SCIENTIFIC NOTE

Saprophytic Fungus Collection by Africanized Bees in Brazil

Anna F H Modro[1], Izabel C Silva[2], Dejair Message[2], Cynthia F P Luz[3]

[1]Escola Superior de Agricultura "Luiz de Queiroz", Depto. de Entomologia, Fitopatologia e Zoologia Agrícola, 13418-900, Piracicaba, SP; fridamodro@gmail.com; [2]Depto. de Biologia, Apiário Central, Univ. Federal de Viçosa, 36570-000, Viçosa, MG; dmessage@ufv.br, icsmel@yahoo.com.br; [3]Secretaria do Meio Ambiente de São Paulo, Instituto de Botânica, Seção de Dicotiledôneas, Av. Miguel Estéfano, 3687, 04301-902, Água Funda, São Paulo, SP; cyluz@yahoo.com.br

Edited by Fernando Noll – UNESP

Neotropical Entomology 38(3):434-436 (2009)

Coleta de Fungos Saprofíticos por Abelhas Africanizadas no Brasil

RESUMO - A coleta de *Cladosporium* sp. por abelhas (*Apis mellifera* L.) foi observada no Brasil em um apiário localizado em Minas Gerais, no período de 10 a 23/11/05, caracterizado pela alta umidade relativa do ar e escassez de recurso alimentar (pólen e néctar). A composição nutricional das bolotas de fungos apresentou alto valor protéico, extrato etéreo e matéria orgânica.

PALAVRAS-CHAVE: *Apis mellifera*, *Cladosporium* sp., pólen, composição nutricional

ABSTRACT - *Cladosporium* sp. collection by bees (*Apis mellifera* L.) was observed in Brazil at an apiary located in Minas Gerais, during November10-23, 2005, characterized by high air relative humidity and low availability of food resources (pollen and nectar).The nutritional composition of the fungi pellets presented high protein value, ethereal extract and organic matter.

KEY WORDS: *Apis mellifera*, *Cladosporium* sp., pollen, nutritional composition

Fungus development on bee pollen is widely known (Medina *et al* 2004, González *et al* 2005), as well as the occasional worldwide collection of fungus spores by bees of the genus *Apis* (Wingfield *et al* 1989, Shaw 1990). However, *Cladosporium*, a fungus dispersed in the air, found in rotten organic matter and as food contaminant, had not been reported in Brazil as being collected by *Apis mellifera* (L).

This work aimed to record for the first time collection of *Cladosporium* sp. by *A. mellifera* in Brazil, and to analyze its nutritional composition.

The experiment was developed in the municipality of Paula Cândido (20º49'S and 42º54'W) in Minas Gerais State, Brazil, in an area characterized by the presence of abandoned pasture, eucalyptus and coffee plantations, and fragments of semidecidual seasonal forest (Mata Atlantica), with 60 years of secondary succession. According to the Köppen system, the climate in the region is of the Cwb type, tropical in altitude, with rainy summers (Sept-Nov) and cold and dry winters (Apr-Sept), annual mean temperature ranging from 14ºC to 23°C and annual mean rainfall of 1,403.8 mm (Valverde 1958).

