FIRST REPORT IN BRAZIL OF *Tyrophagus putrescentiae* (SCHRANK) (ACARI: ACARIDAE) IN COLONIES OF AFRICANIZED HONEY BEES (*Apis mellifera* L.)

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SUMMARY

This is the first report of the presence of the mite Tyrophagus putrescentiae *(Schrank) (Acari: Acaridae) in colonies of Africanized honey bees* Apis mellifera *L. (Hymenoptera: Apidae) in Brazil. Mites were found in different stages of development, infesting combs from rational colonies (Langstroth) in Rio Negrinho, Santa Catarina State, Southern Brazil. Studies that aim to evaluate the relationship of these bees with this mite species should be conducted. Possible damage caused to human health through consumption of contaminated bee products, should not be overlooked and also needs to be evaluated.*

Introduction

The first report of mites in ancient honeycombs was given by Aristotle in 350 B.C., when for the first time was used the name 'akari', a term officially established in 1778 for mites by DeGeer (Moraes and Flechtmann, 2008). Several mites associated with honeybees have been identified (De Jong *et al.,* 1982); their relationship to the bees varies from commensalism to endoparasitism and ectoparasitism (Flechtmann, 1980). A cosmopolitan species, *Tyrophagus putrescentiae* (Schrank) (Acari: Acaridae), has been reported previously as attached to the body of bumblebees (Maggi *et al*., 2011), and in Guatemala the mite was reported after being detected in samples of dead honeybees stored in alcohol solution (Baker and Delfinado-Baker, 1983). Species of the genus *Tyrophagus* have also been reported parasitizing in the laboratory other groups of insects in various stages of development, such as beetles (Brust and House, 1988; Kumar, 1997; Papadopoulou, 2006; Canevari *et al.,* 2012) and flies (Serpa *et al.,* 2004), in addition to being present in cereals and stored food products (Kheradmand *et al.* 2007). From the medical and veterinary standpoint, if ingested, the mite can cause poisoning in humans and animals (Blanco *et al*., 1997; Matsumoto *et al*., 2001; Sánchez-Borges *et al*., 2005; Liao *et al*., 2009; Canfield and Wrenn, 2010), such as acute enteritis, and may be related to the transmission of bacteria, yeasts and pathogenic fungi through food (Serpa *et al.,* 2004). This work represents the first report of the presence of the mite *Tyrophagus putrescentiae* (Schrank) (Acari: Acaridae) in hive combs of Africanized honey bees in Brazil.

Brazilian honey bees reflect decades of introgression between the European honey bee subspecies *Apis mellifera mellifera* and *Apis mellifera ligustica*, imported during the 17th century, and the African subspecies *Apis mellifera scutellata*, introduced in 1956 (Vandame *et al.,* 2002). Now widely distributed in the American continents, these 'Africanized' honey bees (AHBs) represent the predominant type of honey bee in tropical and subtropical regions of South and Central America, and in some regions of North America (Rosenkranz *et al.,* 2000). AHBs were highly successful in Brazil, spreading to all parts of the country by the late 1970s (Teixeira *et al.,* 2008).

Because of the mortality records in colonies of AHBs (*A. mellifera*) in Rio Negrinho, Santa Catarina State, Brazil (26°24'56"S, 49°34'3"W), samples of combs from rational colonies (standard Langstroth beehives) were collected by veterinarians of the official veterinary defense service of the State, on September 6, 2011 and sent to the Honey Bee Health Research Laboratory/APTA, Department of Agriculture and Food Supply, São Paulo, Brazil, in order to investigate the possible causes involved. There were no dead adult bees inside or near the hives during the sampling time.

Using a Carl Zeiss Jena stereo microscope, we found mite populations in three samples from different colonies. Samples of the mites were kept in microtubes containing 70% alcohol, for subsequent identification. The mites were studied at the Acarology Laboratory of the Biological Institute, in the same Institution (APTA) and the species *T. putrescentiae*

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PRIMER REPORTE EN BRAZIL DE *Tyrophagus putrescentiae* (SCHRANK) (ACARI: ACARIDAE) EN COLONIAS OF ABEJAS MELÍFERAS AFRICANIZADAS (*Apis mellifera* L.)

