

Alternative Host Plants of *Calidea panaethiopica* (Hemiptera: Scutelleridae) and *Aphthona whitfieldi* (Coleoptera: Chrysomelidae), Insect Pests of *Jatropha curcas*, South Burkina Faso

Younous Wakaï Djimmy¹, Alizèta Sawadogo¹, Souleymane Nacro^{2,3*}

¹Département des Productions Végétales, Institut du Développement Rural (IDR), Université Polytechnique de Bobo-Dioulasso, Bobo-Dioulasso, Burkina Faso

²Fondation Fasobiocarburant, Léo, Burkina Faso

³Institut de l'Environnement et de Recherches Agricoles, CREAM Kamboinsé, Ouagadougou, Burkina Faso
Email: *snacro2006@yahoo.fr

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Abstract

Jatropha curcas is subject to the attacks of many insect pests, including *Calidea panaethiopica* Kirkaldy 1909 (Hemiptera: Scutelleridae) whose larvae and adults feed on flowers, fruit and seeds of the shrub resulting in quantitative and qualitative losses; the shrub is also attacked by *Aphthona whitfieldi* Bryan (Coleoptera: Chrysomelidae) which feeds on the leaves causing complete defoliation in severe attack. Despite their economic importance, very little is known about the alternative host plants of these insect pests. The study of the ecology of these species is a pre-requisite for the development of appropriate control methods. The identification of alternative host plants of *C. panaethiopica* and *A. whitfieldi* was conducted from June 3rd 2013 to November 30th 2014 in the Sissili province, South Burkina Faso. During that period, four *J. curcas*' plantations of six locations in the province were prospected for alternative host plants of the two insect pests. In each plantation, observations were done across a diagonal up to 500 m away from the plantation. Fallows in the vicinity of the *J. curcas* plantations were particularly examined. Potential host plants of the two insect pests were collected and bred in the laboratory in Léo where they were used to feed the insect pests. Only *Jatropha gossypifolia*, a cousin of *J. curcas*, was found to be a common alternative host plant of both insect pests.

*Corresponding author.

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Keywords

Burkina Faso, Alternative Host Plants *Calidea panaethiopica* and *Apthona whitfieldi*, *Jatropha curcas*

1. Introduction

Jatropha curcas L. (Euphorbiaceae) is a shrub native to Central America that produces inedible oil used as fuel in total or partial substitution of fossil fuels [1]. *Jatropha curcas* seeds contain 30% - 40% oil, which can be an alternative to diesel fuel [2]. Oil of *J. curcas* is a high performance biodiesel unlike other biodiesels, and can be used without mixing and without engine modifications, making the prospects offered by *J. curcas* incomparable to those of others in the field of diesel or alternative to conventional diesel [3]. Biofuels contribute to reducing the energy dependence of countries with no access to oil resources [4]. Nowadays, there is the valuation of the plant of *J. curcas*. This valuation essentially aims at diversifying agricultural production and increasing the incomes of small producers to alleviate poverty in rural areas through the development of short production chains of crude vegetable oil [5]. *Jatropha curcas* L. restores marginal soils, improves soil fertility, reforests degraded land to promote land tenure security, diversifies income generation and fights against straying animals [6].

In Burkina Faso, four species of *Jatropha* are known: *J. curcas* L., *J. gossypifolia* L., *J. podagrica* and *J. integrifolia* [7]. But the species *J. curcas* L. remains the most widespread and the most exploited. The Burkinabe government and private promoters were strongly mobilized for the production of *J. curcas* after the oil crisis of the 2000s [8]. *Jatropha curcas* plantations in Burkina Faso occupied an area of 86,908 ha in 2010 [9].

However, *J. curcas* is subject to the attacks of many pests and diseases that can have a significant impact on the production of this shrub, despite its toxicity and its biocidal properties for which oil is known [1] [10] [11].

In Africa, several insect pests feed on the plant of *J. curcas* L. These include crickets, beetles, bugs, scale insects, etc. [1] [12] [13].

In Burkina Faso, *Calidea panaethiopica* and *Apthona whitfieldi* were reported as the most common insect pests observed in 60% of *Jatropha* plantations [13] [14].

