) Ocorrência de *Hololepta (Leionota) reichii* Marseul, 1853 (Coleoptera, Histeridae) um novo inimigo em colmeias de abelhas africanizadas *Apis mellifera* Lepeletier, 1836 (Hymenoptera: Apidae: Apinae) na localidade de Bocaina, município de Santo Antônio de Leverger, no Estado de Mato Grosso, Região Centro Oeste, Brasil. *Mensagem Doce*, 152. http://apacame.org.br/site/revista/mensagem-doce-n-152-julho-de-2019/artigo-5/

Silva-Neto, C. M; Brito, P. V. A.; Freitas, P. V. D. X. (2019) Predador de abelhas sem ferrão no Cerrado brasileiro: primeiro registro de *Hololepta* (*Leionota*) *reichii* Marseul (Coleoptera, Histeridae) em colônia de *Melipona quadrifasciata*. *Tecnia*, 4: 194-200.