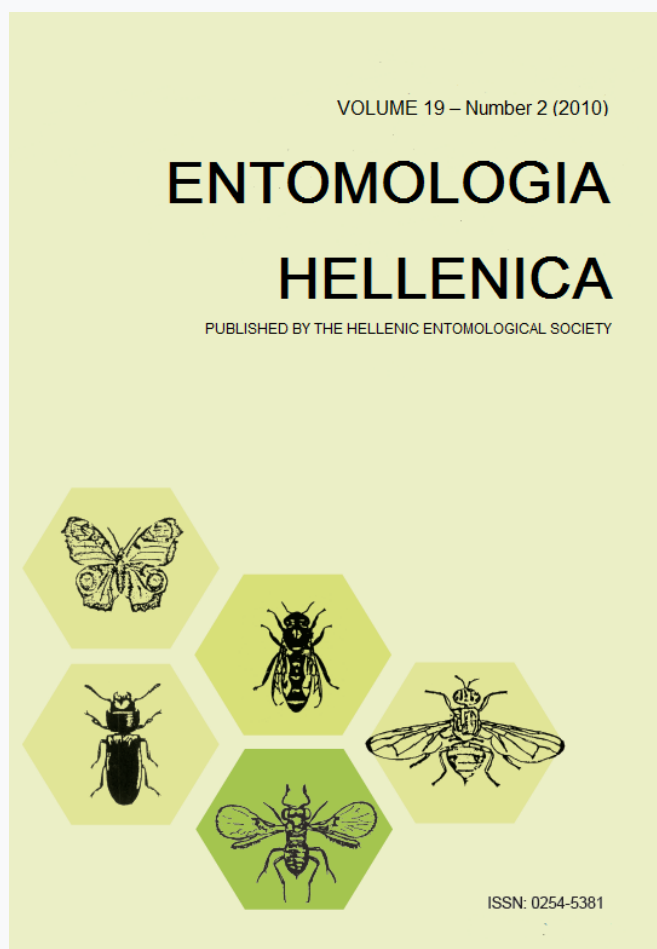


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## Preliminary inventory of scale insects on mango trees in Benin

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## Preliminary inventory of scale insects on mango trees in Benin

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### ABSTRACT

A preliminary inventory of scale insects (Hemiptera: Coccoidea) developing on the mango tree is presented for Northern and Central Benin. The following species, *Gigantococcus euphorbiae*, *Gigantococcus nigroareolatus*, *Ceroplastes uapacae*, *Parasaissetia nigra*, *Saissetia privigna*, *Udinia catori*, *Ferrisia virgata*, *Paracoccus interceptus*, *Phenacoccus solenopsis*, *Rastrococcus invadens*, *Aonidiella orientalis* and *Lepidosaphes tapleyi*, were collected from 2005 to 2007 in mango orchards in the Sudanian area of Benin, on branches, leaves, and particularly on mango petioles and fruits. Nine of these species are recorded for the first time in Benin while *P. interceptus* is recorded in Africa for the first time. Only two, *R. invadens* and *A. orientalis*, of the 12 species are considered as mango pests.

KEYWORDS: Benin, *Mangifera indica*, Margarodidae, Coccidae, Pseudococcidae, Diaspididae, Stictococcidae.

### Introduction

Studies and experiments on fruit fly pests were carried out in the mango orchards of Central and Northern Benin from 2005 onwards in order to develop and disseminate an effective IPM-package against fly pests. The opportunity was taken to collect some coccoid species hosted by the mango tree (*Mangifera indica*, Anacardiaceae). This investigation was important to (i) improve our knowledge of the biodiversity of scale insects associated with the mango tree in Central and Northern Benin, which is the country's main zone of mango production (Vayssières et al. 2008) and to (ii) detect potential invasive species of Coccoidea. For instance, *Rastrococcus iceryoides* (Green) (Hemip-

tera: Pseudococcidae) of South Asian origin, was first recorded in 1989 (Williams and Matile-Ferrero 1999) in East Africa (Tanzania) where it has become a major pest of mango and many other hosts in Kenya (Tang, unpublished data). Should it be introduced into West Africa, its rapid detection will be well worthwhile.

The references to Coccoidea in Benin are in the database ScaleNet where 16 species are listed from 1902 to 2002 (Ben-Dov et al. 2010). No relevant inventory of coccoids has previously been made for this country.

### Materials and Methods

Scale insects were collected on the branches, leaves, petioles and fruits of mango trees

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from 2005 to 2007. The departments and sites where investigations were carried out were: Atacora (Natitingou), Borgou (Ina, Kakara, Komi, N'Dali, Parakou and Tchatchou) and Collines (Dassa Akbowele and Savé Diho). All specimens were therefore collected in Northern and Central Benin, corresponding to the Sudanian area (*sensu lato*). After first photographing the coccids, they were stored in vials (70% alcohol) and sent to the Laboratoire National de la Protection des Végétaux (LNPV) station at Montpellier, France.

