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Survey on termite prevalence and management strategies in eastern Uganda

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SUMMARY

Termites are among the most destructive maize pests worldwide. A significant amount of research has been conducted on termites in Uganda but information on the incidence of termites is rarely updated. However, termite incidence, and associated perceptions in different geographical areas is important for development of sustainable control strategies. Therefore, this study was conducted to ascertain the prevalence of termites in Eastern Uganda and the possible ways to control their damage to crops. Data was collected from 272 respondents using face to face interviews following a questionnaire in the nine districts of Pallisa, Mayuge, Manafwa, Bugiri, Butaleja, Sironko, Kapchorwa, Bukwo and Luuka. Results showed that termite prevalence was very high in all districts with some recording 100%. Termites belonging to Macrotermes spp. predominantly affected maize. Mixed responses were recorded on cropping system effect on termite infestation implying that respondents couldn't tell easily whether the cropping system reduced/increased termite attack. Percentage lodging due to termite attack was significantly higher (P=0.026) in late planted maize. The most dominant termite control strategy among the maize farmers was use of chemicals. Close to 50% of the respondents had never received any information on termites prevalence and management. Therefore, the study recommends more sensitization of farmers on management of termites with emphasis on cost effective and environmentally friendly management practices especially integrated termite control.

Keywords: *cropping systems; maize; prevalence; termites*

INTRODUCTION

Maize (*Zea mays* L.) is among the major crops cultivated globally for food and feed (Zagyi et al., 2024). In particular, maize is an essential food security crop for more than 70 million people in Sub Saharan Africa (Melinda et al., 2013). Accordingly, Uganda is the eighth leading producer of maize in Africa with total production of 3.8 million metric tons as of 2018 although with a low season yield of 1.8 MT ha^{-1} (UBOS, 2020). However, termites attack maize and other crops and cause significant damage (Sekamate and Okwakol, 2007) hence precipitating food insecurity (Hailu et al., 2020). Reports indicate that the severity of termites vary depending on so many factors (Jiregna and Tena, 2013; Bulto and Hirpa, 2016). Such factors include geographical location, management practices, and termite diversity. Ofgaa (2004) reported that termite diversity and geographical location of an area determines the level of damage, other factors constant. In Tanzania, predominant termites species that damaged maize belonged to *Macrotermes* spp, and in terms of field management, the use of bio-termiticides *Tephrosia vogelii* effectively protected maize from termite damage (James et al., 2020). In Benin, *Trinervitermes oeconomus, Amitermes evuncifer and Macrotermes subhyalinus* were the most destructive species of termites to eight crops with maize, yam (*Dioscorea* spp. and sorghum (*Sorghum bicolor* L.) being more susceptible (Loko et al., 2017). In Kenya, damage caused by termites on maize was related to the trial site, termite colony activities, fertilizer type and level, and stage of maize growth (Anyango et al., 2019). In Ethiopia, although farmers were aware of termites as pests, they could not differentiate types of termites. Also, 69% reported porcupines as the most vital pests followed by termites (*Macrotermes*) in their farming systems, and cultural methods including removal of lodged plants and prompt harvesting were used as management strategies (Debelo and Degaga, 2015).

In the context of Uganda, in Nakasongala district, the species of termites that damaged crops included *Nasutitermes arboreus, Macrotermes bellicosus, Macrotermes subhyalinus, Eutermes arborum and Pseudacanthotermes militaris.* Knowledge of termites damage by farmers was influenced by demographic characteristics especially their education, sex, and age (Orikiriza et al., 2012). Hailu et al. (2020) noted that termites prevalence and damage varies by crop type and growth stage, and by district with associated yield loss being 40% in maize followed by beans (*Phaseolus* spp.), soybeans (*Glycine max* L.), and sorghum Similarly, maize was the most damaged (97%) crop in Buikwe district (Kagezi et al., 2023). In terms of management, the common methods of termite control in Nakasongala district were removal of the queen and chemicals, albeit high costs being the principal limiting factor to access and purchase of chemicals (Orikiriza et al., 2012). In addition, another study revealed the push-pull technology, that is, maize intercrop with green leaf desmodium *(Desmodium intortum*) controlled the striga weed and lepidopteran pests, but was vulnerable to termite attack, yet use of chemicals was seen as

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expensive and temporal (Hailu et al., 2020). In Nigeria and Ghana, farmers view termites as pests and endeavour to control them using a wide array of methods such as using wood ash, shea butter residue combined with salt, pepper mixed with cow urine, chemicals and others (Akutse et al., 2011; Hassan and Disina, 2020). However, despite being pests, the importance of ecosystem services provided by termites is well documented (Sileshi et al., 2009; Hassan and Disina, 2020; Kagezi et al., 2023) such as decomposition, recycling of nutrients, and soil formation.

