Farmer perceptions on the effects of termites in Kwa Vonza Location, Kitui County, Kenya

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ABSTRACT

Aims: This study aimed to assess (i) the perception of Kwa Vonza farmers regarding the presence of termites in their land, (ii) the perceived importance of termites,and (iii) how they control termites in their properties.

Study design: This study is based on responses to a questionnaire sent to farmers.

Place and Duration of Study: The study took place in Kwa Vonza Location, Yatta Sub County, Kitui County, Kenya, between April and November 2017.

Methodology: 60 questionnaires, each comprising 20 multiple-choice questions, were sent out to farmers. Out of these, 54 responses were received. Where the response did not require a Yes or No answer, it elicited a response from a standardized five-point scale to demonstrate agreement withthe provided proposition.Data analysis was done using descriptive statistics, in which percentages were tabulated, and frequency tables were generated using Microsoft Excel.

Results:73% of farmers perceived their land as infertile, with the causes ranging from soil erosion, drought, and mono-cropping. 87% of farmers acknowledged termite infestation in their farms but perceived them as destructive. Termite infestation was attributed to deforestation, drought, and flooding. Chemical control was the method of choice to manage termites.

Conclusion: Kwa Vonza farmers do not perceive termites as of any agronomic significance but view them as destructive agents. Further research to address the complex issue of soil management at the farm-scale level that involves farmers is necessary to fill gaps in scientific knowledge and produce advice for practical use.

Keywords: termites; soil fertility; tropical ecosystems; soil biodiversity; farmer perceptions

1. INTRODUCTION

Termites (*Isoptera*) are an order of insects consisting of 2,500 species, out of which 300 are considered pests (Ndiaye et al., 2004). Depending on their family or subfamily, they build their nests underground, in wood or termite mounds (Heyde et al., 2021). Because termites display a high sensitivity to the biotic and abiotic environmental conditions they are exposed to, they can play a key role in tropical ecosystems (Jouquet et al., 2016) just like earthworms do in temperate ecosystems (Manono &Moller, 2015). These soil organisms play important roles in linking abiotic and biotic components of the soil ecosystem by supplying ‘soil services’ such as nutrient cycling, decomposition, and plant growth (Apori et al., 2020; Jouquet et al., 2016; Manono, 2016a).

Large amounts of essential nutrients in the soil are bound in organic form (Khasabulli et al., 2023; Manono, 2014). For these nutrients to be released and made available for plant absorption, they must undergo decomposition and mineralization (Marzi et al., 2021; Manono et al., 2019). Through their feeding and burrowingactivities, termites and earthworms directly influence the breaking down, mixing, and transportation of organic matter and mineral nutrients. They create macrospores that enhance infiltration, water storage, and air regulation while providing channels for root growth and penetration (Manono, 2019; Jouquet et al., 2016). On the negative side, they both contribute to the emissions of greenhouse gases (Quevedo et al., 2021; Manono, 2016b).

Despite playing these important roles, termites are one of the most damaging pests in the tropics and can cause considerable problems in agriculture (Kagezi et al., 2023; Govorushko, 2019). They feed on dead organic matter, but when not available, they will eat live plant material, including crops. In arid and semi-arid lands, termites build underground nests and collect live green plant material such as living grass, crops, seedlings, and weak wilting plants (Lopez-Hernandez, 2023; Lepage et al., 1993). Because of the beneficial roles these organisms play in agroecosystems, they should be carefully managed, considering their benefits against the rate of loss to the ecosystem (Manono, 2016c; Nyeko &Olubayo, 2005).

Individual farmers are the stewards and decision-makers about what happens on their land (Kalovoto et al., 2020; Manono, 2016c; Sileshi et al., 2008). It, therefore, follows that sustaining agricultural productivity depends on maintaining and enhancing the abundance and functional activities of these soil organisms (Manono, 2016c; Sileshi et al., 2008). Farmers could benefit from more quantitative evidence of their perception and knowledge ofthese organisms and their activities in soil fertility and crop production (Manono, 2016c). For example, improved farmer understanding of the importance of these organisms could enable the development of suitable decision support tools that emphasize their management in contributing to agricultural sustainability. This is particularly important in systems that are susceptible to changing land use and management pressures associated with persistent drought, like the Kwa-Vonza location in Kitui County, Kenya. It is with this background that this study explores how small-scale farmers in Kwa-Vonza perceive termites in relation to soil fertility and crop production. Thus, this study aimed to assess (i) the perception of Kwa Vonza farmers regarding the presence of termites in their land, (ii) the perceived importance of termites, and (iii) how they control termites in their properties.

