

## Fall armyworm, *Spodoptera frugiperda* (JE Smith)

### Introduction

The fall armyworm, *Spodoptera frugiperda* (JE Smith), is a polyphagous noctuid moth that originates from tropical and subtropical regions of North, Central and South America. It is considered as one of the most serious pests of maize and, to a lesser extent, sorghum, rice and many other crops. In 2016 it was found in West Africa and, since then, it has invaded almost all Sub-Saharan Africa and large parts of Asia and Oceania. In many regions, it has become the most serious pest of maize, threatening food security and livelihoods of millions of smallholder farmers. It is also a public health issue because the pest is mostly controlled by the application of chemical pesticides (Kenis et al. 2022).

### History of classical biological control against *Spodoptera frugiperda*

There has been no introduction of natural enemy against *S. frugiperda* in its invasion range, where several native parasitoids and predators have adopted the pest. In its native range, in the 20th century, several parasitoids have been introduced from one region to another where they were absent, or introduced from other continents, where they occur on other *Spodoptera* spp. (Kenis et al. 2022). Only one species, the egg parasitoid *Telenomus remus*, introduced from Asia, became established and spread to most of the distribution range of *S. frugiperda* in the Americas. *Telenomus remus*, which is also used as augmentative biological control agent, is already present in Africa and Asia and, thus, it cannot be considered for classical biological control in these continents. However, in the Americas, *S. frugiperda* is attacked by many native natural enemies (Molina-Ochoa et al. 2003; Bahena and Cortez 2005; Kenis et al. 2022). All known predators of *S. frugiperda* are polyphagous but some parasitoids are more specific and could be assessed for introduction in the invasion range.

### Most promising natural enemies for classical biological control

*Chelonus insularis* Cresson (Hym.; Braconidae) is an egg-larval parasitoid. It is the most frequently cited parasitoid of *S. frugiperda* in North, Central and South America, and the one that reaches highest parasitism rates, e.g. over 40% in Nicaragua (Gladstone 1991). As such, it should be considered as a priority species for classical biological control. In the literature, it is mentioned as an oligophagous species, being recorded from several other Noctuidae (Yu et al. 2016), but biotypes or even cryptic species showing higher specificity may occur.

*Eiphosoma laphygmae* Costa Lima (Hym.: Ichneumonidae) is a common larval parasitoid of *S. frugiperda* from Mexico to Brazil. It is particularly abundant in Brazil (Allen et al. 2021). It is supposed to be the most specific parasitoid of *S. frugiperda*, with only two single, doubtful reports on other hosts (Allen et al. 2021) and, therefore, should be considered as a good candidate for introduction into Africa and Asia.

*Aleoides laphygmae* (Viereck) (Hym. Braconidae) is a larval parasitoid also known as being rather specific, with only a handful of reports on other hosts, some clearly erroneous (Yu et al. 2016). It is present throughout the native range of *S. frugiperda* but has only occasionally been reported as a dominant parasitoid (e.g. Wyckhuys and O'Neil 2006).

## Preparedness in biological control of priority biosecurity threats

*Campoletis* spp. (Hym., Ichneumonidae) are larval parasitoids. Several species have been reported attacking *S. frugiperda*, the main ones being *C. sonorensis* (Cameron), *C. flavicincta* (Ashmead) and *C. grioti* (Blanchard) (Molina-Ochoa et al. 2003). Their taxonomy is confusing and misidentifications in the literature are likely. All species are also reported from some other hosts (Yu et al. 2016) but, considering the confusion in their taxonomy, it is possible that at least one species is specific to *S. frugiperda*. A major interest of *Campoletis* spp. is that they are dominant at high elevations and high latitudes (e.g. Murúa et al. 2009), which may suggest that they are particularly suitable for the biocontrol of *S. frugiperda* in colder areas, where the pest is transient.

### Other natural enemies for classical biological control

There are many more parasitoids of *S. frugiperda* in the Americas (Molina-Ochoa et al. 2003; Kenis et al. 2022). Some of them are frequently recorded on this host and can sometimes reach high rates of parasitism, such as *Cotesia marginiventris* (Cresson) (Hym.; Braconidae), *Archytas marmoratus* Townsend and *Lespesia archippivora* Riley (Dipt.: Tachinidae). In the literature, they are reported as being highly polyphagous, but it cannot be ruled out that cryptic species or host biotypes showing higher host specificity occur.

### References

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