



Short Communication

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Kersting's Groundnut [*Macrotyloma geocarpum* (Harms) Maréchal & Baudet] Crop Attracts More Field Pests and Diseases than Reported Before



Eric E Agoyi^{1*}, N'danikou Sognigbe², Médard Kafoutchoni¹, Mathieu Ayena^{3,4}, Frejus AK Sodedji¹, Symphorien Agbahoungba¹, Hospice S Sossou¹, Raymond Vodouhe² and Achille E Assogbadjo¹

¹Non timber forest products and orphan crops Unit & Laboratory of Applied Ecology, University of Abomey-Calavi, Benin

²Bioversity International, Benin

³West Africa Centre for Crop Improvement, University of Ghana, Republic of Ghana

⁴Association for the Development of Soybean in Benin, Republic of Benin

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***Corresponding author:** Eric E Agoyi, Non timber forest products and orphan crops Unit, Laboratory of Applied Ecology, Faculty of Agronomic Sciences, University of Abomey-Calavi, 01 BP 526 Tri postal, Cotonou, Benin

Abstract

It has long been reported that kersting's groundnut [*Macrotyloma geocarpum* (Harms) Maréchal & Baudet] is less susceptible to field pests and diseases. Previous reports focused on bruchids and weevils as the major pests exerting biotic stress on the crop. In the process of setting up a breeding program for the crop in Benin, field experiments were established in four research stations and mission trips organized to visit farmers' fields across the major kersting's groundnut growing areas of Benin. It was observed that the crop is attacked by many field pests and diseases. In total the crop is attacked by:

- i) Fungi: wilt disease, white mold disease, rust disease,
- ii) viruses,
- iii) invertebrates: aphids, grasshoppers, caterpillars, millipedes on pods, and
- iv) Vertebrates: birds, rodents and rabbits

This short communication aims to correct the perceptions of practically no field disease and pest attack so far reported on *Macrotyloma geocarpum*.

Keywords: *Macrotyloma geocarpum*; Wilt; White mold; Virus; Millipede; Aphids

Introduction

Kersting's groundnut [*Macrotyloma geocarpum* (Harms) Maréchal & Baudet] commonly known as "Doyiwé" in Benin, is the third subterranean (produces pods under-ground) legume crop after Peanut (*Arachis hypogaea*) and Bambara groundnut (*Vigna subterranean*) in the country. The species is a hardy and climate resilient crop which tolerates poor, sandy, and acidic soils, and thrives well in semi-arid zones with an average annual rainfall of 500-600mm [1]. It is endemic to West and Central Africa, with strong likelihood that Northern Togo and Central Benin be the center of origin [1]. As a multipurpose plant, kersting's groundnut grain is used for food, animal feed, and traditional medicine, the leaves and vines serve as animal feed as they are harvested in dry seasons and the leaves are used in traditional medicine. The

grain has high nutritional value and contains approximately 21.3% of proteins [2], many essential amino acids such as lysine and methionine [3] and vitamins [4]. Kersting's groundnut has been reported as one of the 30 economically important legume species grown in the tropics [5]. Highly appreciated in urban areas of Benin, the crop has a very high market value and is the most expensive grain legume in west Africa. Its price usually ranges from USD 3 to 5 per kilogram [6]. Recently, this price raised up to 6-7 USD per kilogram in November 2017 (Authors' personal observation). Kersting's groundnut is therefore an important source of income for stakeholders involved in its value chain in Benin. In addition to economic importance, nutritional values, and ability to tolerate drought, kersting's groundnut can fix

atmospheric nitrogen [7] and thus, contribute to improve soil fertility. With these attributes, kersting's groundnut is suitable for low inputs climate smart agriculture to improve food and nutrition security in low income countries.

Despite its nutritional value and palatability attributes, kersting's groundnut is reported as neglected and underutilized crop species in the region [8]. The crop is on the verge of extinction in many growing areas of the West African sub-region due to poor conservation and little research as observed in Benin [6], Burkina Faso [9], Ghana [10], Nigeria [11], and Togo [12]. The underlying reasons of the declining production of the crop include low yield (less than 500kg per hectare), small grain size, poor storage ability, high labour requirement [1], and non-availability of improved varieties [13].