2. MATERIAL AND METHODS

2.1 Study area

This study is based on responses to a questionnaire sent to farmers in Kwa Vonza Location, Yatta Sub County, Kitui County, Kenya, between April and November 2017. The coordinates of the study area are 44°38′ to 44°54′ S and 170°59′ to 171°08′ E. Kwa Vonza is located at 130 Kilometers South East of Nairobi on the Machakos – Kitui road. It is part of the Yatta Plateau, which stretches from the north to the south of the county and lies between Rivers Athi and Tiva. The area experiences a semi-arid climate with very erratic and unreliable rainfall. Annual temperatures range between a minimum of 14 to 22° centigrade and a maximum of 26 to 34° centigrade. There are two rainfall seasons: long rains between March and May and short rains between October and December. The area's soils are low in fertility and range from sedimentary rocks, red sandy soils, to clay black cotton soils.

2.2 Farmer recruitment and analysis.

Respondents were farmers in Kwa Vonza Location with over threeyears of farming experience. The questionnaire comprised 20 multiple-choice questions designed after trials to take no longer than 25 min to complete. Where the response did not require a Yes or No answer, it elicited a response from a standardized five-point scale to demonstrate agreement withthe provided proposition. A blank space was left after each question so that respondents could give an open-ended response or clarification. Participating farmers were given informed written consents, had their anonymity guaranteed, and were reminded that they did not have to participate and that they could stop participation at any stage or refuse to answer certain questions. Sixty questionnaires were sent, out of which 54 responses were received. Some respondents did not answer every question. Therefore, the percentages reported in the analysis are for individual questions. Data analysis was done using descriptive statistics, in which percentages were tabulated, and frequency tables were generated using Microsoft Excel.

3. RESULTS AND DISCUSSION

3.1 Farmer's perception of their land's fertility

Farmers perceive their land's fertility differently, with a majority saying theirs is neither fertile nor infertile, followed by those saying theirs is infertile (Figure 1). The two categories combined comprised 73% of the respondents. When asked what they perceive to be the cause of the infertility, the farmers gave a mix of results, ranging from soil erosion, drought, and mono-cropping (Figure 2). This observation was consistentwith (Okoba&De Graaff, 2005). Although the majority of farmers perceived termites to be destructive (Figure 4), only 14% of the farmers attributed soil infertility to termites (Figure 2). This was so even when a greater percentage (87.5%) of the farmers acknowledged termite infestation in their lands, with a majority of these farmers, comprising 65%, not attributing termites to any soil benefits (Figure 3).

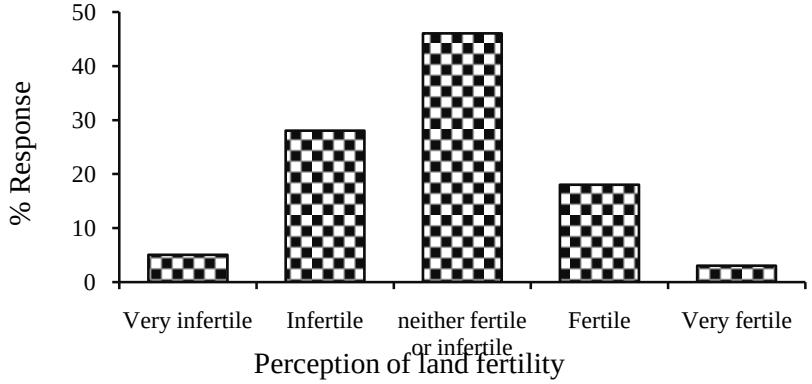

Fig.1. Farmers'perception ofsoil fertility.

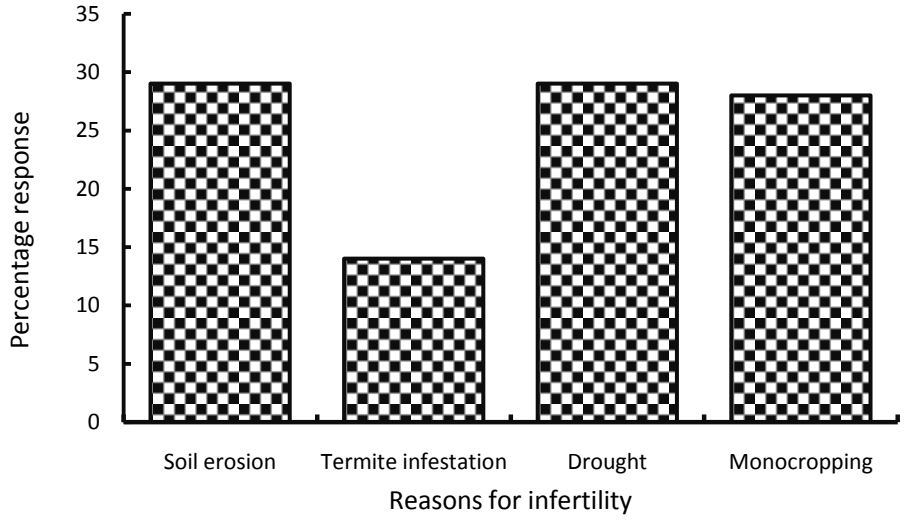

Fig. 2. The reasons for soil infertility.

