

Assessing the Existence Spread and Control Strategies of Parasitic Weed (*Cassytha Filiformis*) on Cashew Trees in Tanzania

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Abstract—Cashew production and productivity has been constrained by biotic and abiotic factors which resulted in a large loss of revenue for both growers and the government. Currently a parasitic weed known as *Cassytha filiformis* also seems to be of economic importance in reducing cashew yields. Due to this importance from 2006/7 season, Naliendele Agricultural Research Institute (NARI) conducted a field survey to assess the existence, spread and control strategies used by farmers and this was followed by research trials in order to address the problem. A total of 350 cashew farmers from major cashew growing areas were interviewed. The survey findings revealed that the parasitic weed was prevalent in most cashew farms particularly to those villages along the coast. Existence of dodder weed was high to those villages located close to the sea compared to those which are far away from the sea. Also the preliminary research findings to date revealed that there is no biological or chemical control for the parasitic weed rather than physical or farm management practices. Correspondingly, several efforts have been done by NARI on awareness creation and also control strategies.

Index Terms—spread, *Cassytha filiformis*, control strategies, cashew

I. INTRODUCTION

Cashew (*Anacardium occidentale* Linn) is the main cash crop in Tanzania. It is the most important export crop in terms of foreign exchange earnings and also it provides employment to several enterprises involved in its processing [1]. The major cashew growing areas in Tanzania are mainly Mtwara and Lindi regions and Tunduru district which produce over 70 percent of the produce, and also Coast and Tanga regions of which all these regions are situated along the coast except Tunduru district [2]. Other non traditional cashew growing areas include Dodoma, Iringa, Mbeya, Singida, Morogoro, Mbalali, Mbinga, Namtumbo and Suluti in Ruvuma region [3].

Cashew production and productivity has been constrained by biotic factors as insect pests and diseases which result in large loss of revenue for both growers and government ([4], [5]). Likewise, recently dodder (*Casytha filiformis*) was cited to be of economic

importance in reducing cashew yields in Tanzania. It might cause yield loss of up to 100 percent if not well managed.

Dodder (*Cassytha filiformis* L.) is a parasitic flowering plant classified in group of angiosperm. It is an obligatory parasitic weed which attacks the host plant by penetrating into the phloem and xylem tissues to obtain water and nutrients without necessarily killing the host plant [6]. This is achieved using structure-like hooks (haustoria) that serve both as mechanical support and roots for obtaining nutrients from host plant. This weed lacks chlorophyll and hence unable to manufacture its own food [7]. Nevertheless, during juvenile stage it exhibit autotrophic mode of nutrition whereby a young slender parasitic seedling is nourished from food reserved in the endosperm which is sufficient for a period of not more than 14 days [8]. The weed is also characterized by hemiparasitic mode of nutrition at maturity stage which is achieved immediately after the young slender seedling is fully established to the host plant. After 14 days this germination part dies leaving no traces behind [6].

A mature tree produces millions of seeds which are enclosed in a capsule. When dry they are shed down and spread on the soil surface to form a seed bank and germinate only when conditions are favourable. The seeds have a dormancy period of more than 10 years [9]. It propagates both through seed and vegetative. Dispersal mechanisms include; water, wind, birds, animals and agricultural equipment and machines working in areas infested with the weed. Additionally, human activities through use of forest soil already infested with dodder seeds during nursery establishment, use of fire wood from infested trees and use of animal droppings (farm yard manure) infested with dodder seeds have also been reported to facilitate their dispersal of the weed to non-infested areas to begin new colonization ([8], [7]).

In Tanzania, *C. filiformis* has been found to parasitize a wide range of hosts such as cashew, mangoes, neem tree, citrus, shrubs, herbaceous succulents and a variety of grasses (Fig. 1).

From 2006/07 NARI started receiving complain from cashew farmers on the presence and effect of dodder to cashew trees and hence the need for immediate solutions. This was due to the fact that farmers' knowledge on spread and mode of attack of *C. filiformis* was very

limited and centered on traditional values and belief. Poor understanding of the ecology and life cycle of dodder was also among the limitations for control of the weed by farmers and extension officers. Due to the importance of this parasitic weed, in 2006/08 seasons NARI started conducting research on this weed particularly on existence, cause, spread, effect and mitigation strategies.

The main objectives of research were to study the existence, cause, spread and effect of dodder weed on cashew orchards in major cashew growing areas of Tanzania; to study farmers' knowledge on dodder weed and their management practices and also to suggest possible mitigation strategies for the control of dodder weed in cashew orchards.

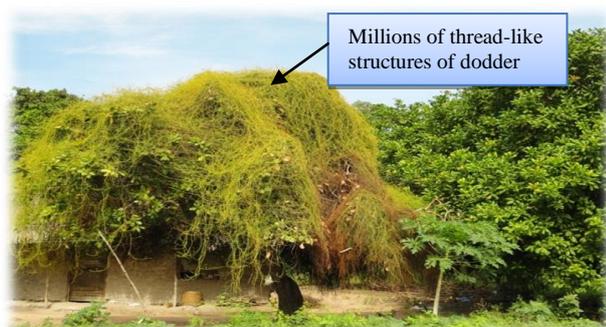


Figure 1. High infestation of dodder weed on cashew plant hinders flowering and fruit setting phenology which greatly affects yield and hence economic gains.

