



# Diversity and community structure of insect pests developing in stored sorghum in the Northern-Sudan ecological zone of Burkina Faso



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## ABSTRACT

Stored insect pests often create major problems for farmers worldwide. Comprehensive data of insect pests of stored sorghum in Burkina Faso are scarce. Understanding the population structure of insect fauna infesting stored sorghum is important for development of management strategy. Sorghum panicles were collected from January to September 2011 in farmers' granaries in the Northern-Sudanian ecological zone of Burkina Faso to determine the diversity of insect pests and their importance in post-harvest losses. A total of 14 species of insect pests were recorded, including twelve coleopteran and two lepidopteran species. Species diversity peaked between May and September. The highest insect diversity was recorded in sorghum stored in straw granaries and on red coloured grains when compared with that of sorghum stored in mud granaries and on white coloured grains. *Rhyzopertha dominica* (Fabricius) appears to be the primary insect pest followed by secondary pests including *Oryzaephilus mercator* (Fauvel), *Cryptolestes ferrugineus* (Stephens) and *Sitophilus zeamais* (Motschulsky). The distribution pattern of the pests in granaries corresponds to the Mandelbrot model in which colonization of species in an environment depends on the physical conditions of that environment and on the species currently present, which suggest a progressive colonization occurs in waves with stocks of grain.

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## 1. Introduction

Sorghum, *Sorghum bicolor* (L.) Moench, is one of the most important cereals in the semi-arid tropics providing a major source of dietary energy and protein for nearly a billion people living in semi-arid areas (Belton and Taylor, 2004; Rooney, 2004). In Burkina Faso, sorghum serves as the major staple food crop in terms of production (1,923,805 tons) and acreage (1,788,695 ha; DGPSA, 2013); the country is the third largest African producer of sorghum (FAOSTAT, 2012).

Many sub-Saharan Africa (SSA) countries, including Burkina Faso, suffer from chronic food deficits that are caused by several factors such as the persistently low productivity of staple crops.

Post-harvest loss (PHL) is an often-forgotten factor that also contributes to chronic food deficits. A joint report of the World Bank, Natural Resources Institute in the United Kingdom and Food and Agriculture Organization of the United Nations states the value of PHL for grains in SSA could potentially reach nearly US\$4 billion yr<sup>-1</sup> out of an estimated US\$27 billion yr<sup>-1</sup> of value in grain production (Anonymous, 2011). Storage insect pests cause much of this PHL for grains. Insect pests can not only directly cause grain weight loss for stored sorghum but can also alter the physicochemical properties of the grain (Park et al., 2008). Insects that develop within storage facilities for grains may also favour the development of poisonous aflatoxins produced by the fungus *Aspergillus flavus* (Lamboni and Hell, 2009).

Comprehensive data related to insect pests infesting high value stored commodities, such as cassava, maize and cowpea, are available (Caswell, 1961; Ratnadass and Sauphanor, 1989; Nukenine, 2010); however, to date very little work has been conducted on the insect fauna of stored sorghum (Ratnadass et al.,

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1994; FAO, 1998). Thus, in 2009, an inventory of insect pests affecting stored sorghum in the South-Sudanian ecological zone within Burkina Faso led to the identification of nine species of Coleoptera and Lepidoptera in the storage facilities (Waongo et al., 2013).

The present article reports on the population structure of insect fauna infesting stored sorghum in the North-Sudanian ecological zone of Burkina Faso. The objectives were to: (1) determine the temporal variability and diversity of insect pest communities within on-farm stored sorghum (2) identify the effects of sorghum grain colour on the abundance and diversity of insect pest species and (3) determine the effects of various types of storage structures on insect pest fauna.

## 2. Methods

### 2.1. Study area

This study was conducted from January to September 2011 in Bazèga, Ganzourgou Boulkiemdé and Kourwéogo provinces, Burkina Faso, all located in the North-Sudanian ecological zone (Fig. 1). Burkina Faso experiences a unimodal rainfall pattern, with a rainy season lasting from June to October. The four provinces received 675 mm–700 mm of rainfall in 2011. During the sampling period, mean temperatures ranged from 24.6 °C to 34.1 °C across the study area while the average relative humidity varied from 25% (June and

October) to 76% (July to September; Fig. 2).

### 2.2. Sampling of villages and producers

Within each province, local agricultural services aided researchers in compiling a list of all villages with high sorghum production during the 2010 cropping season. Those villages were likely to have sufficient stocks of sorghum to cover the sampling period. From that list, five villages were randomly selected in each of the four provinces covered by the study. In each of these villages focus group discussions were carried out with sorghum farmers; this allowed the selection of three farmers in each village with the highest stocks of grain who all voluntarily participated in the study. A total of 20 villages and 60 granaries were selected for analysis in this study.

