



Photo T. Haye

FAW Biological Control in Sub-Saharan Africa

Marc Kenis

CABI

KNOWLEDGE FOR LIFE



Since the arrival of FAW in Africa, all categories of biological control have been considered for the continent:

Invasiveness, biology, ecology, and management of the fall armyworm, *Spodoptera frugiperda*

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Table 1. Parasitoids recorded from *S. frugiperda* in the field in African countries, as mentioned in the references.

Species ¹	Biology ²	Countries	References ³
Dipt: Tachinidae			
<i>Drino quadrixonula</i> (Thomson)	Larval-(pupal)	Benin, Ghana, Mozambique, Uganda, Zambia	b,d,f,k
<i>Drino</i> sp.	Larval	Burkina Faso	c
<i>Exorista larvarum</i> (L.)	Larval	Egypt	o
<i>Drino imberbis</i> (Wiedemann) (= <i>Palexorista zonata</i> (Curran))	Larval	Ethiopia, Kenya	m
<i>Sturmiopsis parasitica</i> (Curran)	Larval-pupal	Uganda	l
Hym: Braconidae			
<i>Bracon</i> sp.	Larval	Ghana	i
<i>Chelonus bifoveolatus</i> Szépligeti	Egg-larval	Benin, Burkina Faso, Ghana, Senegal, Uganda, Zambia	b,c,f,i,l,o
<i>Chelonus curvimaculatus</i> Cameron	Egg-larval	Kenya, Zambia	f,i,m
<i>Chelonus intermedius</i> (Thomson)	Egg-larval	Egypt	p
<i>Chelonus</i> sp.	Egg-larval	Niger	
<i>Coccygaster luteum</i> (Brullé)	Larval	Benin, Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Mozambique, Tanzania, Uganda, Zambia	a,b,c,e,f,i,l,m
<i>Cotesia flavipes</i> Cameron	Larval	Uganda	l
<i>Cotesia icipe</i> Fernandez-Triana and Fiaboe	larval	Benin, Cameroon, Ethiopia, Ghana, Kenya, Tanzania, Zambia	a,b,f,m
<i>Cotesia ruficornis</i> (Haliday)	Larval	Egypt	p
<i>Cotesia sesamiae</i> (Cameron)	Larval	Cameroon	a
<i>Cotesia</i> sp.	Larval	Niger	d
<i>Diolcogaster</i> sp.	Larval	Uganda	l
<i>Meteorus</i> sp.	Larval-pupal	Uganda	l
<i>Meteorida testacea</i> (Granger)	Larval-pupal	Benin, Ghana	b,i
<i>Microplitis rufiventris</i> (Kokujev)	Larval	Egypt	o
<i>Parapanteles</i> sp.	Zambia	Zambia	f
Hym.: Eulophidae			
<i>Euplectrus laphygmae</i> (Fertière)	Larval	Nigeria, Zambia	f,k
Hym: Ichneumonidae			
<i>Charops</i> sp. / <i>C. cf. diversipes</i> Roman	Larval	Benin, Cameroon, Ghana, Mozambique, Niger, Uganda	a,b,d,e,l
<i>Charops ater</i> Szépligeti	Larval	Kenya, Tanzania	m
<i>Diadegma</i> sp.	Larval	Zambia	f
<i>Enicospilus capensis</i> Thunberg	Larval	Zambia	f
<i>Metopius discolor</i> Tosquinet	Larval-Pupal	Benin, Ghana, Mozambique, Zambia	b,e,f
<i>Pristomerus pallidus</i> (Kriechbaumer)	Larval	Benin	b
<i>Pristomerus</i> sp.	Larval	Zambia	f
Hym: Scelionidae			
<i>Telenomus remus</i> Nixon	Egg	Benin, Cameroon, Côte d'Ivoire, Ghana, Kenya, Niger, Nigeria, Uganda, South Africa, Tanzania, Zambia	a,b,g,h,j,k,l,m
Hym: Trichogrammatidae			
<i>Trichogramma chilonis</i> (Ishi)	Egg	Cameroon, Kenya	a,g,m
<i>Trichogramma mwanzai</i> Schulten and Feijen	Egg	Tanzania, Zambia	g,n
<i>Trichogramma</i> sp.	Egg	Benin, Ghana	b
<i>Trichogrammatoidea lutea</i>	Egg	Zambia	n
<i>Trichogrammatoidea</i> sp.	Egg	Niger	d,j
Nematoda: Mermithidae			
Undetermined Mermithidae	Larval	Burkina Faso, Senegal, Zambia	c,f,o