In the lab they were slide mounted using the following procedure: specimens were macerated in 10% KOH, cleaned in distilled water, stained in a mixture of fuschin acid, distilled water, glycerol and lactic acid, dehydrated in acetic acid and lavender oil and mounted in Canada balsam. These slide-mounted specimens have been deposited in the collection of the LNPV.

Several taxonomic and ecological articles were used for their identification and establishing their distribution (Morrison 1928, McKenzie 1938, Ezzat and McConnell 1956, Williams 1960, De Lotto 1967, Hanford 1974, Williams 1986, Ben-Dov 1993, Ben-Dov 1994, Hodgson 1994, Ben-Dov and German 2003, Williams 2004, Ben-Dov 2005, Hodgson et al. 2008, Unruh and Gulian 2008, Hodgson et al. 2009).

## Results

The recorded species are:

### Margarodidae:

#### *Gigantococcus euphorbiae* (Brain 1915)

Collected by J.-F. Vayssières on 05/05/2007, in Tchatchou. This species was originally described from South Africa on *Euphorbia* tree under the name *Icerya euphorbiae*. Distribution: restricted to South Africa and Zimbabwe.

Hosts: at least six botanical families, including Euphorbiaceae, Fabaceae and Moraceae.

Not known as a pest.

#### *Gigantococcus nigroareolatus* (Newstead 1917)

Collected by J.-F. Vayssières on 04/05/2005, in N'Dali. This species was originally described from Uganda on coffee under the name *Icerya nigroareolata*.

Distribution: restricted to Uganda, Kenya, Zaire and Ghana.

Hosts: *Acalypha* spp. and *Croton* spp. (Euphorbiaceae), *Coffea* spp. (Rubiaceae) and *Theobroma cacao* (Sterculiaceae).

Minor pest.

### Coccidae:

#### *Ceroplastes uapacae* (Hall 1931)

Collected by J.-F. Vayssières on 04/04/2007, in Tchatchou, Kakara and Komi (Monastery). This species was originally described from Zimbabwe on *Uapaca kirkiana* (Euphorbiaceae) and *Zyzygium malaccense* (Myrtaceae). It was recorded on agricultural crops and in dense forest in West Africa. In South America, it was recorded on mango (*Mangifera indica*) in Colombia (Vera Wolf pers. com.).

Distribution: Afrotropical from Senegal to Mozambique as well as in Colombia.

Hosts: eight botanical families, including Myrtaceae, Rutaceae and Anacardiaceae.

Not known as a pest.

#### *Parasaissetia nigra* (Nietner 1861)

Collected by J.-F. Vayssières on 06/04/2006, in Tchatchou, also in Dassa Akbowele and Savé Diho. This species was described from Sri Lanka on coffee under the name *Lecanium nigrum*.

Distribution: cosmopolitan.

Hosts: very polyphagous species.

Minor pest.

#### *Saissetia privigna* (De Lotto 1965)

Collected by J.-F. Vayssières on 04/05/2007, in Ina. This species was originally described from Ruiru, Kenya on *Coffea arabica*.

Distribution: East and South African distribution. Known from India, Pakistan and Sri Lanka, Egypt, Israel, Turkey and Greece.

Hosts: 10 botanical families, including Anacardiaceae, Rubiaceae, Rutaceae and Solanaceae. Minor pest on mango (*Mangifera indica*) in Israel.

***Udinia catori* (Green 1915)**

Collected by J.-F. Vayssières on 06/04/2006 in Kakara (O.B.), also found in Tchatchou, Komi, Parakou Korobourou, Dassa Akbowele and N'Dali. This species was originally described from Nigeria, Kabba Province from pod of kola nut under the name *Lecanium catori*.

Distribution: from Senegal to Nigeria.

Hosts: polyphagous, 16 botanical families, including Anacardiaceae, Rubiaceae and Rutaceae.

Minor pest.

This species is important because it is quite often associated with weaver ants for which the scales supply honeydew, important in the diet of the ants. The association between this soft scale and the weaver ants, *Oecophylla longinoda*, is important when taking an IPM approach against major pests of mango orchards such as fruit flies (Van Mele et al. 2007).

**Pseudococcidae:**

***Ferrisia virgata* (Cockerell 1893)**

Collected by J.-F. Vayssières on 18/05/2006, in Tchatchou, then in N'Dali. This species was described from Jamaica on grass under the name *Dactylopius virgatus*.