Based on the above overview, understanding field termite prevalence and farmers' perceptions and knowledge influences the nature of control to take. In fact, according to Loko et al. (2017), farmer sensitization and development of integrated termite control methods is recommended. Currently, there is no up-to-date data on the prevalence and diversity of termites in Eastern Uganda, yet the considerable amount of maize is produced in there. It is against this background that this study was undertaken to establish the prevalence, and the methods used for controlling termites in maize fields in Eastern Uganda.

MATERIALS AND METHODS

The study was conducted between the months of July and September 2017 in the lowland districts of Bugiri, Butaleja, Pallisa, Luuka, Manafwa, Sironko and Mayuge, and the highland districts of Bukwo and Kapchorwa during the maize growing season. Total of 272 farming households were interviewed, considering both small and large-scale maize farmers. The nine districts where the survey was conducted are among the leading producers of maize in eastern Uganda. Only households involved in maize cultivation at the time of the survey and the previous year were selected. A descriptive cross-sectional survey design was used following a three-stage cluster sampling technique to select the households, based on existing reports on the presence of termites in these districts. Purposive sampling was used to select only maize farmers. A questionnaire was used to collect information from farmers and agricultural extension officers. The tools were pretested to determine their reliability and validity. Some of the questions respondents were asked include: which cropping system do you use, what major maize production constraints did you observe this season, which are the most prevalent pests affecting maize production, what are the symptoms of termite damage and at what stage is the termite attack more prevalent, when do you plant maize and what is the level of damage/lodging, what mitigation measure did you use to counteract the effect of termites, if you used chemicals to spray against termites, what was the application rate of the chemical and how many times did you spray with that particular chemical, have you got any information on termites, their effects and mitigation measures? If yes, what was the source of the information. After interaction with respondents, the process was followed by physical visit to the field to assess the prevalence or symptoms of damage by termites. In the process, information on the total number of plants planted and total number of plants lodged due to termites was assessed, and the percentage lodging calculated. In addition, termites' samples were collected and put in bottles containing alcohol and taken to the laboratory for taxonomic identification by morphological means. Data was coded and analysed using SPSS (Version 20). Descriptive statistics like frequencies were used to summarise termite infestation and cropping systems, symptoms of termite damage, and control methods. Accordingly, chi-squared tests were used to test the relationship between practices like planting and termite's infestation level.

RESULTS AND DISCUSSION

Termite infestation was the most prevalent and the second most prominent pest reported (39%) was the fall armyworm (FAW) (*Figure 1*). The highland areas of Kapchorwa and Bukwo districts reported higher termite incidences compared to the lowland areas (*Figure 2*). The most dominant termite species observed in the field was *Macrotermes bellcosus* (*Figure 3*). Though farmers in eastern Uganda practice both mixed and mono-cropping, mixed responses were given on the level of termites infestation by cropping system but with slightly more districts reporting more termites under monocropping than under mixed cropping (*Table 1*).

Figure 1. **Overall farmers' response on insect pest occurrence in the surveyed districts**

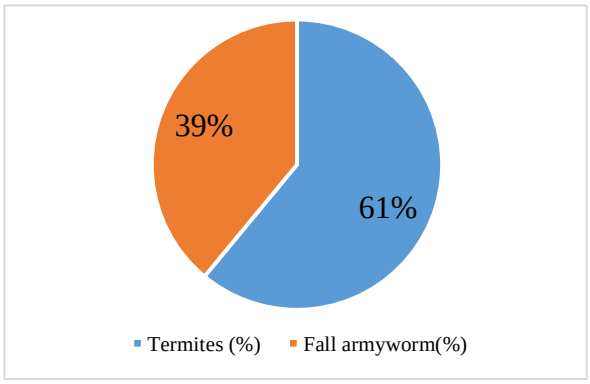

Figure 2. **Termite incidence in selected districts**

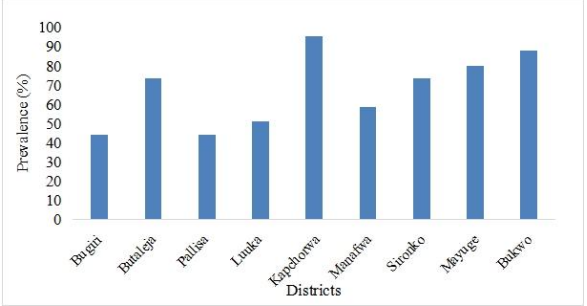

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Figure 3. **Dominant species of termite in the surveyed area**

