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Eiphosoma laphygmae, a Classical Solution for the Biocontrol of the Fall Armyworm, *Spodoptera frugiperda*?

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Abstract

The fall armyworm, *Spodoptera frugiperda* (J E Smith, 1757) is an invasive Lepidoptera and one of the most damaging cereal pests in the tropics, having arrived in Africa in 2016, spreading through the continent, then on to Asia. Current control methods rely on insecticides whereas biological control might offer a more sustainable solution. The parasitoids, *Eiphosoma laphygmae* and *E. vitticole* (Hymenoptera: Ichneumonidae), previously considered as synonyms, are potential classical biological control agents, yet knowledge on their biology needs to be collated and specificity assessments conducted. We aimed to assess existing knowledge on biology, identify their natural distribution, collate reported parasitism rates from field studies and determine which other parasitoids co-occur with them. We conducted a systematic literature review using the keyword “*Eiphosoma*” on 11.11.2019 in Web of Science, Agricola, CAB-Abstracts, and Food Science and Technology Abstracts. On 12.11.2019, we searched using the search string (“*Eiphosoma vitticole*” OR “*Eiphosoma laphygmae*”) in full text in googlescholar. We had 121 initial hits. We then excluded papers from outside the topic areas and three for which we had no access, retaining 44 papers in English, Portuguese and Spanish.

Reports on the natural distribution of *E. laphygmae* were restricted to the American tropics with the most northerly record from Northern Mexico and the most southerly from the state of Sao Paulo, Brazil. In fields where *E. laphygmae* naturally occurred, it was the second most important contributor to the mortality of the fall armyworm, after *Chelonus insularis*, another hymenopteran parasitoid. On average, *E. laphygmae* parasitized 4.3% of fall armyworm in field studies. The highest parasitism rates were observed in Costa Rica (13%) and Minas Gerais Brazil (14.5%). *E. laphygmae* appeared to establish better in more diverse systems with weeds. Given that it is assumed to be synovigenic, it is dependent on protein and nectar from wild flowers for egg production. As African farming systems often have high diversity, this may favour the establishment of *E. laphygmae* if eventually introduced as a classical biological control agent.

Keywords: Biological control, *Eiphosoma laphygmae*, *Eiphosoma vitticole*, fall armyworm, larval parasitism, maize, *Spodoptera frugiperda*