The female of *C. panaethiopica* usually lays its eggs on fruit and sometimes on the underside of leaves of *Jatropha*. Larvae and adult of *C. panaethiopica* feed on the flowers and fruits of *J. curcas*. Attacked flowers become dried and attacked fruits often have brown spots causing necrotizing malformed or empty seeds. The average grain loss of *J. curcas* due to *C. panaethiopica* was 59% [15]. As for *A. whitfieldi*, the female lays her eggs in the soil at the base of the neck of the plant. After hatching, the larvae and the adults feed on the leaves.

Despite the economic importance of these insect pests, their alternative host plants are not yet well known. However, [16] reported that cotton in Tanzania, sorghum and sunflower in South Africa are host plants for *C. dregei*, which is a cousin of *C. panaethiopica*. Author [17] indicated that *C. panaethiopica* was a polyphagous insect of many host plants containing toxic compounds, such as *Ricinus communis*, *J. podagrica* and *Gossypium* sp. This is why our focus was on species of Euphorbiaceae family. The potential host plants were cultivated in six communes of the Sissili province, South Burkina Faso: Léo, Biéha, Boura, Niabouri, Tô and Silly.

In conclusion, *C. panaethiopica* larvae and adults and *A. whitfieldi* adults have been found hosts of *J. gossypifolia* in addition to *J. curcas* their preferred host. No other host plant was found in South Burkina Faso for these insect pests. It would be necessary to extend our research to other agro ecological regions of Burkina Faso to increase the chance to find probable host plants of these insect pests.

The main objective of this study was to identify alternative wild or cultivated host plants of *C. panaethiopica* and *A. whitfieldi* in South Sudan region of Burkina Faso. This knowledge is important in the process of developing efficient control methods against these insect pests.

2. Material and Methods

2.1. Material

2.1.1. Study Sites

The study was conducted from June 3rd 2013 to November 30th 2014 in six locations, namely Léo, Biéha Boura,

Niabouri, Tô and Silly in the Sissili province, South-Sudanese zone of Burkina Faso.

2.1.2. Plants

The plant material was composed of sorghum panicles (*Sorghum bicolor*), cotton capsules (*Gossypium hirsutum*), sunflower (*Helianthus annuus*), tobacco (*Nicotiana tabacum*), fruits and flowers of perennial or annual wild Euphorbiaceae for *C. panaethiopica* and leaves for *A. whitfieldi*.

2.1.3. Insect Material

The insect material was composed of adults and larvae of *C. panaethiopica* and adults of *A. whitfieldi*.

2.2. Methods

2.2.1. Sampling Methods

The search for alternative host plants for *C. panaethiopica* and *A. whitfieldi* included both herbaceous and woody Euphorbiaceae. The most important criteria were that the *J. curcas*' plantation had to be closed to a fallow. In each selected *J. curcas*' plantation, each four sides of the field were prospected and the vicinity fallow was also visited up to 500 m from the *J. curcas*' field. The observations were done along a diagonal of the plantation. At least four fields were visited once a week in each commune. Potential host plants were identified, registered (their scientific name and their phenology were mentioned in a book) their organs (small branches, leaves, flowers etc.) were removed and brought back to the laboratory in Léo for feeding test by the two insect pests.

2.2.2. Breeding Method

The experience started as soon as the targeted plants were established in the field from June to November and the experience in the laboratory lasted for about twelve weeks. In the laboratory, adults and larvae of *C. panaethiopica* have been in contact with fruits and flowers of different potential host plants cultivated or wild. Four adult couples and five larvae of *C. panaethiopica* were put in a plastic box of 40 cm × 50 cm with a hole of 15 cm × 10 cm on each side, in the presence of fruits and flowers of each potential host plant. Four other adult couples of *C. panaethiopica* were also placed in a breeding box in the presence of *J. curcas* fruit as a control. The fruits and flowers of potential host plants were renewed once a week.

The observations in the laboratory focused on the behavior of *C. panaethiopica* vis-à-vis the fruits and flowers of potential alternative host plants. These observations were done twice a day, morning at 7 am and evening at 18 pm. The insects were kept in conditions closed to those of the surrounding environment (30°C temperature, 69% RH, and a photoperiod of 12:12 [L:D] h). The laboratory was well-ventilated thanks to large windows.

Regarding *A. whitfieldi*, each Euphorbiaceae was put in a plastic box and was brought into contact with the insect pest. The observations were done twice a day.