### 2.3. Storage of sorghum grain

Farmers usually harvest sorghum in late October in this part of Burkina Faso, and store it in granaries in November; consumption of the grain is expected to last until the next harvest. However, following poor growing seasons the stocks are often depleted before the following harvest. In the selected villages, sorghum was stored as panicles in two types of structures and our sample included both types: 20 mud granaries with straw roofs and 40 woven straw granaries. We identified two types of sorghum based

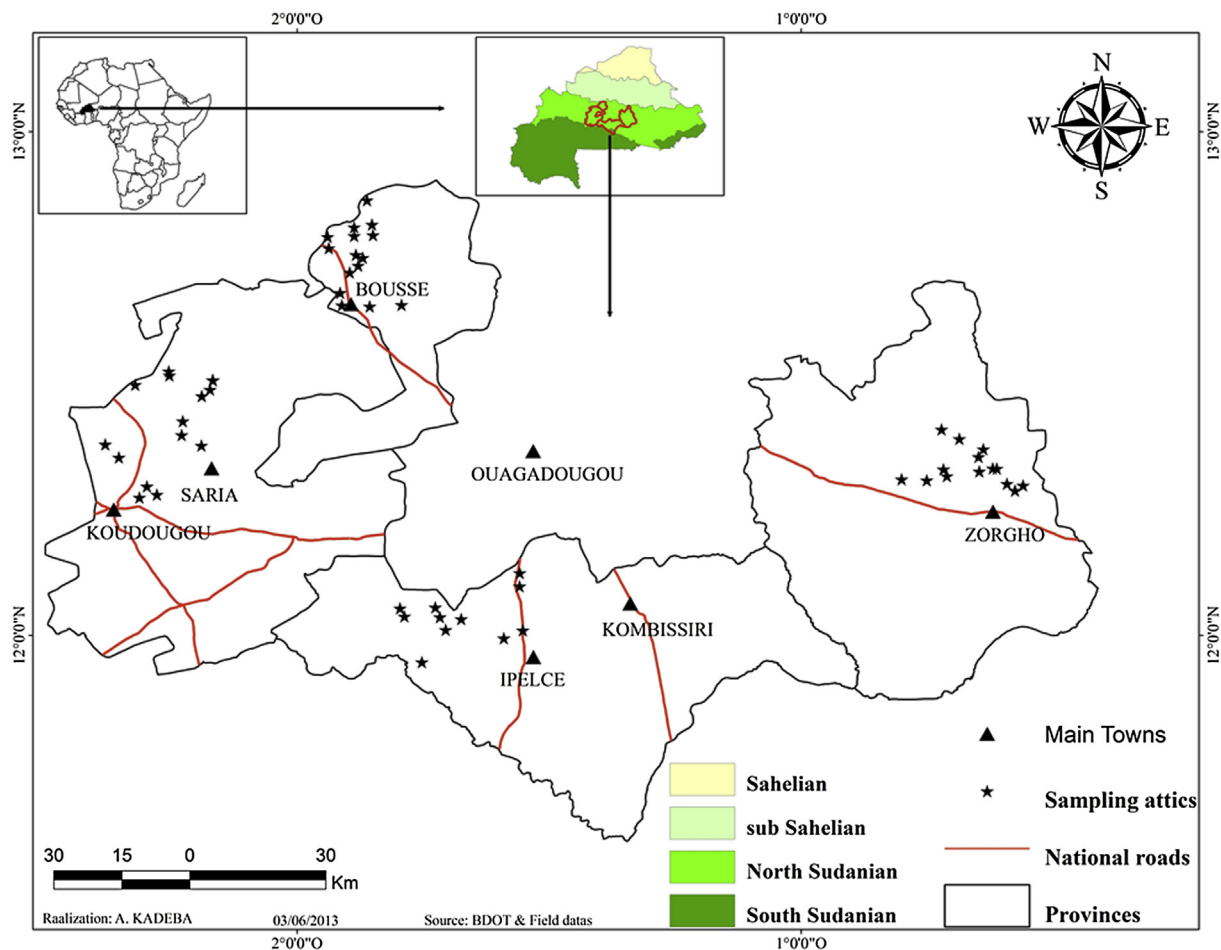


Fig. 1. Map of Burkina Faso showing the four provinces and locations.

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