It is folk knowledge that kersting's groundnut is less susceptible to field pests and diseases. This opinion is supported by several authors. For instance, Achigan Dako & Vodouhè [1] reported "In semi-arid regions Kersting's groundnut is not subject to serious attacks from diseases or pests. In more humid regions fungal diseases (rust, mold) may occur. Stored seed is very liable to infestation by weevils (*Piezotrachelus* spp.) and beetles (Bruchidae)". From a kersting's groundnut germplasm collecting mission in Northern Ghana, Adu-Gyamfi et al. [13] concluded that

"field insect pests and diseases were not generally constraints to production of the crop. Pests were, however, found to be a problem during storage". The same observations were made by Assogba et al. [6] in Benin. The authors stated "some pests and diseases were reported by producers, among these, the most important were viruses, early yellowing of leaves and petioles. Most farmers reported that these stresses had no great effect on the yield of this crop". In addition, Amujoyegbe et al. [11] assessing the causes of rapid disappearance of kersting's groundnut in south-western Nigeria did not report any pest and disease as driving factor of the declined production of the crop. Although Akohoue et al. [14] observed no use of pesticide by farmers, the authors pointed out that production constraints may include disease pressure such as plant wilting, stem and pods rot, and high susceptibility to beetles and recommend that effective pest and disease management strategies such as the development of resistant cultivars be envisaged.

This short communication is motivated by observations made in four field experiments and farmers' fields visits across the major Kersting's groundnut growing areas of Benin. The paper aims to inventory field pests and diseases and stress out the need to consider them as a major impediment to the production of Kersting's groundnut (*Macrotyloma geocarpum* (Harms) Maréchal & Baudet).

Material and Method

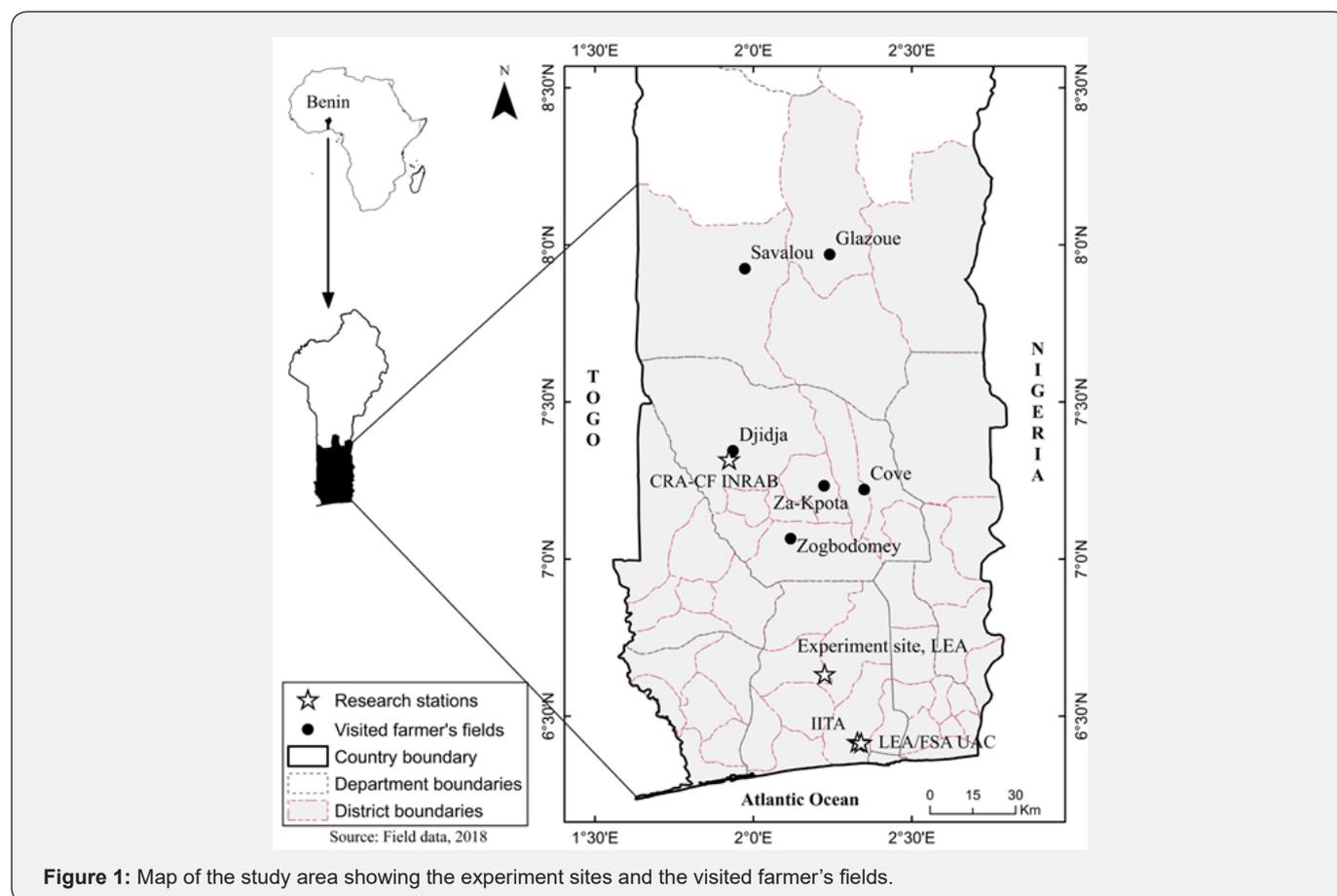


Figure 1: Map of the study area showing the experiment sites and the visited farmer's fields.