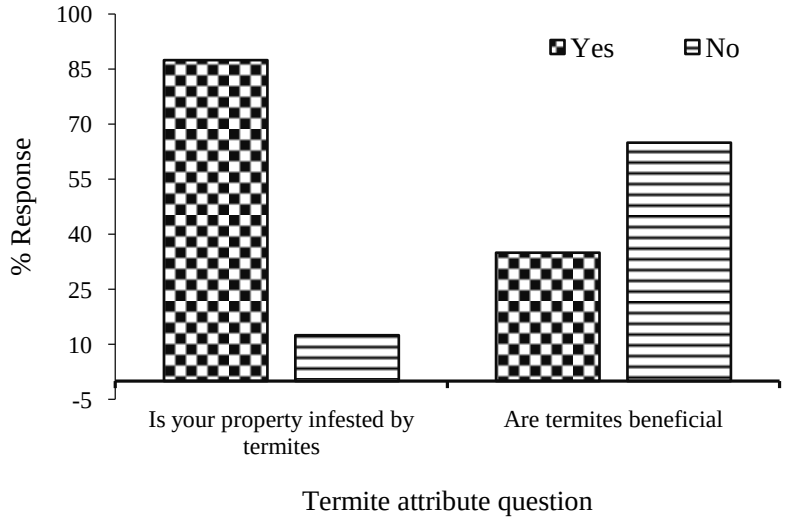

Fig. 3. Termite infestation in the farms and perception of benefit.

3.2 Effect of termite infestation in farms.

The majority of farmers, comprising 40%, associated termites with crop destruction, while 33% associated their presence with lower yields (Figure 4). A further 16% associated termites with house destruction. Only 5% of the farmers perceived termites as playing a role in enhancing soil fertility (Figure 4). From this perspective, it would be noted that a majority of farmers, comprising 89% of respondents, perceived termites as destructive, consistent with other studies (Govorushko, 2019; Lepage et al., 1993). It should be noted that the arguments put forward by scientists on the beneficial roles of termitesas a result of their bioturbation activities lead to the breaking up of surface crusts, reducing soil compaction, increasing soil porosity, improving water infiltration and enhancing water holding capacity. Litter degradation (Jouquet et al., 2016) may be invisible to farmers and, therefore, are not able to recognize these roles and associate them with termites.

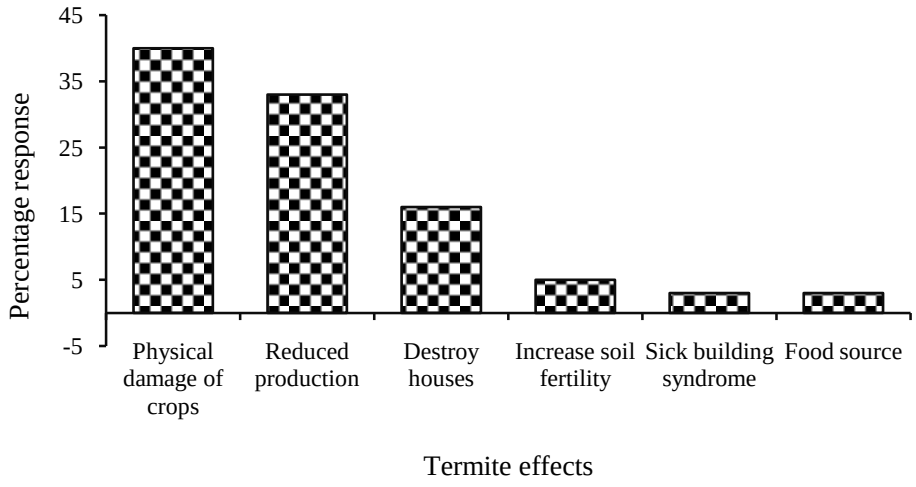

Fig. 4. Effects of termite infestation in the farms.

3.3 Causes of termite infestation

A majority comprising 72% of respondents, attributed termite infestation to three factors, viz, deforestation, drought, and flooding (Figure 5). Out of these, deforestation and drought,they accounted for 52%. Only 2% of respondents considered termites to be food, a contradiction to the majority who consider termites as food in western Kenya (Kinyuru et al., 2013). Kwa-Vonzais a drought-prone area; when it rains, it causes flooding in the termite mounds. This forces them out of their mounds to avoid drowning, just like earthworms do (Manono, 2014). In such circumstances, people are able to see them easily. However, during droughts and deforestation, termites tend to be all over the place (Charles et al., 2021).