This study was conducted during the rainy season, from June to September 2014.

3. Results

The list of potential host plants wild or cultivated for *A. whitfieldi* and *C. panaethiopica* studied in South Sudan region of Burkina Faso is presented in **Table 1**.

The sign (+) indicates that the insect pests attack the host plant in the field and the laboratory and the (-) means they do not feed on the plant in both conditions.

C. panaethiopica (Hemiptera: Scutelleridae) feeds on the flowers and fruits of *J. curcas* and *A. whitfieldi* (Coleoptera: Chrysomelidae) consumes the leaves of *J. gossypifolia*. The latter is a very common wild Euphorbiaceae of the outskirts of swampy areas and near the boxes in the Sissili province. The two insect pests were absent on all other potential host plants identified in the study area. However, the rare literature reported that *C. panaethiopica* met on a large host range including cultivated crops.

The results showed that larvae and adults of *C. panaethiopica* and adults of *A. whitfieldi* are pests of *J. gossypifolia* in addition to *J. curcas*.

4. Discussion

The study on the alternative host plants of *C. panaethiopica* and *A. whitfieldi* included crops like sorghum, cotton, sunflower, tobacco and wild perennial or annual Euphorbiaceae. The results of this study have shown that

Table 1. List of potential host plants of *Calidea panaethiopica* and *Aphthona whitfieldi* in the Sissili province, South Sudanian zone of Burkina Faso.

Plants examined	Larvae and adults of <i>C. panaethiopica</i>	Damaged parts	Adults of <i>A. whitfieldi</i>	Damaged parts
<i>Sorghum bicolor</i>	-	absence	-	absence
<i>Gossypium hirsutum</i>	-	absence	-	absence
<i>Helianthus annuus</i>	-	absence	-	absence
<i>Nicotiana tabacum</i>	-	absence	-	absence
<i>Jatropha gossypifolia</i>	+	Fruits and flowers	+	Leaves
<i>Manihot esculenta</i>	-	absence	-	absence
<i>Euphorbia egyptica</i>	-	absence	-	absence
<i>Euphorbia hirta</i>	-	absence	-	absence
<i>Phyllanthus amarus</i>	-	absence	-	absence
<i>Sapium grahamii</i>	-	absence	-	absence
<i>Flueggea virosa</i>	-	absence	-	absence
<i>Hymenocardia acida</i>	-	absence	-	absence
<i>Bridelia ferruginea</i>	-	absence	-	absence
<i>Euphorbia convolvuloides</i>	-	absence	-	absence
<i>Euphorbia heterophylla</i>	-	absence	-	absence
<i>Chrozophora brocchiana</i>	-	absence	-	absence
<i>Phyllanthus maderespatensis</i>	-	absence	-	absence
<i>Acalypha senensis</i>	-	absence	-	absence
<i>Acalypha ciliata</i>	-	absence	-	absence
<i>Acalypha crenata</i>	-	absence	-	absence
<i>Pedelanthus thymaloïdes</i>	-	absence	-	absence
<i>Euphorbia hyssopifolia</i>	-	absence	-	absence
<i>Acalypha segetalis</i>	-	absence	-	absence
<i>Euphorbia kamerunica</i>	-	absence	-	absence
<i>Ricinus communis</i>	-	absence	-	absence

C. panaethiopica and *A. whitfieldi* are pests of *J. gossypifolia* in addition to *J. curcas*. Surprisingly, and in contradiction with what is reported in the literature, both insect pests have only been found on any other plant in Southern Burkina Faso. However, [18] reported that *C. panaethiopica* was a polyphagous insect of many host plants that contain toxic compounds. These host plants include *Ricinus communis*, *J. podagrica* and *Gossypium* sp. Author [16] reported *C. dregii* Germar as being a cotton pest in Tanzania and sorghum and sunflower pest in South Africa. Authors [17] and [19] reported in India and West Africa, some Hemiptera such as *Calidea* spp., *Eurystylus* sp., *Campylomma* sp., *Creontiades Rambar pallidus* and *Nezara viridula* as major insect pests of sorghum. Author [20] reported that in Nigeria, *C. panaethiopica* was a pest of flowers and fruits of *Ricinus communis*. For [21] in Ghana, *C. dregii* is a common pest throughout the year, usually on the flowers and sometimes on the stems of *J. podagrica*.

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