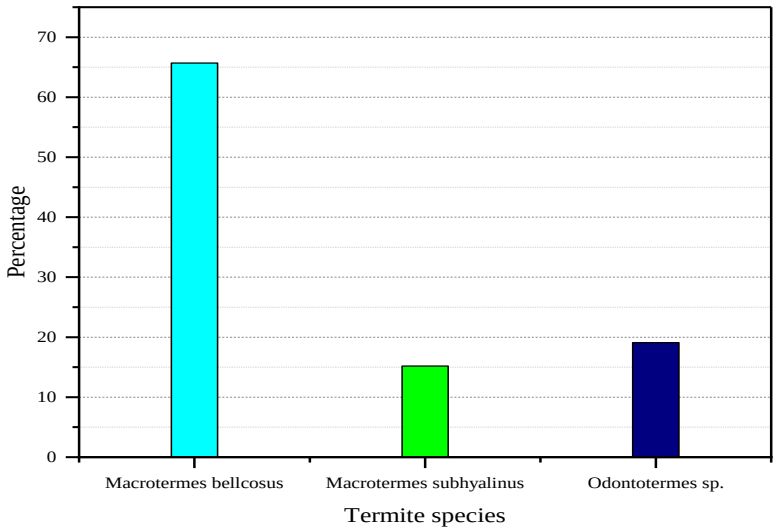
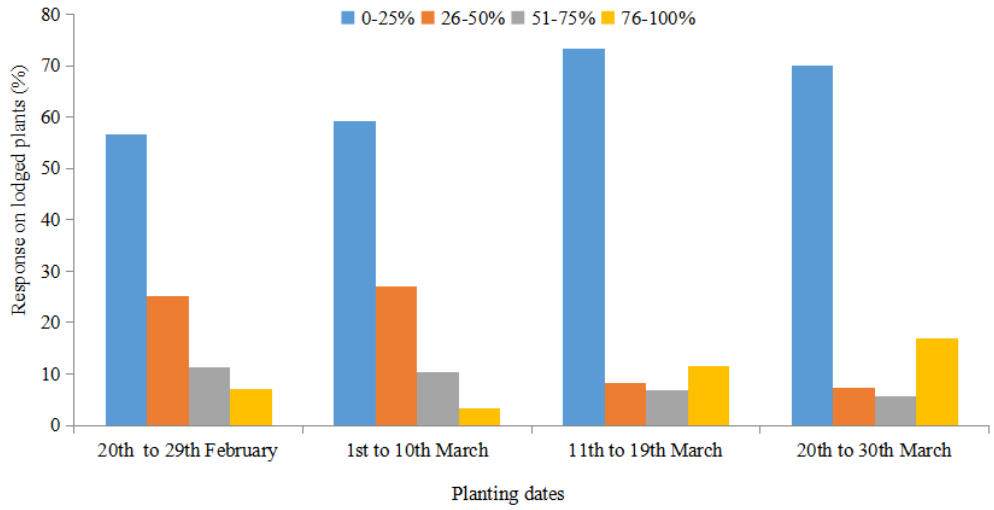


Table 1. **Farmers' response on level of termite infestation by farming system**

District	Monocropping	Mixed Cropping	Total
Bugiri	53.3	46.7	100
Butaleja	42.9	57.1	100
Pallisa	60.0	40.0	100
Luuka	46.7	53.3	100
Kapchorwa	50.0	50.0	100
Manafwa	13.3	86.7	100
Sironko	31.2	68.8	100
Mayuge	60.0	40.0	100
Bukwo	53.3	46.7	100

Relating termite infestation to planting date, planting date had a significant effect (χ^2 = 23.246, V = 0.219, df=8, P=0.026) on percentage lodging due to termite attack. Generally, respondents reported lodging to be low in early planting as opposed to late planting. For example, lodging of 0–25% was slightly higher between 11th–30 March planting time and low in between 20th February to 10th March. Similarly, the lodging rate of 76–100% was low in early planting (20th February to 10th March) but became slightly higher in late planting (20th to 30 March) (*Figure 4*).