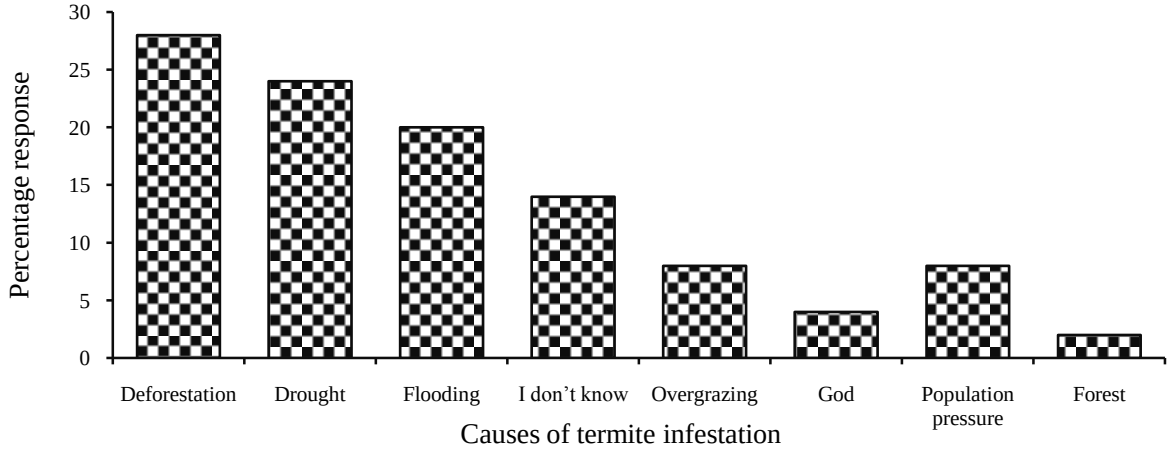

Fig. 5. Causes of termite infestation.

3.4Strategies forcontrolling termites

Because farmers perceived termites to be destructive, it was prudent to enquire how they controlled them. The majority of the respondents, comprising 45%, controlled termites with chemicals, while 26% physically destroyed termite mounds to remove the queen (Figure 6). Chemical control is used as a termite control strategy in many places (Ahmad et al., 2021;

Ejomah et al., 2020). Another 22% used wood ash from their kitchen. This method has been reported to be used in other studies (Oliver-Villanueva et al., 2013).

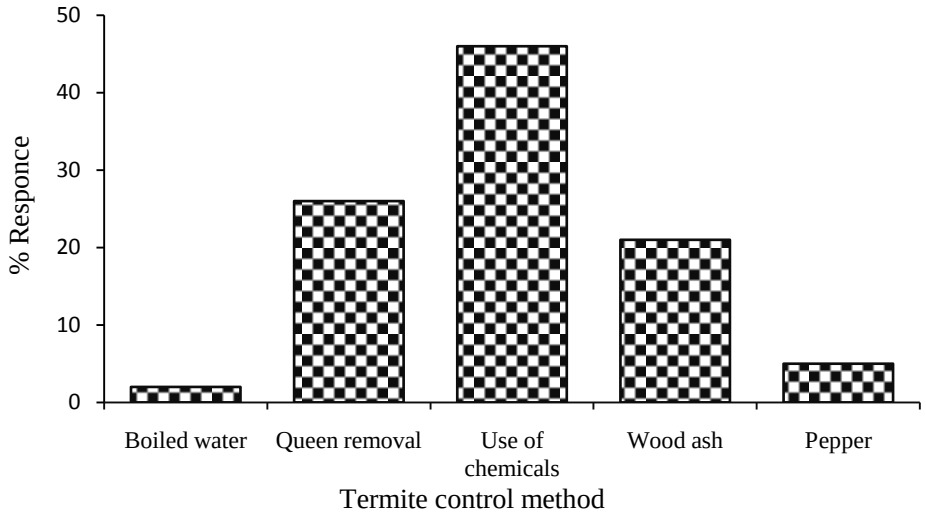

Fig. 6. Methods used to control termites.

3.4Methodological constraints

Caution should be taken when interpreting the outcome of this study because of the small sample size and homogeneous characteristics of the farmer respondents. Nevertheless, 90% of farmers contacted responded to questionnaires, and this should be considered a model study that should be expanded to other regions.

4. CONCLUSION

This study revealed that farmers in Kwa Vonza do not perceive termites as of any agronomic significance but view them as destructive agents. This calls for further social science research to address the complex issue of soil management at the farm-scale level. Farmer involvement may help prioritize options for filling gaps in scientific knowledge and producing advice for practical use.

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Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

AUTHORS' CONTRIBUTIONS

The authors contributed equally to the design, data collection, analysis, and writing of this article. All authors read and approved the final manuscript.

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