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RESUMEN

Este es el primer reporte de la presencia del ácaro Tyrophagus putrescentiae *(Schrank) (Acari: Acaridae) en colonias de abejas melíferas africanizadas* Apis mellifera *L. (Hymenoptera: Apidae) en* **Brasil. Se encontraron ácaros en diferentes estadios de desarrollo, infestando panales racionales (Langstroth) en Río Negrinho, Estado de Santa Catarina, Brazil. Deben llevarse a cabo estudios para evaluar la relación entre esas abejas y estas especies de ácaros. Posibles daños a la salud humana por consumo de productos de abejas contaminados no deben ser ignorados y también deben ser evaluados.**

PRIMEIRO RELATO NO BRASIL DE *Tyrophagus putrescentiae* (SCHRANK) (ACARI: ACARIDAE) EM COLÔNIAS DE ABELHAS AFRICANIZADAS (*Apis mellifera* L.)

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RESUMO

Este é o primeiro relato da presença do ácaro Tyrophagus putrescentiae *(Schrank) (Acari: Acaridae) em colônias de abelhas* Apis mellifera *L. africanizadas (Hymenoptera: Apidae) no Brasil. Os ácaros foram encontrados em diferentes estádios de desenvolvimento, infestando favos de colônias racionais (Langstroth) em Rio Negrinho, Santa Catarina, sul do Brasil. Estudos que busquem avaliar a relação destas abelhas com esta espécie de ácaros devem ser conduzidos. Possíveis danos causados para a saúde humana, por meio de consumo de produtos contaminados, não devem ser negligenciados e também precisam ser avaliados.*

(Schrank, 1781) was identified based on Zhang and Fan (2005).

Mites were found in three colonies of Africanized honey bees (*A. mellifera*), among the 20 hives that made up the apiary. In the colonies where the infestation was noticeable, there was a small population of adult bees with abundant food and offspring. The other colonies were also sparsely populated, although without the apparent presence of mites. Thousands of mites (*T. putrescentiae*) (Schrank, 1781) were found in their different development stages covering basically all the brood area in the three samples (Figures 1 and 2). Mites were found on the larvae, pupae, bee bread (fermented pollen mixture stored in the honeybee combs) and in the empty cells. Besides the mites (*T. putrescentiae*), hyphae of unidentified fungus were also observed abundantly on the combs, along with the young larvae and pupae of *A. mellifera*. The ectoparasitic mite *Varroa destructor* (Acari: Varroidae) was also found parasitizing adult bees (4.1%) and brood cells (4%) in the same combs.

This is the first record of *T. putrescentiae* in colonies of Africanized honey bees (*A. mellifera*) in an apiary in Brazil. It is possible that due to the great diversity of environments it inhabits, the mite was introduced into the infested colonies by foraging bees, similar to the report by Schwarz and Huck (1997). Baker and Baker-Delfinado (1983) studied populations of phoretic organisms on *A. mellifera* in Guatemala and identified *T. putrescentiae* in the samples of bees which had been placed in alcohol, suggesting that the mite is phoretic.

The finding of abundant hyphae covering the combs of the analyzed samples of AHBs, supports previous findings that the mite is fungivorous (Parkinson *et al.*, 1991; Hubert *et al.,* 2003; Zhang and Fan, 2005). *Tyrophagus* species prefer environments already infested by fungi. Indoor bee colonies under certain circumstances, such as when the humidity is high, there is protein food stored as pollen and the colonies are sparsely populated, become conducive to the development of fungi and provide a food source and favorable environment for the development of mite populations (Hughes, 1961; Duek *et al.,* 2001). It should be noted that the peak losses of colonies (>50%) in the studied location occurred in winter (season with low temperatures and rainfall and abundant pollen and nectar from flowering plants), with a considerable amount of condensation of water inside the hives. While the grooming behavior of the bees is an important factor in the population dynamics of the mite *Varroa destructor* in Africanized honey bees, it may not be as effective against individuals of *T. putrescentiae*, due to their small size (~0.4mm in adulthood), in addition to the fact that the affected colonies were weakened, which may have had a detrimental effect of their grooming behavior, and thereof provided more favorable conditions for the development of the mite population. Although in some studies an interspecific relationship and harmonic phoresy between mites and bees has been observed (Eickwort, 1997), it is not possible to determine whether the relationship of *T. putrescentiae* and the bees is parasitic or phoretic. It is likely that the mites are introduced into the honey bee colonies by worker bees foraging for pollen and nectar in the

Figure 1. Adult *Tyrophagus putrescentiae* Schrank found in brood combs of Africanized honey bees *Apis mellifera* L.