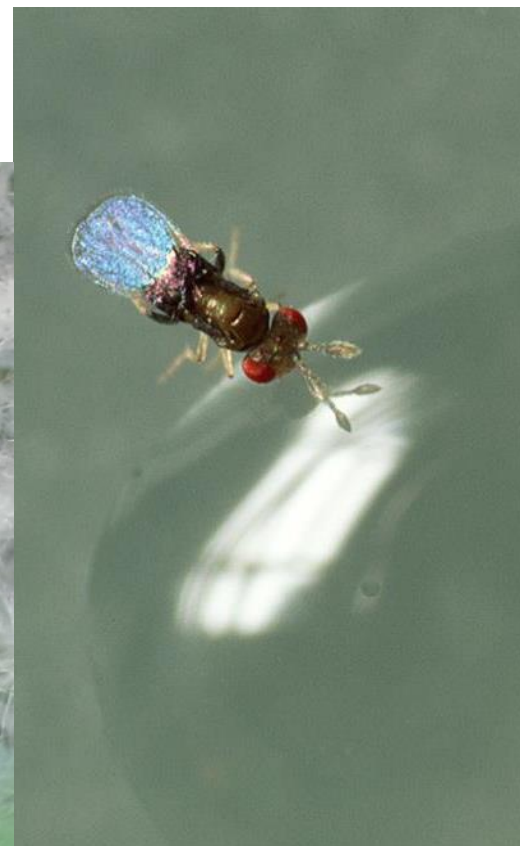
¹Parasitoids may be wrongly identified in the source reference, and different rows may refer to the same parasitoid species.

²Host stage attacked and killed

³a = Abang et al. 2021, b = Agboyi et al. 2020, c = Ahissou et al. 2021c, d = Amadou et al. 2018, e = Caniço et al. 2020, f = Durocher

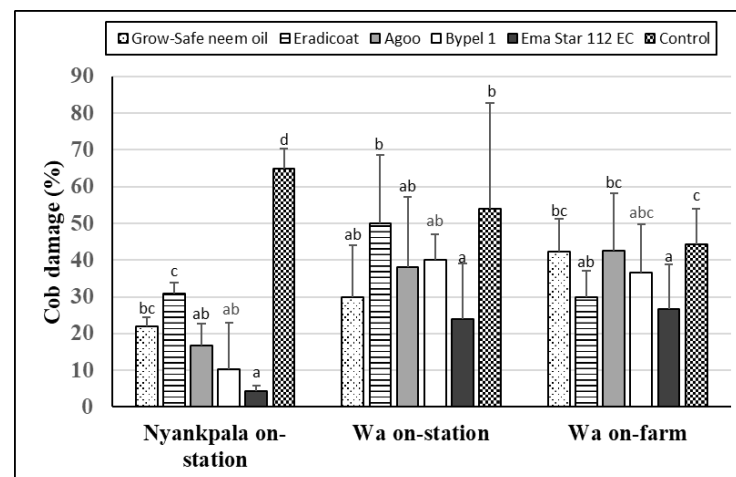
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Photo: Thomson Reuters Foundation/Charles Mkoka



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**Well covered
by other talks**

Classical biological control

Introduction of a natural enemy of exotic origin to control a pest, usually also exotic, aiming at a permanent control of the pest

In Africa, several big successes of classical biological control



Cassava mealybug

Papaya mealybug



Mango mealybug

Cassava green mite



(C) G. Goergen



Classical biocontrol of FAW is not easy

- FAW is a pest in its area of origin
- In America, FAW natural enemies do not seem to play a major role (according to literature)
- In Africa, FAW is already attacked by a complex of parasitoids and other natural enemies



Classical biocontrol of FAW is not easy

But worth trying:

- FAW is still a big issue in Africa with huge amount of pesticides used on maize causing serious impacts on livelihood including human health.
- Even a general decrease of population levels by 10-20% would have huge benefits at continental scale
- Total control is not necessary. Minor damage usually does not result in yield losses
- CBC is at no cost for farmers.



