

Sentinel apiaries – epidemiological surveillance – training programas as strategies for early detection of the SHB in AHB in Costa Rica

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Introduction

- The small hive beetle (SHB), *Aethina tumida* (Coleoptera: Nitidulidae)
- Is a parasite and scavenger of honey bee colonies (*Apis mellifera*)
- Endemic to sub-Saharan Africa



- It has become an invasive species with well-established populations in North America and Australia
- In 1996, SHBs were discovered in colonies of European subspecies of honey bees in the southeastern USA
- SHBs cause considerable economic damage to apiculture in the USA



The SHB in Africanized honey bee (AHB) colonies in North and South America

- ✦ Mexico = October 2007
- ✦ Brazil = 2016
- ✦ Colombia = October 2020
- ✦ Paraguay = May 2022
- ✦ Bolivia = June 2022



In Central America

- SHB was discovered in El Salvador in 2013 (OIE, 2013)
- While, in Nicaragua it was found in March 2014 (Calderón et al., 2015)
- Guatemala = it was reported in August 2020 (Garcia-Ochaeta, 2020)



In Nicaragua

- SHB was confirmed in AHB colonies
- San Juan del Sur - Department of Rivas (South of the country)
- About 8 kilometers north of the border with Costa Rica
- Increases the risk of invasion of this pest into bee hives in Costa Rica





SHB in San Juan del Sur - Department of Rivas - Nicaragua



What did we do in Costa Rica after SHB detection in Nicaragua?

1- Epidemiological surveillance

2- Training activities

3- Sentinel apiaries (The National Animal Health Service (SENASA-Costa Rica))



1- Epidemiological surveillance

- ✦ After confirmation of the SHB in Rivas-Nicaragua in March 2014
- ✦ A sampling of the main beekeeping areas was conducted
- ✦ We inspected 476 colonies belonging to 77 apiaries
- ✦ Five of the seven provinces of Costa Rica
- ✦ Provinces Guanacaste-Puntarenas-Alajuela-San José- Heredia



Colony inspection

- ✦ On average 5 colonies were randomly monitored per apiary
- ✦ By examining individual frames - hive covers - bottom boards

Traps

- ✦ In addition, 2 Cutts Beetle Blaster[®] traps were placed per colony
- ✦ For a period of 8 to 15 days
- ✦ We added 25 ml of vegetable oil as a killing agent



2- Training program

- Training activities like workshops - fieldwork
- Were directed to technicians - beekeepers - students
- Focused on SHB recognition - identification - methods for colony inspection



Training materials

- We delivered to beekeepers flyers and brochures
- With images illustrating different stages of the SHB life cycle
- To facilitate SHB recognition and identification





Escarabajo Adulto

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EL PEQUEÑO ESCARABAJO DE LA COLMENA (AETHINA TUMIDA)

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Trampa para coleccionar escarabajos

Presentación

El pequeño escarabajo de la colmena es una plaga (depredador) que afecta principalmente las colmenas de abejas melíferas, causada por el escarabajo *Aethina tumida*. Es originario del Sur de África, en donde es considerado como un problema secundario ya que las abejas africanas tienen mecanismos de defensa para limitar su población y solo causa daños importantes en colmenas muy débiles. Sin embargo en los Estados Unidos y en Australia, donde se estableció en colmenas de abejas europeas ha causado pérdidas económicas considerables. Se considera como una especie invasora que hay que combatir.

Cómo reconocerlo?

La larva
 Es el estado más dañino para la colmena ya que requiere grandes cantidades de alimento para su desarrollo. Mide aproximadamente un centímetro de largo y es blanca. A primera vista se puede confundir con la larva de la polilla (*Galleria melonella*), sin embargo ciertas características que permiten diferenciarla:

- Presencia de tres pares de patas cerca de la cabeza
- Presencia de espinas dorsales en cada segmento


Cómo prevenirlo?