Photo Courtesy Louis Kasuga.

II. METHODOLOGY OF THE STUDY

The survey was conducted to major cashew growing areas in Tanzania namely Mtwara and Coastal regions. Coast region lies on the eastern part of Tanzania mainland along the Indian Ocean coastal belt. It is located between latitude 6° and 8° south of equator and between longitudes $37^{\circ} 30'$ and 40° east of Greenwich meridian. According to the 2012 National census; the region has a population of 1,098,668 people. The region has a typical coastal climate with a mean temperature of 28°C . The rainfall patterns ranges from 800 mm to 1000mm per annum (Pwani region socio-economic profile). In Coast region two districts were selected mainly Mkuranga and Bagamoyo (Fig. 1). The surveyed villages were Mwarusembe, Kimanzichana, Kaskazini, Kiparang'anda, Dundani, Lukanga and Njopeka (Mkuranga district) and Zinga, Msinune, Fukayosi, Matimbwa, Yombo, and Chasimba (Bagamoyo district). These villages were selected in collaboration with DAICO's office. At village level farmers were selected basing on the presence of dodder weed in his/her cashew farm in collaboration with village secretary and ten cell leaders. A total of 246 farmers were interviewed with an average of 18 farmers per village.

Mtwara region lies between longitudes 38 and 40 East of Greenwich and between 10 and 11 latitudes south of the equator. According to the 2012 census, it has a population of 1,270,854 people. The region is comprised by six districts namely Masasi, Nanyumbu, Mtwara

Urban, Mtwara Rural, Newala and Tandahimba. The means maximum temperature is 30.5°C and minimum is 21.7°C . The pattern of rainfall is single peaked unimodal but often interrupted by dry spell in February. The average rainfall varies between 810-1090mm [10]. In this region Mtwara district was selected for the survey (Fig. 2). The surveyed villages were Mtendachi, Msakala, Mngoji, Nalingu and Tangazo. A total of 117 farmers were interviewed with an average of 23 farmers per village. Actual observation of the cashew field and structured questionnaire was used to collect information from respondents. Data were analysed using Statistical Package for Social Science (SPSS).

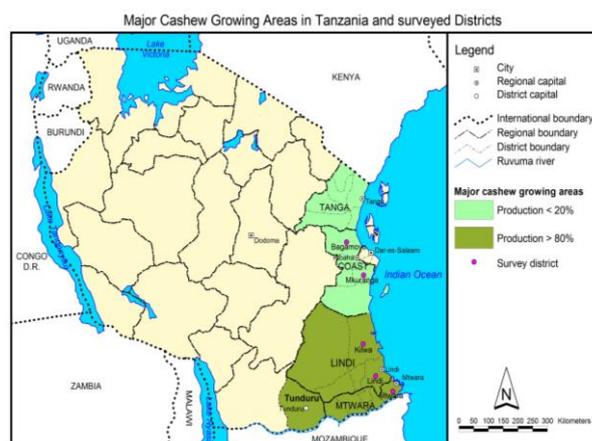


Figure 2. Map of Tanzania showing major cashew growing area and surveyed districts

Efforts to identify the weed mainly scientific name, taxonomy and its ecology were done by NARI in collaboration with the botany department of the University of Dar-es-salaam. After the field survey, on-station and on farm trials were also set to establish management and control strategies of the weed.

III. RESULTS AND DISCUSSION

A. Socio-Economic Characteristics of the Respondents

In this study 70 percent of the respondents were male and the rest were female. Also among these respondents about 48 percent had primary level of education, 35 percent had no formal education, 7 percent were standard four and adult education and about 3 percent had ordinary level of secondary education. The findings revealed that dodder weed was not new to almost all the respondents. However, the weed was locally known as *lututukanga* (70%), *utetekanga* (38%), *mlangamia* (4%) and *mdengelo* (>50%) this particularly in Mtwara region.

B. Existence, Spread and Incidence of Dodder Weed to Major Cashew Growing Areas

The findings revealed that dodder weed existed in all surveyed villages in Mtwara and Coast regions, although the severity of dodder varied between the regions, villages and distance from the shore. The severity of dodder was relatively higher in the Coast region compared to Mtwara region. This was attributed to

different levels of management practices such as weeding, pruning, thinning, ploughing and intercropping. It has been noted that, attack of dodder is higher in neglected and abandoned cashew farms than farms that are well managed. Appropriate management practices are rarely done in the Coast region compared to Mtwara region. This is due to the fact that in Mtwara region farmers has limited alternative cash crops mainly sesame, pigeon peas and groundnuts and these crops perform better to few selected agro-ecological zones, hence farmers invest more in cashew farms particularly in those cashew based farming systems. Also more cashew research works has been done in this region compared to the Coast region. In the Coast region dodder was prevalent in most cashew farms (75%) in all villages surveyed (Mwarusembe, Kaparang'anda, Dundani, Lukanga and Njopeka) in Mkuranga district and villages (Chasimba, Matimbwa) in Bagamoyo district. Except Kimanzichana in Mkuranga and Zinga, Yombo, Msinune, and Fukayosi which it occurred in some farms (25%) only. In Mtwara region dodder existed in 10 percent of all farms surveyed in the district, although the severity was relatively higher in Kilwa district.

