NAPIER STUNT DISEASE VECTOR IDENTIFICATION AND CONTAINMENT OF THE DISEASE ON FARM

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Abstract
Napier grass stunt is a new disease, caused by a Phytoplasma, which has seriously affected Napier production in Western Kenya. Phytoplasma are mainly transmitted through use of infected planting materials and insect vectors. The objectives of this study were to identify potential vectors of Napier stunting disease and use them in transmission experiments to identify resistant germplasm that can be exploited by plant breeders and to sensitise farmers on the methods to contain the disease. During the surveys conducted in 4 districts in western Kenya in 2004 and 2005, insects were collected using a sweep net, suction trap and sticky traps. They were sorted using aspirators and preserved in 70% ethanol for identification using taxonomic keys. Phytoplasma detection in insects was by Polymerase chain reaction (PCR) assays. The severity of the disease and baseline data on farmers' Napier production practices was also recorded. Mobile clinics and 'going public' meetings were conducted to sensitise farmers on the mode of Napier disease transmission and containment. Over 30 leafhopper and plant hoppers species were collected and identified. The most common ones were from Cicadelidae, Delphacidae, Fulgoridae, Derbidae and Cercopidae families. From the PCR assays three species were found to be Phytoplasma positive. Over 1, 000 farmers attended the 'going public' sessions in 4 days and most of them were not aware of the disease. Farmers asked more than 28 questions related to Napier Stunting disease. The same study will continue before initiating studies on transmission mechanisms to select efficient vectors for germplasm resistance screening.

Introduction
About 80% (25.6 million) Kenyans depend on Agriculture for their livelihoods (food, income and employment). Dairy farming is especially popular with smallholder farmers as it enables them to produce a number of readily marketable products to maximise their income (Abate 1992). Majority of Kenyans depend on milk as a major protein source, especially children and expectant mothers. Milk is also a major source of income for rural households and often women and children are the main beneficiaries from sale of milk income from milk is used to purchase food during shortages, other household necessities and pay children's school fees. Napier grass (*Pennisetum purpureum*) is the major livestock feed for most dairy farmers in Kenya and neighbouring countries. Surplus Napier is also sold to generate extra revenue. With the rapidly increasing population and subdivision of land, and decrease in farm size many farmers are changing to zero grazing, a practice that requires large quantities of fodders which Napier can provide since it has potential yields of about 50-100 tones of green matter per hectare per year if recommended agronomic practices are used (Muyekho *et al.* 2003). Napier grass is also being promoted in the 'Push-Pull' production system for the control of maize stem borers and striga weeds and also in the management of insect Resistance (Mulaa *et al.* 2004a and b).

However Napier has recently been attacked by a disease that severely reduces its productivity, especially in Western Kenya regions. Napier grass stunting disease is a newly recognised and is caused by a phytoplasma (Jones *at al*. 2004), which significantly affects Napier production with an incidence of between 30% and 90% seen in many smallholder fields (Mulaa and Ajanga, 2005). By year 2004, it was estimated that the disease had affected the Napier grass crop across about 23,298 km^2, about 2 million households comprising 9 million people (30% of the population) in Western Kenya and the Rift Valley provinces (District Agricultural Office Annual Reports, 2004). The disease is spreading very fast in Kenya and currently cultivars such as Bana, French Cameroon and Kakamega 1 and 2, being used are susceptible to Napier stunting disease. It is important that control measures are explored to safeguard this important grass and the the small scale dairy production enterprise. One possibility is to explore for stunt disease resistance among the existing germplasm by using proven vectors. Auchenorrhyncha insects transmit Phytoplasma and the objectives of this project are: to identify potential vectors and use them in transmission experiments to identify resistance that can be exploited by plant breeders in Kenya and other countries in Africa and also sensitise farmers on the methods that can be used to contain the disease on-farm.

Materials and methods

Insect Collections

Leafhoppers and plant hoppers were collected from Napier fields using sweep nets, suction trap and sticky traps and aspirators from October 2004 until July 2005 at several locations in western Kenya. Collections were also done on some crops and grasses close to Napier plots, including sugarcane, maize and sorghum. The insects were sorted, and preserved in 70% ethanol for taxonomic identification and phytoplasma testing using PCR (Bosco *et al.* 2002). Voucher specimens were kept for future reference. The incidence of the disease was also scored and recorded on each farm visited. Data on Napier acreage, varieties grown by the farmers and their farming practices and experiences with the disease were also recorded.

Collection of Baseline data on farmers' perceptions and disease management

A checklist and observations were used to collect information on farmers' perceptions on the Napier stunting disease. Other information collected included: farmer agronomic and disease management practices and their suggestions on disease and pest management solution. This information was collected from individual farms and also during public meetings with farmers in western Kenya.