Classical biocontrol of FAW is not easy

But worth trying:

- Population levels are usually lower in the Americas, where the role of natural enemies is often underestimated
- Following classical biological control, some invasive pests become less damaging in their area of introduction than in their area of origin

FAW has many natural enemies in America



H. Gross, Bugwood.org



Johnny N. Dell, Bugwood.org



Embrapa



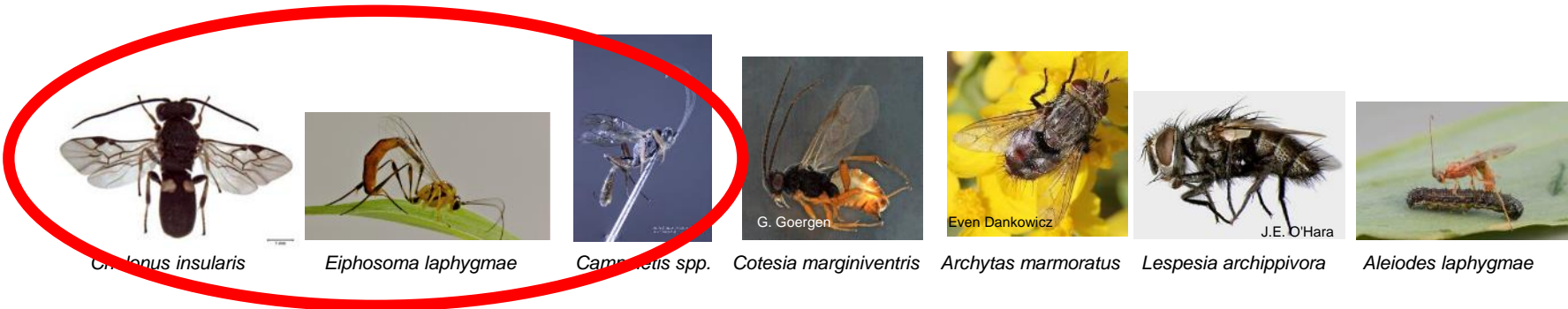
G. Goergen

FAW parasitoids in the Americas

Main criteria used for the selection of CBC agents

- Efficiency in all environments (+ frequent and + abundant)
- Specificity
- Climatic suitability
- Empty niche in the area of introduction

FAW parasitoids in the Americas (literature and own surveys)



Literature	Abundance/ Frequency	*****	****	****	****	****	***	***
	Specificity	**	***	*	*	*	*	**
	Bolivia	***	***	*(**)		***	**	
	Nicaragua	***	*	*	*	**	**	(**)



Chelonus insularis

The most abundant and frequent parasitoid of FAW in North, Central and South America



But not very specific

Other *Chelonus* spp. are important parasitoids of FAW in Africa and Asia

Eiphosoma laphygmae

One of the most abundant parasitoids in the Americas but regional variations



Most specific parasitoid of FAW

- Only two other hosts mentioned (once) in the literature (errors??)
- Host specificity screening in quarantine in Switzerland and Pakistan 16 species tested, among which 4 *Spodoptera* spp. No positive results.

No congeneric species on FAW in Africa and Asia



Eiphosoma laphygmae

Issues



- Rearing methods need improvement
- Establishment of a quarantine rearing in Africa failed so far
- New strains needed

***Campoletis* sp.**

Most abundant parasitoid of FAW at high elevations



- Taxonomy unclear
- From the literature not specific
- Specificity presently being assessed at CABI

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