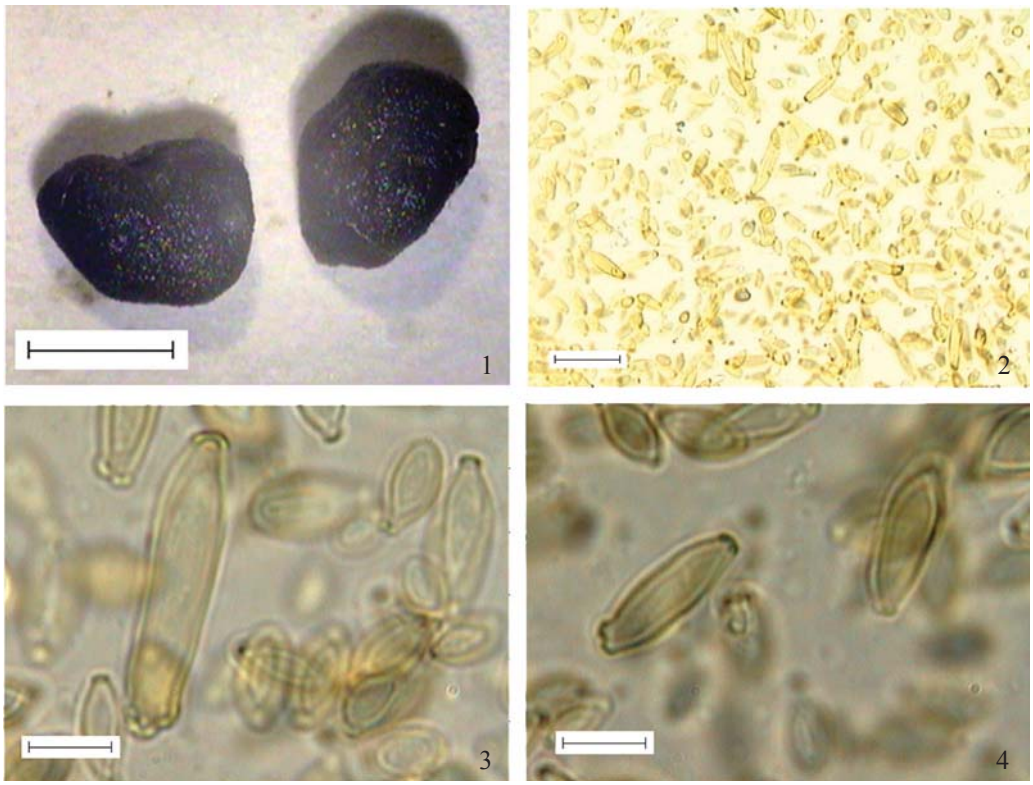
Aiming to collect pollen pellets, five africanized *A. mellifera* beehives were randomly selected and installed in Langstroth beehives with a pollen collector of the intermediary type coupled to the upper portion of each hive.

Collections of pollen pellets and flowered plants in the studied region were carried out from August 15 to November 23, 2005. The pollen pellet samples were cleaned, weighed, placed in plastic bags separated by sample and temporarily stored at -20ºC. The fungus pellets were separated from the pollen pellets based mainly on their characteristic dark turning into black coloration (Fig 1) and by light microscopy observations.

The fungus and pollen samples were sent to the Laboratory of Animal Nutrition (UFV – Department of Animal Science) for routine physico-chemical analyses, according to Silva (2002), for the determination of percentage of dry matter, organic matter, ashes or mineral matter, crude protein, ethereal extract and total carbohydrates. The fungi were identified at the Mycology Laboratory (UFV – Department of Phytopathology).

The *Cladosporium* sp. samples were collected, grouped as pellets and transported to the beehives by the bees in a manner similar to the pollen collection (Figs 2-4).

Although the pollen collectors had been installed in the field since August 15, 2005, the occurrence of fungus pellets in the samples was detected only during November 10-23, 2005, a period characterized by high air relative humidity



Figs 1-4 Photomicrography in optical microscopy of *Cladosporium* sp., collected in *Apis mellifera* hives in November 10-23, 2005, in Minas Gerais, Brazil. 1) Aspect of *Cladosporium* sp. spore pellets, scale = 2 mm; 2) Overall view of *Cladosporium* sp. spores, scale = 20 μm; 3-4) Detail of *Cladosporium* sp. spores, scale = 5 μm.

(November average = 85%), energy feed scarcity (nectar) and protein feed (pollen), and consequently, by weakened beehives in the region studied.

The reasons bees collect fungi are unknown; however, low offer of protein resources near the apiary may have influenced bees, which collected other resources, such as fungi, to supply the needs of their colony, once sufficient pollen was unavailable (Shaw 1990).

In its nutritional composition, the *Cladosporium* sp. pellets presented higher ethereal extract, crude protein and organic matter and lower mineral matter and total carbohydrate values than the average of the results for these nutritional components from the pollen gathered during the same period (Table 1), with the pollen types most collected during the fungus collection period being *Alchornea* and *Cecropia*. Despite the high protein value of the fungi evaluated, the bee capacity to distinguish the nutritional composition of the feed to be collected is quite discussed (Pernal & Currie 2001, Cook *et al* 2003). However, Wingfield *et al* (1989) observed that *A. mellifera* apparently prefers collecting the fungus *Melampsora ricini* over pollen, whenever the fungus is available.

The fungi collected could be used as a protein resource for the brood; however, since this is predominantly a saprophyte genus, some species may induce the occurrence of diseases in the beehives, and depending on the proportion of spores collected in comparison to the pollen stocked, they may negatively affect beehive balance (Prest *et al* 1974, Shaw 1990, Calderon *et al* 2004).