Todavía no se ha reportado la presencia del Pequeño Escarabajo en Costa Rica. Sin embargo fue detectado en México en el 2007, por lo cual deben tomarse las siguientes precauciones para prevenir su ingreso:

- Comprar material apícola libre del escarabajo
- No mover colmenas hacia zonas infestadas
- Mantener el apiario limpio
- Mantener material en buen estado
- Mantener colonias fuertes y estables
- Revisar y mantener limpia la sala de extracción

Ciclo biológico del escarabajo (6-8 semanas)

Sin control la población de escarabajo aumenta rápidamente. En dos meses 80 - 36000 individuos



El adulto

Es de color café oscuro - negro. Mide entre 5 y 6 milímetros (2/3 del tamaño del cuerpo de la abeja). Tiene tres pares de patas, son anchos y aplastados.

Al abrir la colmena los adultos se pueden observar corriendo sobre los panales o en el piso, tratando de ocultarse de la luz. Se encuentran en lugares oscuros de la colonia.

Cómo controlarlo?

Fuera de la colmena:
 Se puede controlar el estadio de pupa que permanece varias semanas en el suelo debajo de la colmena. Por lo cual se puede remover el suelo y además aplicar lo siguiente:

- Muriato de Potasio: deshidrata la pupa
- Insecticidas (Diazinon o Dursban) con el cuidado necesario para no afectar las abejas.

En el interior de la colmena:
 Control químico con el Coumaphos. Se reporta una efectividad de hasta un 90%.
 Control biológico:
 • Selección de abejas resistentes, con alto comportamiento higiénico.
 • Uso de trampas con cebo (vinagre, polen...) para capturar los escarabajos adultos.

Brochure about the SHB: cycle - identification

3- Sentinel apiaries

- . After Bee Pathology Program of the Tropical Beekeeping Research Center (CINAT-UNA)
- . Confirmed the presence SHB in Rivas, Nicaragua-in March 2014
- . The National Animal Health Service (SENASA-Costa Rica)
- . Placed a “sentinel apiary” made up of 4 AHB colonies
- . In Santa Cecilia - La Cruz - province of Guanacaste



Sentinel apiary

- Santa Cecilia is close to the border with Nicaragua
- About 20 kilometers from the border (straight line distance)

Sentinel apiary

- Because in this area the number of AHB colonies is very low
- SENASA installed and monitored the sentinel apiary
- Colonies were checked visually by examining individual frames - hive covers and bottom boards





Meeting between SENASA and CINAT/UNA to visit and inspect the sentinel apiary in Santa Cecilia-La Cruz-Guanacaste -August 2015

SHB detection in Costa Rica

- SHBs were detected in the sentinel apiary
- In August 2015 (8 years ago)
- Specifically in La Cruz, province of Guanacaste
- Only adult beetles were detected in the AHB colonies
- Those colonies were immediately eliminated (burned)
- Movement was restricted to and from this region





SHB adult: *Aethina tumida*





SHB detection in La Cruz, Guanacaste - Costa Rica. August 2015



Hypothesis:

- The SHB most likely entered Costa Rica through natural dispersal from Nicaragua

Facts

- SHB was detected in Costa Rica 1.5 years after its detection in Nicaragua
- The distance between the infested apiary in Nicaragua and the sentinel apiary in Costa Rica was close= about 18 km



SHB detections through epidemiological surveillance

- ◆ In September 2018, adult SHBs were found in a wild honey bee colony (established swarm)
- ◆ In Heredia-Central Valley (middle of the country)
- ◆ About 265 km south from the first detection site
- ◆ No intensive beekeeping is practiced at this point in the Central Valley