Figure 4. **Farmers' response on planting date and percentage lodging due to termite attack**



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In terms of Termite infestation signs and control as shown in *Table 2*, the most observable sign of termites that majority (21.3%) of the farmers noted was lodging of the plant, while some farmers (14%) also observed termites moving in their fields. Most farmers (33%) reported using chemicals as the most effective method of controlling termites compared to cultural (3.7%) and mechanical methods (1.5%). In fact, majority (25.7%) of the farmers that use chemicals to control termites relied on rocket insecticide to spray their crops while Super-cyper insecticide was the least (0.7%) used by farmers. Most of the farmers (14%) that used chemicals sprayed their crops only twice during the season. Additionally, majority of the respondents were not sure of which chemical and its rate was effective for control of termites though a small proportion (13.2%) reported Ambush to be an effective chemical (*Table 3*). Overall, in terms of access to termite control information, majority (45.6%) of the farmers had no prior information on termites, their effects, and mitigation measures. Other than the neighbours and friends who contributed 11% as major sources of information, most information on termite management as reported by 45.6% of respondents is obtained from quite scattered sources categorised as 'others' herein, such as agro-input dealers, maize middlemen, farmer's own knowledge and occasionally, agriculture extension officers (*Table 4*).

Table 2. **Termite infestation symptoms and control**

Symptoms	Frequency (%)
Wilting and drying of the maize plant	11.1
Trails of soils on the maize plant	13.2
Lodging due to termite attack	21.3
Termites are seen moving	14.0
Others	40.4
Total	100
Spraying with chemicals	33.1
None	18.3
Cultural methods	3.7
Manual or mechanical methods	1.5
Others	43.4
Total	100

Results from this survey show that there is high prevalence of termites, and *Macrotermes subhyalinus was* the most dominant species eastern Uganda. The dominance of *Macrotermes subhyalinus* in farmers' fields was probably because of the nature of vegetation and soil that allowed them to make mounds easily. This compares with Apori et al. (2020) who reported that Uganda, *Macrotermes subhyalinus and Macrotermes bellicosus* were among the dominant specie of termites inhabiting arable land in Uganda. Overall, uncertainty of farmers in the methods of controlling termites and mono-cropping were perceived as the major cause of overall prevalence of all the three termite species. Besides, even the chemicals used to control these termites seemed not very effective. However, from a general perspective, respondents have limited knowledge on management of termites as most of them acknowledged doing nothing to repel the termites. Yet, earlier, the significance of the knowledge of farmers was emphasized in aiding the development and implementation of suitable termite control remedies (Loko et al., 2019). Accordingly, Obi et al. (2008) in Nigeria also found that maize was the most affected crop by termites followed by other crops including cassava (*Manihot esculenta*). This could be due to the palatability and nature of maize compared to all the other crops.

Table 3. **The of use chemical method in termite control**

Chemical used	Frequency (%)
Rocket	25.7
Ambush	6.6
Super-cyper	0.8
No chemical used	66.9
Total	100
Application time	
Once	11.0
Twice	14.0
Thrice	8.1
No application	66.9
Total	100
Effectiveness rating	
Excellently	1.5
Good	11.0
Fair	14.0
It did not work at all	6.6
Not sure	66.9
Total	100
Specific chemical effectiveness	
Rocket	5.1
Ambush	13.2
Super cyper	8.8
Other	0.7
Not sure	72.1
Total	100

Table 4. **Information on termite management**

Reception of information	Frequency (%)
No	45.6
Yes	11.1
Undecided	43.3
Total	100
Source of information	
Media	2.2
Neighbours and friends	11.8
Others	45.6
Not sure	40.4
Total	100.0

Generally, the uncertainty in utilization of chemicals amounted to high termite prevalence in the eastern districts. It became clear that there was an information gap on termites amongst farmers with many of them acquiring information from neighbors,

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friends and middlemen that tend to be unreliable. Currently, control of termite in East Africa depends on primarily on the use of chemicals (Logan et al., 1990). Sekamatte and Okwakol (2007) reported that effectiveness of termite chemical control methods depends on the knowledge of farmers in applying them say dosage, application regime and timing. However, the chemicals used have significant effects on the ecosystem functioning. It is essential to appreciate that termites are both beneficial and destructive to the ecosystems. Hence, maintaining termite provisioning and functionality ecosystem services is possible by using sustainable integrated means (Sileshi et al., 2009; Mugerwa et al., 2014). It is therefore, imperative to understand the explicit structure of termite assemblages in the maize growing areas in order to develop sustainable control measures. In additional incorporating farmers knowledge on the perceived effects and consequently management of termites becomes indispensable in holistic management of termites.

CONCLUSIONS

The study showed a perceived high prevalence of termites on maize in eastern Uganda, with districts of Bugiri, Butaleja, Sironko and Mayuge registering over 70% prevalence. The dominant termite species was *Macrotermes bellcosus.* Some farming practices like late planting and mono-cropping significantly increased the infestation of termites in the field, and limited knowledge by farmers caused high incidences of termites. More sensitization is required to increase farmers' awareness on factors that increase termite prevalence and associated management methods including integrated control methods. Also, farmers need to plant maize early in the season to avoid high infestations and damaged maize by termites.

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