The plants observed under flowering during the aforementioned period were *Baccharis dracunculifolia*, *B. melastomaefolia*, *Enterolobium contortisiliquum*, *Hydrangea macrophylla*, *Lantana* sp., *Leonurus sibiricus*, *Murraya paniculata*, *Petrea* sp., *Petroselinum crispum*, *Rosa* sp., *Stachytarpheta* sp., *Tibouchina granulosa*, *Verbena bonariensis*, *Vismia martiana* and *Vitex sellowiama*, most being arbustive or herbaceous (83.3%) located on dirty pastures or gardens (83.3%).

According to Stevenson (1974), *Cladosporium* is

Table 1 Physico-chemical analyses carried out in pollen pellets and fungus pellets in *Apis mellifera* bees in Minas Gerais, collected in November 10-23, 2005.

Nutritional composition (%)	Samples	
	Pollen pellets	Fungus pellets
Dry matter	68.6	85.0
Humidity	31.5	15.0
Organic matter	97.1	97.5
Mineral matter	3.0	2.5
Crude protein	23.8	28.8
Ethereal extract	1.0	2.5
Total carbohydrates	72.3	66.2

generally associated with aphids, since the honeydew secreted by these insects is an important attraction for fungus development. Thus, both the flowering plant species and the honeydew secreted by aphids may have influenced the bee attraction for the fungus sources. Another factor that may have influenced the occurrence and collection of *Cladosporium* over this period was the presence of coffee plantations near the apiary during fruit ripening, because of the commonness of the coffee berry contamination by fungi (Chalfoun *et al* 2007).

In conclusion, despite the reasons *A. mellifera* collected saprophytic fungi collection (*Cladosporium* sp.) in the study area remain unknown, the interactions among the climatic factors (high humidity), food scarcity (pollen and nectar), high protein value of the fungi, and existence of honeydew and coffee berry contamination in the field may have all affected bee behavior in collecting fungus.

Acknowledgments

We thank UFV Professors Robert Weingart Barreto, Ph.D., for *Cladosporium* sp. identification and Edenio Detmann, D.S., for the nutritional analysis of the samples.

References

Calderón R A, Rivera G, Sánchez L A, Zamora L G (2004) Chalkbrood (*Ascophaera apis*) and some other fungi associated with africanized honey bees *(Apis mellifera*) in Costa Rica. J Apic Res 43: 187-188.

Chalfoun S M, Cunha R L, Carvalho V L, Nogueira D A (2007) Seletividade de fungicidas cúpricos e sistêmicos sobre o fungo *Cladosporium cladosporioides* em cafeeiro. Summa Phytopathol 33: 93-95.

Cook S M, Awmack C S, Murray D A, Williams I H (2003) Are honey bees' foraging preferences affected by pollen amino acid composition? Ecol Entomol 28: 622-627.

González G, Hinojo M J, Mateo R, Medina A, Jiménez M (2005) Occurrence of mycotoxin producing fungi in bee pollen. Int J Food Microbiol 105: 1-9.

Medina A, González G, Sáez, Mateo R, Jiménez M (2004) Bee pollen, a substrate that stimulates ochratoxin A production by *Aspergillus ochraceus* Wilh. Syst Appl Microbiol 27: 261-267.

Pernal S F, Currie R W (2001) The influence of pollen quality on foraging behavior in honeybees (*Apis mellifera* L.). Behav Ecol Sociobiol 51: 53-68.

Prest D B, Gilliam M, Taber III S, Mills J P (1974) Fungi associated with discolored honey bee, *Apis mellifera*, larvae and pupae. J Invertebr Pathol 24: 253-255.

Shaw D E (1990) The incidental collection of fungal spores by bees and the collection of spores in lieu of pollen. Bee World 71: 158-176.

Silva D J (2002) Análise de alimentos: métodos químicos e biológicos. Viçosa, Imprensa Universitária UFV, 235p.

Stevenson G B (1974) Biologia dos fungos, bactérias e vírus. São Paulo, Polígono, 267p.

Valverde O (1958) Estudo regional da Zona da Mata de Minas Gerais. R Bras Geogr 20: 1-82.

Wingfield M J, Wyk P S van, Viviers M (1989) Rust-spores, bees and pollen. Mycologist 3: 31-32.

Received 24/IX/07. Accepted 09/X/08.