Eiphosoma laphygmae, a solution for classical biological control of the fall armyworm, *Spodoptera frugiperda*?

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Introduction

- *Spodoptera frugiperda* (J.E. Smith 1757) is a neotropical Lepidopteran pest affecting maize and other crops
- It arrived in Africa in 2016 and has since spread throughout the continent and on to Asia and Australia
- Current management relies on insecticides, whereas biocontrol might be more sustainable
- Larval parasitoid *Eiphosoma laphygmae* (Costa Lima) (Hymenoptera: Ichneumonidae), often misidentified in literature as *E. vitticole* (Cresson), is such a potential classical biocontrol agent
- Knowledge on biology needs to be collated and specificity assessed

Fig 1: *Eiphosoma laphygmae* (photo credit, Tim Haye, 2019)

Objectives

- Collate existing knowledge on parasitoid biology
- Identify natural distribution of parasitoid
- Collate reported parasitism rates from field studies
- Determine co-occurrence of parasitoids

Methods

Systematic review with two keyword searches:

- ("*Eiphosoma vitticole'* OR "*Eiphosoma*" on 11.11.2019 in Web of Science, Agricola, CAB-Abstracts, Food Science & Technology Abstracts
- "*Eiphosoma laphygmae*") on 12.11.2019 in full text in googlescholar

→ 121 initial hits, we retained 44 papers in English, Portuguese, Spanish*

Conclusions

- **Highly specific to *S. frugiperda* in native environment**
  → host range testing needs to be conducted
- **Natural distribution restricted to the neotropics**
  →potential candidate for most of FAW-invaded Africa
  →climate matching necessary
- **Predominant parasitoid in vegetatively diverse systems**
  → higher diversity of agricultural systems in Africa than in the Americas is favourable for its establishment

Results

1. Native range of parasitoid *E. laphygmae*

Fig 2: Native range of *Eiphosoma laphygmae* (n=33)

2. Parasitism rates from field studies

- Only sites where *E. laphygmae* occurred were selected
- Sampling techniques tend to underestimate parasitism rates
- **Highly specific to *S. frugiperda***
- On average, 25.1% (n=18 locations) of all fall armyworm (FAW) larvae were parasitized
- Mean parasitism rate by *E. laphygmae* was 4.8% (0.7% - 14.5%)
- In Mexico, a tendency was observed that *E. laphygmae* occurred mainly in winter crops (Mérey et al. 2012)

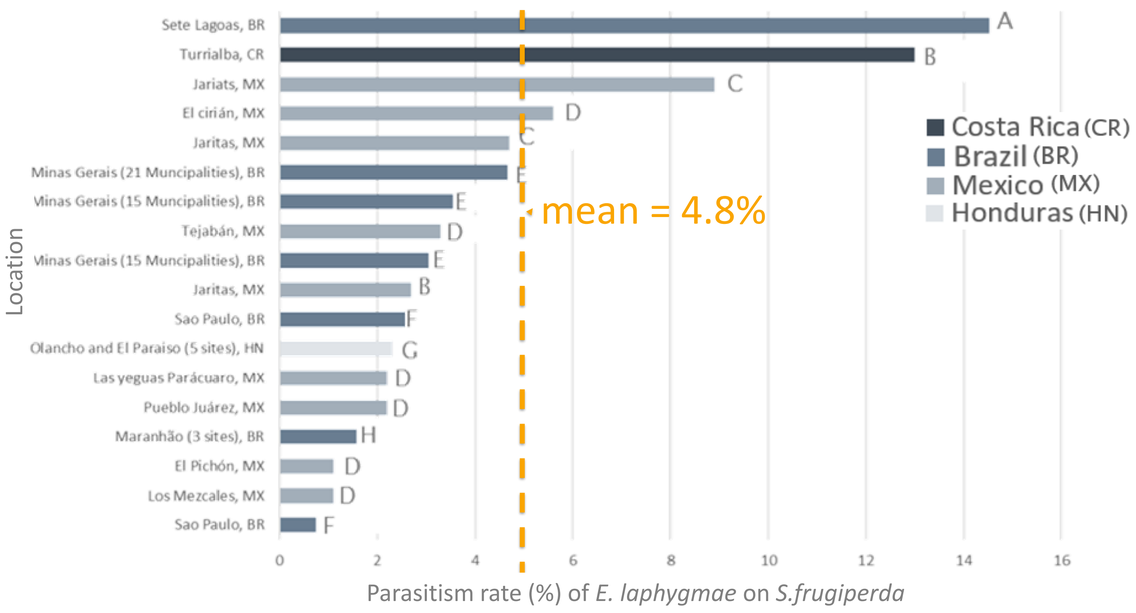

Fig 3: Parasitism rate by *Eiphosoma laphygmae* on *Spodoptera frugiperda* at different locations in the Americas (n=18)
*Sources: A= Cruz et al. 2010, B= Marenco and Saunders 2010, C= Jourdie et al. 2008, D=Molina-Ochoa et al. 2004, E=Cruz et al. 2009, F=Patel and Habib 1986, G=Wheeler et al. 1989, F= Silva et al. 2008

3. Co-occurrence of other parasitoids

In fields where *E. laphygmae* naturally occurs:

- *Chelonus insularis* is the predominant parasitoid followed by *E. laphygmae*
- *E. laphygmae* predominates in weedy, diverse fields whereas *C. insularis* predominates in less weedy fields (Cortez-Madrigal 1998)

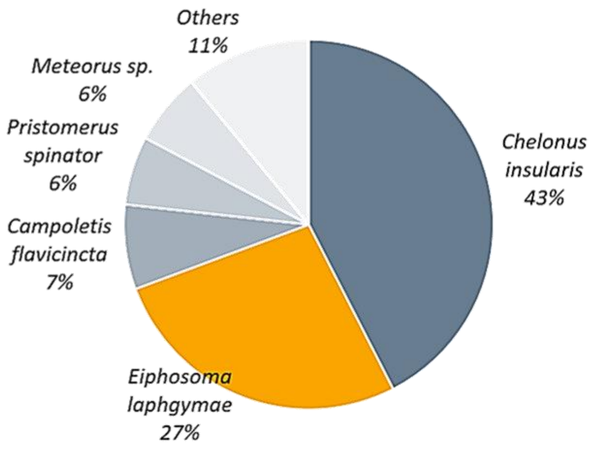

Fig 4: Mean contribution *of Spodoptera frugiperda* parasitoids to total parasitism of the three most dominant species in fields where *Eiphosoma laphygmae* occured (n=24).

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Further references included in the systematic review are available at the Q code link above.

Tropentag,
9-11 September, 2020