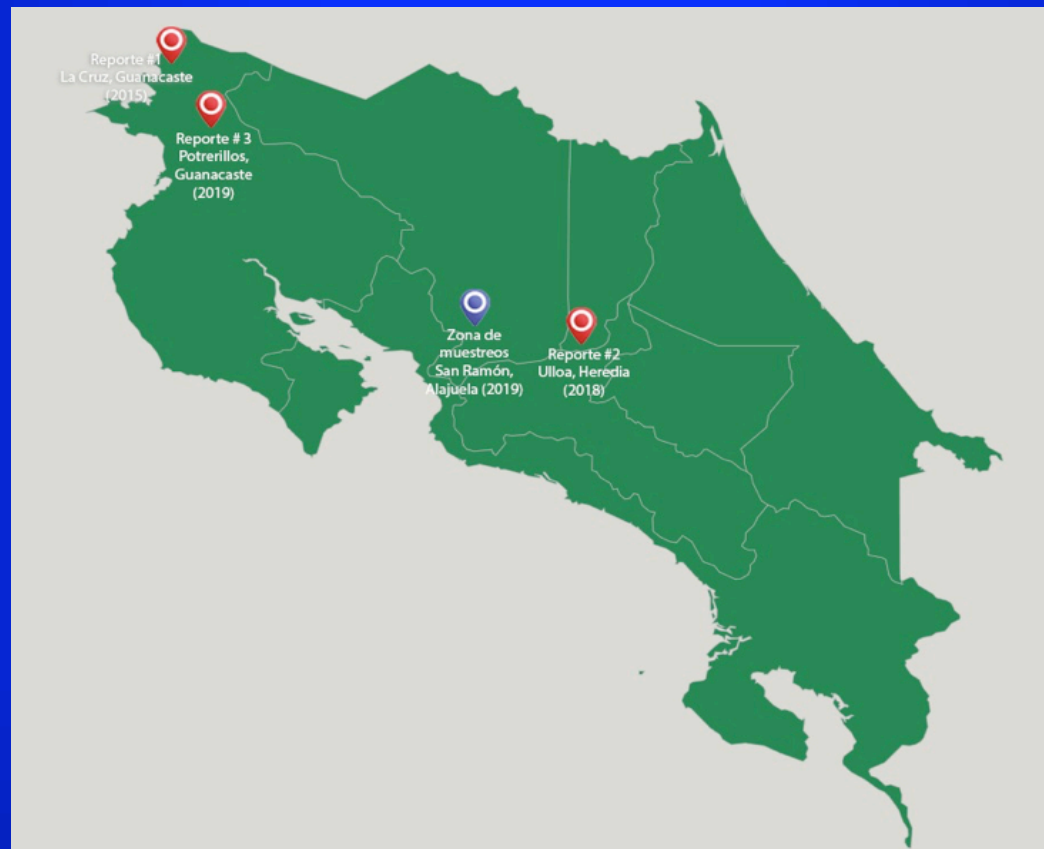
- ✦ This place is located nearby important fruit distribution center
- ✦ That receives fruits from all over Costa Rica, including Guanacaste
- ✦ We hypothesized that the SHBs found in Heredia, Central Valley in 2018
- ✦ Could have arrived in fruit transported into the facility from Guanacaste



Other SHB detections

- In October 2019, SHB was confirmed in a commercial apiary
- In Potrerillos-Liberia, province of Guanacaste
- About 25 km south from the initial point of detection in the country
- Four years after its detection in Costa Rica
- Only adult beetles were detected in the beehives





SHB detections: 1= La Cruz, Guanacaste (2015) 2= Heredia, Central Valley (2018) 3= Liberia, Guanacaste (2019)



Nowadays SHB has been detected in collaboration with trained beekeepers

- The SHB has been found in different commercial apiaries
- Especially in the provinces of Guanacaste - Alajuela - San José
- It has been detected in collaboration with trained beekeepers
- Beekeepers are able to recognize the SHB infestations via adult (and larval) morphology



In summary

- ✦ Implementing strategies for the early detection of the SHB as it spreads to new countries or areas requires
- ✦ As illustrated by the case of Costa Rica
 1. Implementing sentinel apiaries
 2. The development of epidemiological surveillance
 3. The development of training activities for technicians and beekeepers to aid in SHB recognition



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