Distribution: Pantropical.

Hosts: very polyphagous. Recorded in sub-Saharan Africa on okra (*Abelmoschus esculentus*), roselle (*Hibiscus sabdariffa*), cacao (*Theobroma cacao*), coffee (*Coffea arabica*) and pineapple (*Ananas comosus*).

Minor pest.

***Paracoccus interceptus* (Lit 1997)**

Collected by J.-F. Vayssière in Komi on 04/04/2006, then in N'Dali, Ina. This species was described from the Philippines by Ezzat and McConnell (1956) under the name *Alloccoccus morrisoni* (homonym replaced) on *Lansium domesticum* (Meliaceae).

Distribution: oriental from India to Indonesia. New for Africa.

Hosts: develops on 18 botanical families (Figure 1).

Minor pest.

***Phenacoccus solenopsis* (Tinsley 1898)**

Collected by J.-F. Vayssières on 22/06/2006, in Tchatchou. This species was described from USA (New Mexico), found with the ant, *Solenopsis geminata* Fabricius.

Distribution: Neotropical and Nearctic; in Asia (China, India and Pakistan); in Africa (Nigeria and Cameroon).

Hosts: develops on 13 botanical families. Noted as a pest on cotton in India and Pakistan. Pest for cotton.

***Rastrococcus invadens* (Williams 1986)**

Collected by J.-F. Vayssières on 24/02/2006, in Parakou (Monastery), then in Parakou Korobourou. This species was described from Pakistan on *Mangifera indica*.

Distribution: oriental and spreading in tropical Africa, mainly as a pest of mango.

Hosts: very polyphagous species, about 30 botanical families. Pest of mango and also of many other cultivated plants. It was first collected on mango trees in the 1980s along the coasts of Benin and Togo (Williams 1989). By the mid-1990s, it had invaded most of West and Central Africa. In the urban areas, this mealybug attacked mango, citrus, shade trees (*Terminalia catappa*) and many other plants. The biological control of this mango pest by two parasitoid species was successful by the end of 1990s (Bokonon-Ganta et al. 2002).

**Diaspididae:**

***Aonidiella orientalis* (Newstead 1894)**

Collected by J.-F. Vayssières on 09/10/2007, in Atacora (Natitingou). This species was described from India, Andhra Pradesh on *Panicum* spp. under the name *Aspidiotus orientalis*.

Distribution: widely distributed in tropical and subtropical zones; in Africa in the east and south.

TABLE 1. Scale insect species recorded in Benin and on mango tree in 2005-2007.

Family	Species		Departments of Benin (rec. 2005-2007)	
<b>Margarodidae</b>	<i>*Gigantococcus</i>	<i>euphorbiae</i>	(Brain 1915)	Borgou
	<i>*Gigantococcus</i>	<i>nigroareolatus</i>	(Newstead 1917)	Borgou
<b>Coccidae</b>	<i>*Ceroplastes</i>	<i>uapacae</i>	Hall 1931	Borgou
	<i>Parasaissetia</i>	<i>nigra</i>	(Nietner 1861)	Borgou, Collines
	<i>*Saissetia</i>	<i>privigna</i>	De Lotto 1965	Borgou
	<i>*Udinia</i>	<i>catori</i>	(Green 1915)	Borgou, Collines
	<i>Udinia</i>	<i>farquharsoni</i>	(Newstead 1922)	
<b>Pseudococcidae</b>	<i>*Ferrisia</i>	<i>virgata</i>	(Cockerell 1893)	Borgou
	<i>Maconellicoccus</i>	<i>hirsutus</i>	(Green 1908)	
	<i>Nipaecoccus</i>	<i>viridis</i>	(Newstead 1894)	
	<i>*Paracoccus</i>	<i>interceptus</i>	Lit 1997	Borgou
	<i>Phenacoccus</i>	<i>madeirensis</i>	Green 1923	
	<i>Phenacoccus</i>	<i>manihoti</i>	Matile-Ferrero 1977	
	<i>*Phenacoccus</i>	<i>solenopsis</i>	Tinsley 1893	Borgou
	<i>Rastrococcus</i>	<i>invadens</i>	Williams 1986	Borgou
<b>Stictococcidae</b>	<i>Parastictococcus</i>	<i>multispinosus</i>	(Newstead 1908)	
	<i>Stictococcus</i>	<i>sjostedti</i>	Cockerell 1903	
<b>Diaspididae</b>	<i>Aonidiella</i>	<i>citrina</i>	(Coquillett 1891)	
	<i>*Aonidiella</i>	<i>orientalis</i>	(Newstead 1894)	Atacora
	<i>Aspidiotus</i>	<i>destructor</i>	Cockerell 1869	
	<i>Aspidiotus</i>	<i>elaeidis</i>	Marchal 1909	
	<i>Aulacaspis</i>	<i>tubercularis</i>	Newstead 1903	
	<i>*Lepidosaphes</i>	<i>tapleyi</i>	Williams 1960	Borgou
	<i>Pinnaspis</i>	<i>strachani</i>	(Cooley 1898)	
	<i>Pseudaonidia</i>	<i>trilobitiformis</i>	(Green 1896)	
	<i>Spinaspidotus</i>	<i>fissidens</i>	(Lindinger 1909)	
	<i>Unaspis</i>	<i>citri</i>	(Comstock 1881)	