This paper used an observational approach to gather information on field pests and diseases attacks limiting kersting's groundnut production. Field experiments were established in four research stations and mission trips were organized to visit farmers' fields across the major kersting's groundnut growing areas of Benin. Namely:

- a. Seed multiplication experiments at IITA-Benin with 91 accessions.
- b. Seed increase experiment at the legume crop improvement site of the orphan crops Unit, Laboratory of Applied Ecology (LEA), University of Abomey-calavi (UAC) with 16 accessions.

c. Germplasm maintenance field set with 114 accessions at the varietal trial site of Sékou.

d. Germplasm characterization experiment at the Centre de production expérimentale de Djidja (CRA-CF, INRAB) with 81 accessions. Observations made in these experiments were supplemented with visits to farmers' fields in the major kersting's groundnut growing areas of Benin, including: Cové, Djidja, Glazoué, Savalou, Zakpota, and Zogbodomè (Figure 1).

Identification of causing agents was done for wilt disease. Following massive wilting of plants during the experiment in IITA, samples were taken, and analyses performed in laboratory to confirm the causing agent. For the other diseases putative agents were proposed based on symptoms.

Observations

Table 1: Field pests and diseases attacking kersting's groundnut [*Macrotyloma geocarpum* (Harms) Maréchal & Baudet].

No	Pest/Disease	Plant Part Attacked	Causing Agent	Illustration
1	Wilt Disease	Root and Entire Plant Die	<i>Pythium</i> spp	
2	White Mold	Leaves	<i>Oidium</i> spp (putative)	
3	Rust Disease	Leaves	To be Determined	
4	Virus	Leaves	To be Determined	
5	Millipede Attack	Pods	<i>Myriapoda</i> spp	
6	Grasshopper Attack	Leaves	<i>Locustra</i> spp	
7	Caterpillar Attack	Leaves	<i>Lepidoptera</i>	

8	Aphids	Stems and Vines	Aphididae	
9	Bird Attack	Dig up and cut or eat seeds after sowing	Various Bird Species	
10	Rodent Attack	Cutting off young plants after emergence and pod after harvesting	Various Rodents Species	

Four groups of attack were observed, covering ten field pests and diseases, as illustrated in Table 1.

These include:

- a. Fungi attacks: wilt disease, white mold disease, rust disease.
- b. Virus attacks.
- c. Invertebrates attacks: aphids, grasshoppers, caterpillars, millipedes on pods.
- d. Vertebrates attacks: birds, rodents and rabbits.
 - a. Wilt disease caused by *Pythium* sp: The plant begins to wilt from the roots and ends up dying. Wilt disease can decimate plant populations causing up to hundred percent loss on plot basis. This disease occurs during both vegetative and reproductive stages.
 - b. White mold appears on kersting's groundnut leaves mainly during reproductive stage, it may be caused by *Oidium* sp.
 - c. Rust disease appears on leaves which turn rusty. The causing agent of the kersting's groundnut rust disease is yet to be determined.
 - d. Virus disease: the leaves begins to shrink at pre-anthesis, the causing agent yet to be determined, however aphids (5) that gather around plant stems and vines at early plant growth stage could be the vector of viruses that cause the leaves to shrink.
 - e. Aphids, they gather around plant stems and vines at early plant growth stage. These aphids could feed on flower causing distortion, turn leaves yellow and stunt shoots, or produce sticky exudate that may favour the growth of mold fungus, aphids may also inject toxin into plants causing leaves to curl [15].
 - f. Kersting's groundnut leaves can be consumed by grasshoppers belonging to the *Locustra* genus.
 - g. Larvae of *Lepidoptera* species (Caterpillars) feed on the leaves of young plants, this attack was observed throughout

the life cycle of the plant.

- h. It was observed that immediately after sowing, birds can pick up and section the seeds, thus causing lower germination rate.
- i. Rodents cut young plants and consume fresh pods of newly harvested kersting's groundnut plants.
- j. Millipedes attacks were also observed (*Myriapoda* sp), creating holes in pods or causing pods rot, and subsequently significant yield loss if harvesting is delayed.

Conclusion and Recommendation

We showed that kersting's groundnut is susceptible to a wide range of field pests and diseases. Further investigations are needed to identify the causal agents of some of the damages and to assess the effects of pest's attacks on yield reduction and grains quality. Wilt disease seems to be the most harmful, as it causes systematic death of the plants and can cause hundred percent loss within the plant population on plot basis. It is recommended that investigations be done on these pests and diseases, especially the *Pythium* causing wilt disease. These investigations are necessary to precisely document their causing agents, evaluate their incidence and severity as well as yield loss incurred. Such investigations will enable better understanding of the reasons driving the crop out of production, so as to propose adequate solutions to the conservation of the plant resource and the development of the kersting's groundnut sector.

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