Farmer sensitisation on Napier disease containment on-farm

A series of public meetings and mobile Clinics were held in west Kenya to gain more information about the distribution of this devastating disease and also to learn more about farmers' reactions on its occurrence (Boa *et al*. 2005). A total of 13 public meetings were convened in 5 districts. The responses received will be used to plan publicity campaigns, actions to control and contain the disease and suggest future research topics. Using leaflets, farmers were sensitised on the mode of Napier stunting disease transmission and simple methods of containing and managing the disease. These include; use of clean planting materials which are also tolerant to pests and diseases, recommended agronomic practices such as inspecting the crop regularly and uprooting and replanting with clean disease free materials, removing the diseased parts of plants and burning the diseased materials.

Results and discussions

Many insect species were found to be associated with Napier grass. More insects were collected from diseased Napier fields especially where Napier had been cut more frequently and on young crop (less than 5 months old), than on old Napier fields. Several insect species were collected, mostly leaf and plant hoppers (Table I and 2). The most common families were Cicadelidae (sub families Typhlocybinae, Cicadelidae and Deltophalinae), Cercopidae and Derbidae. The distribution of the species varied, while Cicadellinae were found in most sites, the Cercopidae were mainly found in Busia district near the swampy areas. From the preliminary Polymerase Chain Reaction (PCR) results the positive insects with phytoplasma similar to that causing Napier stunting disease were from family Delphacidae. His family was collected only in Busia and not in other target areas (Bungoma, Butere/Mumias and Kisumu) where the stunting disease is also prevalent. It may indicate that there are other families (yet to be collected that could be involved in the transmission of the disease as well. Furthermore the PCR results were still preliminary and it might be too early to conclude that the other families were not vectors of stunting disease. Most farmers growing Napier in the sites surveyed had Napier acreage ranging between 0.25 and 5.00 acres, with majority having 0.5-1.00 acre. Survey findings indicate that the stunting disease incidence is high (ranging between 5% and 80%) and it is increasing. The stunting disease appears to affect Napier plots which have been cut more than twice and which are not fertilized. Most farmers were not aware of the presence of the Napier stunting disease and asked several questions related to the disease and other crops. Some farmers thought low soil fertility, water- logging, damage by rodents and other factors caused the disease. They wanted to know the actual causes of the disease and how the disease could be managed and if there were any resistant varieties of Napier grass to the disease.

Table 1–Percent stunting disease incidence on Napier and potential insect vectors collected in three districts in Western Kenya and Kisumu

District	Division	Acreage of Napier	Incidence of disease (%)	No. of Collected insects per farm & most Common Species
Bungoma	Webuye Kanduyi Bumula Boyofu	0.25-1.5	5-80	25-200 Cicadulinae, Cofana,, Empoasca
Butere/ Mumias	Mumias Matungu Buchifi Butere	0.1-2	10-80	50- 100 Cicadulinae, Empoasca, Derbidae
Busia	Matayos Nambale Busia	0.25-3.5	5-85	50 Cofana, Delphacidae, Cercopidae Cicadulinae, Empoasca
Kisumu	Kisumu township	0.5 rice	-	113 Cicadulinae, Empoasca , Stalk eyed fly Derbids, Cofana

Table 2–Leaf hoppers and Plant hopper Families and Species Collected from Western Kenya in 2004 and 2005

Plant Hoppers (Fulgoroidea)	Plant Hoppers (Fulgoroidea)	Leaf Hoppers (Cicadelidae)
Delphacidea	Lophopidae	Agallia sp.
Rhinotettix sp.	Elasmoscellis sp.	Balclutha sp.
Leptodelphaxsp. Peregrinus sp.	Lophops sp.	Cicadellid sp.
Thriambus sp.		Cicadulina sp.
	Ricaniidae	Cofana unimaculata
	Ricania sp.	Cofana spectra
Cercopidae	Tettigometridae	Empoasca sp.
Locris sp.	Hilda sp.	Exitianus sp.
Aphrophoridae		Hecalus sp.
Poophilus sp.	Tropiduchidae	Macrosteles sp.
Derbidae	Nomica sp.	Platyretus sp.
Dictyopharidae		Nephotettix sp.
Flatidae		Signoretia sp.
Flugoridae		Stymphalus sp

Conclusion

The disease is widespread in Western Kenya and is spreading to other areas. There is an urgent need to create awareness of the disease to farmers and develop management intervention to control its spread. More work is needed to complete vector identification, determine transmission mechanism and screen for resistance/tolerance among Napier germplasm. Other important areas of research could include identification of alternative fodder crops to Napier.

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