\*first report for Benin

Hosts: very polyphagous species, developing on more than 70 botanical families. Common pest on mango (*Mangifera indica*), *Citrus* spp., tea (*Camellia sinensis*), date palm (*Phoenix dactylifera*) and papaya (*Carica papaya*).

***Lepidosaphes tapleyi* (Williams 1960)**

Collected by J.-F. Vayssières on 23/06/2007, in Parakou Korobourou. This species was

described from Sudan, Shendi on *Mangifera indica*.

Distribution: Sudan, Tanzania, Egypt, and in Asia (India and Indonesia) and some Pacific islands.

Hosts: developing on 17 botanical families including mango (*Mangifera indica*) from India. Not known as a pest.



FIG. 1. *Paracoccus interceptus* on mango fruit.

## Discussion

The presence of 12 species of Coccoidea shows the biodiversity of the scale insects in this Sudanian area, 9 of which had not been previously recorded in Benin (Table 1). Among these 9 newcomers, four species are afrotropical and five cosmopolitan. The 10<sup>th</sup>, *P. interceptus*, is new for Africa. This species is present in South-East Asia, regularly

intercepted on fruits in USA and occasionally in Europe (Williams 2004). Developing on 18 botanical families in which Anacardiaceae with *Spondias dulcis* in Thailand. From these 12 species only *R. invadens* and *A. orientalis* are considered as pests of the mango tree. The successful control of *R. invadens* is a renowned classical biological example (Neuschwander et al. 1994, Boknon-Ganta et al. 2002) in Benin and other

humid areas of West Africa. Where found, *A. orientalis* is widespread on mango leaves but it remains a very scarce and localised species as a mango pest.

The Asian species, *Rastroccocus iceryoides*, which is a major pest of mango in East Africa, was not recorded during this study. So, until 2007 at least, this mango threat was not present in Benin. Of course, rapid detection of new pest introductions is extremely important for obtaining early control of threats to mango such as *R. iceryoides*.

Since this study was carried out only in northern and central areas of Benin, similar collections are now being made in the southern mango orchards of Benin in the Atlantique and Mono departments, which is a more humid zone representative of the Guinea-Congolian area. Next year, this will produce a more complete list of scale insect species associated with the mango tree in Benin.

The ScaleNet database listed 16 species present in Benin, to which was added *Parasaissetia nigra* (EPPO 1997). Including the 10 new records from our study, a total of 27 scale insect species (Table 1) have now been identified and recorded for Benin. This seems a relative small number compared with the 86 species which were already recorded in Nigeria, a very large neighbouring country with many agro-ecological zones.

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## Προκαταρκτικός κατάλογος κοκκοειδών εντόμων (Hemiptera: Coccoidea) σε δένδρα μάνγκο στο Μπενίν

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### ΠΕΡΙΛΗΨΗ

Ένας προκαταρκτικός κατάλογος κοκκοειδών εντόμων που αναπτύσσονται σε δένδρα μάνγκο παρουσιάζεται για το κεντρικό και βόρειο Μπενίν. Τα ακόλουθα είδη, *Gigantococcus euphorbiae*, *Gigantococcus nigroareolatus*, *Ceroplastes uapacae*, *Parasaissetia nigra*, *Saissetia privigna*, *Udinia catori*, *Ferrisia virgata*, *Paracoccus interceptus*, *Phenacoccus solenopsis*, *Rastrococcus invadens*, *Aonidiella orientalis* και *Lepidosaphes tapleyi*, συλλέχθηκαν από το 2005 ως 2007 σε σπορώνες μάνγκο στην περιοχή Sudanian του Μπενίν. Από αυτά, 12 είδη συλλέχθηκαν από κλαδιά, φύλλα και σε σημεία του κάλυκα στα φρούτα. Εννέα είδη αναφέρονται για πρώτη φορά στο Μπενίν και ένα για πρώτη φορά γενικά στην Αφρική. Μόνο δύο είδη, τα *R. invadens* και *A. orientalis*, από τα 12, θεωρούνται ως επιζήμια για την καλλιέργεια.