LATIN AMERICAN NATURAL ENEMIES OF THE COFFEE BERRY BORER, WITH EMPHASIS ON THE NEMATODE *Metaparasitylenchus hypothenemi*

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Contents...
- Introduction
- The importation of African natural enemies of CBB into Latin America.
- Latin American natural enemies of the CBB.
- The nematode *Metaparasitylenchus hypothenemi* as a natural enemy of CBB.
- Interference between *M. hypothenemi* and *P. coffea*.
- Concluding remarks and perspectives.

Introduction...
- The CBB is the main entomological problem
- CBB has a cryptic life-cycle
- Exotic pest in Latin America

Introduction...
- Damage is caused by larvae and adults
- Damage in quality and quantity of coffee
- Classical biological control attempts

The African Parasitoids...
*Prorops nasuta*  *Cephalonomia stephanoderis*

The African Parasitoids...
*Prorops nasuta*  *Cephalonomia stephanoderis*
The African Parasitoids...

*Phymastichus coffea*

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**Latin American Natural Enemies of *Hypothenemus hampei* Recorded Under Field Conditions.**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Country</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cotesia sp.</em></td>
<td>Brazil</td>
<td>Generalist predator</td>
<td>Da Fonseca &amp; Araújo, 1939</td>
</tr>
<tr>
<td><em>Ancistrocerus sp.</em></td>
<td>Brazil</td>
<td>Occasionally predator</td>
<td>Da Fonseca &amp; Araújo, 1939</td>
</tr>
<tr>
<td><em>Acromyrmex sp.</em></td>
<td>Ecuador</td>
<td>Attack on adults</td>
<td>Klein-Koch et al., 1988</td>
</tr>
<tr>
<td><em>Unidentified species</em> (Proctotrupidae)</td>
<td>Brazil</td>
<td>Endoparasitoid of adults</td>
<td>Brassett, 1995</td>
</tr>
<tr>
<td><em>Clytus sp.</em></td>
<td>Mexico</td>
<td>Ectoparasitoid of larvae</td>
<td>Peter-Lackstädt, 1980</td>
</tr>
<tr>
<td><em>Clytra sp.</em></td>
<td>Colombia</td>
<td>Endoparasitoid of adults</td>
<td>Brassett et al., 2002</td>
</tr>
<tr>
<td><em>Dendrocerus sp.</em></td>
<td>Colombia</td>
<td>Predators of immature stages</td>
<td>Brassett et al., 2002</td>
</tr>
<tr>
<td><em>Seven species of ants</em></td>
<td>Colombia</td>
<td>Generalist predators</td>
<td>Brassett et al., 2002</td>
</tr>
<tr>
<td><em>Hyposoter sp.</em></td>
<td>Mexico</td>
<td>Predators of immature stages</td>
<td>Infante et al., 2003</td>
</tr>
<tr>
<td><em>Hemipterus sp.</em></td>
<td>Mexico</td>
<td>Endoparasitoid of puparia + adults</td>
<td>Castillo et al., 2002</td>
</tr>
</tbody>
</table>

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**Juvenile Stages of *M. hypothenemii* After Being Extracted from a CBB Adult Female**
Metaparasitylenchus hypothenemi (Allantonematidae)

Discovered in 1999 and described as a new species in 2004

The Nematode...

An adult female of M. hypothenemi

The Nematode...

Life-Cycle (16 days)

The Nematode...
The Nematode...

J-1 Nematodes

The Nematode...

J-1 Nematodes

Fecundity of CBB Infected with *M. hypothenemi*

<table>
<thead>
<tr>
<th>Sample</th>
<th>CBB Parasitized</th>
<th>CBB Unparasitized</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>0.8</td>
<td>10.3</td>
</tr>
<tr>
<td>4</td>
<td>6.5</td>
<td>33.3</td>
</tr>
<tr>
<td>5</td>
<td>1.3</td>
<td>11.8</td>
</tr>
<tr>
<td>6</td>
<td>4.3</td>
<td>6.5</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>4.6</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>9.3</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>7.1</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>8.2</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Presence of *M. hypothenemi* in the Soconusco Region (Chiapas).

Interference between *M. hypothenemi* and *P. coffea*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CBB Survivorship</th>
<th>CBB Parasitized by the Nematode</th>
<th>CBB Parasitized by <em>P. coffea</em></th>
<th>CBB that Yielded Adults of <em>P. coffea</em></th>
<th>Adults of <em>P. coffea</em> Emerged from each Host</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. coffea</em></td>
<td>12.1 ± 0.5 a</td>
<td>0</td>
<td>80.8 a</td>
<td>79.2 a</td>
<td>1.5 ± 0.12 a</td>
</tr>
<tr>
<td><em>M. hypothenemi</em></td>
<td>23.6 ± 1.5 b</td>
<td>95 b</td>
<td>0 b</td>
<td>0 c</td>
<td>0 c</td>
</tr>
<tr>
<td><em>P. coffea</em> + <em>M. hypothenemi</em></td>
<td>12.1 ± 1.1 a</td>
<td>85 a</td>
<td>85.7 a</td>
<td>18.3 b</td>
<td>0.13 ± 0.10 b</td>
</tr>
<tr>
<td>Control (No Parasitism)</td>
<td>41.2 ± 1.2 c</td>
<td>0 b</td>
<td>0 b</td>
<td>0 c</td>
<td>0 c</td>
</tr>
</tbody>
</table>
The Interaction Between *M. hypothenemi* and *P. coffea*

Conclusions...

- The discovery of *M. hypothenemi* expands the number of natural enemies recorded for the CBB.
- This is the first record of a nematode attacking the CBB under natural conditions in the Americas.
- Apparently this organism is widely distributed in coffee plantations of Chiapas and Central America.

- Levels of mortality in CBB adults due to this nematode reached 15.3%.
- Average number of eggs laid by CBB was lower in parasitized individuals (1.7 eggs) than non-parasitized (10.7 eggs). This leads to believe that *M. hypothenemi* affects the reproductive organs of the CBB.
- *M. hypothenemi* occurs in the body cavity of larva, pupa and adult stages of the CBB.

- This nematode can interfere with the parasitic activity of *Phymastichus coffea* increasing the mortality of its progeny.
- Because the CBB is the most important pest of coffee and *M. hypothenemi* partially or completely sterilizes the female beetle, it is worthy of further investigations as a potential biological control agent.