Also the findings revealed that, the incidence of dodder weed on cashew trees was relatively high along the coastal belt and few distances from the seashore compared to inland areas. This was probably due to differences in the agro ecologies of these areas particularly on temperatures, humidity, rainfall and soils type. The incidence was observed to different villages like Dundani, Njopeka, Mwarusembe and Kimanzichana in Mkuranga district and Zinga and Matimbwa in Bagamoyo district and Kilwa than those far inland.

C. Farmers' Knowledge on Dodder and Their Control Strategies

Based on the survey findings, it was found that, majority (82%) of the respondents were less knowledgeable about the sources of the weed. However, explanation given by different farmers on the weed existence, propagation, survival and dispersal was variable with some similarities on certain issues. Nevertheless, in many cases the weed has been associated with some traditional believes for the cure of certain human health problems, hence some of the respondents (30%) reported to maintain some few trees which have been attacked by dodder weed particularly those close to their home steady purposely in case of health problem they can use the dodder weed as medicine. Others reported it as a weed and they tried to control without success. Various control strategies were used by the respondents, majority (55%) of the respondents in Coast region were pooling down the climbing weed (thread like structure) using hands or hooked stick, 18 percent early weeding, 15 percent reported no control, 8 percent pruning, 2 percent burning the weed and 1 percent digging. While in Mtwara region, 62 percent of respondents were pooling down the climbing weed, 10 percent pruning, 4 percent early weeding, 3 percent digging, 3 percent burning, 10 percent no control and 8 percent cutting the thread. However, all these practices have resulted to

limited success as regeneration of the weed occurred within a short period of time.

D. What Has Been Done by NARI so Far to Reduce the Spread and Effect of Dodder Weed to Cashew Growing Areas?

Knowledge of dodder weed particularly on the life cycle, survival mechanism and mode of infection, ecology, host preference, and also management practices has been established by NARI through literature review and also research trials.



Figure 3. A participant attended dodder training workshop at CWT conference hall at Muheza District, in Tanga Region: Photo Courtesy by Nassoro Abdalah (ZCO) NARI



Figure 4. A participant demonstrates on mechanical control of dodder weed by pulling thread-like structures using a hooked stick. Photo Courtesy by Nassoro Abdalah (ZCO) NARI

The preliminary research findings showed that, currently there is no biological or chemical control of the dodder weed rather than physical or appropriate farm management practices. Due to inadequate knowledge by the farmers and extension officers on dodder weed management, NARI in collaboration with district agricultural offices proposed and conducted awareness workshops to selected extension officers from major cashew growing districts including those in the Coast and Mtwara regions. The main objective was to create awareness and knowledge on dodder about its ecology, mode of spread, effect and management practices of the parasitic weed. The training workshops included both theory and practical sessions (Fig. 3 & Fig. 4). It was expected that by training extension officers the knowledge acquired will trickle down to cashew farmers who are main beneficiaries in the cashew industry. About 120 selected village/ward extension officers from major

cashew growing areas particularly Rufiji, Mkuranga, Kisarawe, Kibaha, Bagamoyo (Coast region); Pangani, Muheza, Korogwe, Mkinga (Tanga region); Mtwara Mikindani and Mtwara district and also Kilwa Masoko and Lindi district attended dodder training workshops between 2011 and 2013.

IV. CONCLUSION AND RECOMMENDATION

The findings revealed that, dodder weed existed in all surveyed villages in Mtwara and Coast regions, although the severity of dodder varied between the regions, villages and distance from the shore. At least two cashew trees were attacked by dodder weed in all surveyed cashew orchards and the yield loss approximately ranged from 50 to 100 percent. Incidence of dodder weed was high to those villages located close to the sea compared to those which are far away from the sea. Poor management practices was the major source and contributed to rapid spread of dodder weed particularly to some of the villages in Bagamoyo and Mkuranga districts. Farmers' attempts to control the weed had scant success. This was due to the fact that, there was little knowledge among farmers about the source, spread and mitigation or control strategies. Basing on the findings above, the following recommendations were made;

- Cashew stakeholders should support trainings to more other extension staffs and farmers to all cashew growing areas in Tanzania. Only few Extension officers (10) per district had that opportunity to attend the workshop while the majority didn't.
- Recently, there are many newly recruited extension officers who are not familiar with dodder and also cashew production technologies. They also need some orientation on the knowledge of cashew production.
- Intercropping with annual crops is more encouraged because frequent weeding will disturb the seed bank and smother the young developing seedlings of dodder weed.

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