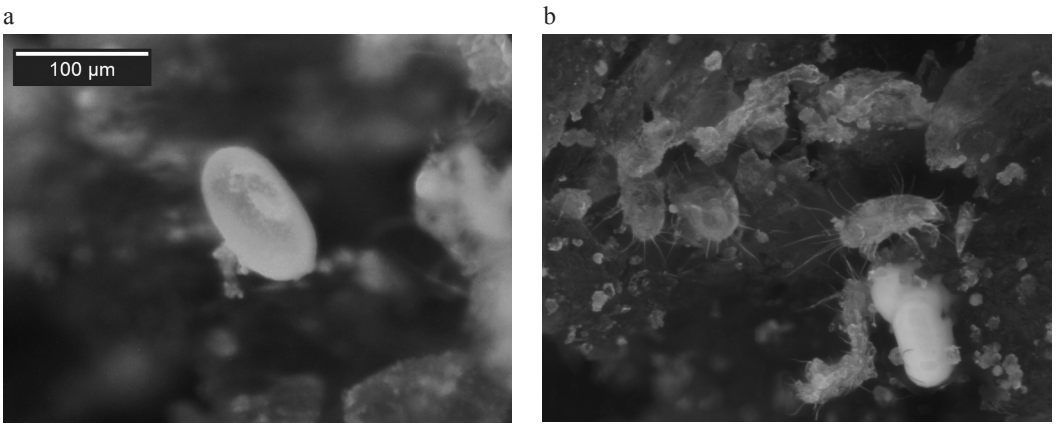

Figure 2. Samples of brood combs showing mite infestation in different stages of development. a: egg of *Tyrophagus putrescentiae* b: adults of *Tyrophagus putrescentiae*.

environment, or even by mere contact with the moist soil in search of water (OConnor and Klimov, 2003). The sparsely populated colony and high humidity conditions are conducive to the proliferation of fungi and protein food stock, which provides food and a favorable environment for the mite populations to develop.

This is the first report of the presence of the mite *Tyrophagus putrescentiae* in Africanized honey bee hives. Detailed studies that evaluate the relationship of these bees with these mites should be conducted, not only for the health of the bee colonies, but also for the possible damage caused to human health through the consumption of contaminated bee products. The role of *Tyrophagus putrescentiae* or other species on bee products needs further studies and evaluation, as these mites have been associated with human allergies and digestive problems (VanDer Heid *et al*., 1998), can affect people indirectly as a potential vehicle of dissemination of pathogen, parasites, decomposers (Gorham, 1979) or can be potential vectors for prion infections (Lupi, 2003, 2006).

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REFERENCES

Baker EW, Delfinado-Baker M (1983) New mites (*Sennertia*: Chaetodactylidae) phoretic on honey bees (*Apis mellifera* L.) in Guatemala. *Int. J. Acarol.* 9: 117-121.

Blanco C, Quiralte J, Castilho R, Delgado J, Artega C, Baber D, Carrilho T (1997) Anaphylaxis after ingestion of wheat flour contaminated with mites. *J. Allergy Clin. Immunol.* 99: 8-13.

Brust GE, House GJ (1988) A study of *Tyrophagus putrescentiae* (Acari: Acaridae) as a facultative predator of southern corn rootworm eggs. *Exp. Appl. Acarol. 4*: 344-355.

Canevari GC, Rezende F, Silva RB, Faroni LRA, Zanuncio JC, Papadopoulou S, Serrão JE (2012) Potential of *Tyrophagus putrescentiae* (Schrank) (Astigmata: Acaridae) for the biological control of *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae). *Braz. Arch. Biol. Technol. 55*: 299-303.

Canfield MS, Wrenn WJ (2010) *Tyrophagus putrescentiae* mites grown in dog food cultures and the effect mould growth has on mite survival and reproduction. *Vet. Dermatol.* 21: 58-63.

De Jong D, Morse RA, Eickwort GC (1982) Mite pests of honey bees. *Annu. Rev. Entomol. 27*: 229-252.

Duek L, KaufmanG, Palevsky E, Berdicevsky I (2001) Mites in fungal cultures. *Mycoses 44*: 390-394.

Eickwort GC (1997) Mites: an overview. In Morse R, Flottum K (Eds.) *Honey Bee Pests, Predators and Diseases*. A.I. Root. Medina, OH, USA. pp 239-250.

Flechtmann CHW (1980) Two mites associated with bee (*A. mellifera* L.) in Peru. *Anais Esc. Sup. Agric. Luiz de Queiroz 37*: 737-741.

Gorham JR (1979) The significance for human health of insects in food. *Annu. Rev. Entomol. 24*: 209-224.

Hubert J, Stejskal V, Kubátová A, Munzbergová Z, Vánová M, Zdárková E (2003) Mites as selective fungal carriers in stored grain habitats. *Exp. Appl. Acarol.* 29: 69-87.

Hughes AM (1961) *The Mites of Stored Food*. Technical Bulletin Nº 9. Ministry of Agriculture; Fisheries and Food. London, UK. 287 pp.

Kheradmand K, Kamali K, Fathipour Y, Goltapeh EM (2007) Development, life table and thermal requirement of *Tyrophagus putrescentiae* (Astigmata: Acaridae) on mushrooms. *J. Stored Prod. Res. 43*: 276-281.

Kumar D (1997) Mite infestation in stored grain pest culture. *Insect Environ. 3*: 42-47.

Liao CE, Hsu EL, Tsai JJ, Ho CM (2009) Immunologic characterization and allergenicity of recombinant Tyr p 3 allergen from the storage mite *Tyrophagus putrescentiae*. *Int. Arch. Allergy Immunol. 150*: 15-24.

Lupi O (2003) Could ectoparasites act as vectors for prion diseases? *Int. J. Dermatol. 42*: 425-429.

Lupi O (2006) Myiasis as a risk factor for prion diseases in humans. *J. Eur. Acad. Dermatol. Venereol. 20*: 1037-1045.

Maggi M, Lucia M, Abrahamovich AH (2011) Study of the acarofauna of native bumblebee species (*Bombus*) from Argentina. *Apidologie 42*: 280-292.

Matsumoto T, Goto Y, Miike T (2001) Anaphylaxis to mite contamined flour. *Allergy 56*: 247.

Moraes GJ, Flechtmann CHW (2008) *Manual de Acarologia: Acarologia básica e ácaros de plantas cultivadas no Brasil*. Holos. Ribeirão Preto, Brasil. 288 pp.

OConnor B, Klimov P (2003) *North American Bee-Associated Mites: Potential Threats to Native and Introduced Pollinators*: Leptus ariel *Southcott, 1989*. http://insects.ummz.lsa.umich.edu/beemites/Species_Accounts/Leptus_ariel.htm (Cons. 04/27/2014).

Papadopoulou SC (2006) *Tyrophagus putrescentiae* (Schrank) (Astigmata: Acaridae) as a new predator of *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae) in tobacco stores in Greece. *J. Stored Prod. Res. 42*: 391-394.

Parkinson CL, Jamieson N, Eborall J, Armitage DM (1991) Comparison of the fecundity of three species of grain store mites on fungal diets. *Exp. Appl. Acarol. 12*: 297-302.

Rosenkranz P, Kirs R, Stümer M (2000) Population dynamics and varroatosis tolerance factors in Uruguaian honey bees. *Anais 4º Encontro Sobre Abelhas*. FFCLRP, USP. Ribeirão Preto, Brasil. pp. 152-158.

Sánchez-Borges M, Suárez-Chacón R, Capriles-Hulett A, Caballero-Fonseca F (2005) An update on oral anaphylaxis from mite ingestion. *Ann. Allerg. Asthma Immunol. 94*: 216-221.

Schwarz HH, Huck K (1997) Phoretic mites use flowers to transfer between foraging bumblebees. *Insect. Soc. 44*: 303-310.

Serpa LLN, Franzolin MR, Barros-Battesti DM, Kakitani I (2004) *Tyrophagus putrescentiae* predando insetos adultos de *Aedes aegypti* e *Aedes albopictus* em laboratório. *Rev. Saúde Públ. 38*: 735-737.

Teixeira EW, Chen Y, Message D, Pettis J, Evans JD (2008) Vírus infection in Brazilian honey bees. *J. Invert. Pathol. 99*: 117-119.

VanDer Heid S, Niemeijer NR, Hovenga H, Monchy JGR, Dubois AEJ, Kauffman HF (1998) Prevalence of sensitization to the storage mites *Acarus siro, Tyrophagus putrescentiae,* and *Lepidoglyphus destructor* in allergic patients with different degree of sensitization to the house-dust mite *Dermatophagoides pteronyssinus*. *Allergy. 53*: 426-430.

Vandame R, Morand S, Colin ME, Belzunces LP (2002) Parasitism in the social bee *Apis mellifera*: quantifying costs and benefits of behavioral resistance to *Varroa destructor* mites. *Apidologie 33*: 433-445.

Zhang ZQ, Fan QH (2005) *Revision of* Tyrophagus Oudemans *(Acari: Acaridae) of New Zeland and Australia*. MAF Science Policy Project FMA122. Auckland, New Zealand. 188 pp.