

Empowering smallholder farmers in the management of livestock ticks

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Abstract

The Government of Tanzania through the Ministry of Livestock and Fisheries Development and livestock industry stakeholders developed a National Livestock Policy (NLP) of 2006 that availed opportunities and challenges for accelerating the growth and contribution of the livestock industry to poverty reduction and the national economy by making more optimal use of available land, animal and human resources. The establishment of livestock disease free zones was highlighted as one of the interventions in the livestock industry. However, this is practically difficult as some diseases such as those transmitted by ticks are potentially distributed in the country. The impact of tick borne diseases has been tremendous in Tanzania of which smallholder farmers are adversely affected. In attempt to address this problem, a project “Development of acaricidal agents from *Commiphora swynnertonii* for management of livestock ticks for smallholder farmers” was implemented by a team of researchers from Nelson Mandela African Institution of Science and Technology (NM-AIST), National Institute of Medical Research (NIMR) and a community based organization. Two postgraduate students have been engaged in collaboration with small holder famers to: (i) characterize secondary metabolites with acaricidal activities from the *C. swynnertonii* stem bark exudates; (ii) determine chemical markers for acaricidal agents from *C. swynnertonii* stem bark exudate; and (iii) evaluate on-station acaricidal effects of *C. swynnertonii* formulations. The project has been well received by smallholder famers in Tarime district and Mogabiri Agricultural Development Center. This is a positive sign that the innovation will be easily adopted by the farmers. Successful implementation will contribute in poverty reduction as stipulated in United Republic of Tanzania National Strategy for Growth and Reduction of Poverty I, II and III.

Key words: Acaricidal agents, *Commiphora swynnertonii*, Tanzania

Résumé

Le Gouvernement de la Tanzanie à travers le Ministère de l'élevage et de développement de la pêche, et les intervenants de l'industrie d'élevage ont élaboré une politique nationale de l'élevage (PNL) de 2006, présentant des opportunités et des défis pour accélérer la croissance et la contribution de l'industrie de l'élevage à la réduction de la pauvreté et

l'économie nationale en faisant une utilisation plus optimale des terres disponibles, des animaux et des ressources humaines. La création de zones exemptes de maladies du bétail a été soulignée comme l'une des interventions dans le secteur de l'élevage. Toutefois, cela est difficile dans la pratique car, certaines maladies, telles que celles transmises par les tiques sont potentiellement réparties dans le pays. L'impact des maladies associées à la tique est énorme en Tanzanie, les petits agriculteurs en sont lésés. Pour tenter de résoudre ce problème, un projet, «Développement d'agents acaricides de *Commiphora swynnertonii* pour la gestion des tiques du bétail pour les petits agriculteurs» a été mis en œuvre par une équipe de chercheurs de Nelson Mandela- Institution Africaine pour les Sciences et la Technologie (Nelson Mandela-African Institution of Science and Technology) (NM-AIST), l'Institut National de la Recherche Médicale (National Institut for Medical Research (NIMR) et une organisation communautaire. Deux étudiants en troisième cycle ont été engagés en collaboration avec des petits fermiers pour: (i) caractériser les métabolites secondaires avec des activités acaricides provenant des exsudats d'écorce de la tige de la *C. swynnertonii*; (ii) déterminer les marqueurs chimiques pour les agents acaricides de l'écorce de la tige de l'exsudat de *C. swynnertonii*; et (iii) l'évaluation en station acaricide effets des formulations de *C. swynnertonii*. Le projet a été bien accueilli par les petits paysans dans le district de Tarime et le Centre de développement agricole de Mogabiri. Ceci est un signe positif que l'innovation sera facilement adoptée par les agriculteurs. La mise en œuvre réussie contribuera à la réduction de la pauvreté tel que stipulé dans la Stratégie Nationale pour la Croissance et la Réduction de la Pauvreté I, II et III de la République-Unie de Tanzanie

Mots clés: agents acaricides, *Commiphora swynnertonii*, la Tanzanie

Introduction

Tick-borne infections resulting from tick infestation in livestock are a common veterinary health problem in Tanzania. Tick borne diseases (TBD), namely, East Coast Fever, Anaplasmosis, Babesiosis and Cowdriosis have been reported to affect the optimal livestock productivity in Tanzania and the whole of East African region (Nonga *et al.*, 2012). In Tanzania, TBD has been reported to be the main cause of reported cattle deaths and was estimated to account for 68% of the 364 million USD annual total losses resulting from tick-borne diseases in Tanzania (Mukhebi *et al.*, 1992). The strategy to lower losses attributed to tick infestation in Tanzania has been through the application of synthetic acaricidal agents usually suspended in water and applied on the animal skins to prevent tick manifestations and thus transmission of pathogens. Despite of promising results through the use of synthetic acaricidal agents, unaffordability of veterinary services and reduced susceptibility of ticks to some acaricides leads to serious loss of cattle among the poor small holder farmers.

The consortium composed of researchers from Nelson Mandela African Institution of Science and Technology (NM-AIST), National Institute of Medical Research (NIMR) and a community based organisation identified a need to explore indigenous practices for the management of ticks before the introduction of synthetic acaricides in Tanzania. Available documented and undocumented information highlights that indigenous people used wild plants' exudates and one of such plants is *Commiphora swynnertonii* locally known as *mbambaa*

(Shambaa). Based on this anecdotal information the team opted to develop alternative acaricidal agents which are affordable, eco-friendly, effective and applicable to rural small holder farmers from *C. swynnertonii* exudates. The composition of the consortium was to ensure that an innovative public-private partnerships (PPs) between university, government and civil society is created. PPs are viewed as an effective options to address challenges facing societies.

Methodology

The implementation of this project involves two postgraduate students registered at NM-AIST, Mogabiri Agricultural Extension Center and small holder farmers. The male to female ratio of postgraduate students was 1:1 and they are both under the Department of Sustainable Agriculture and Biodiversity Ecosystem Management which trains students on how to harness natural resources in order to address challenges facing agricultural sector. A combination of male and female students facilitated easy interactions with the communities in Tanzania. It is easy for a man to discuss issues with fellow men and likewise to ladies. This is important especially during acaricidal on- station trial and during the collection of plant materials. Similarly the mentors and supervisors of the graduate students were also nominated and assigned taking into consideration the gender-responsive nature of the research effort.

In order to achieve project research objectives, the first student was guided to develop acaricidal formulations from the *C. swynnertonii* exudates using water and soap solution whereas the second student concentrated in the development of acaricidal templates to be employed as acaricidal markers in the *C. swynnertonii* acaricidal agents. *Commiphora swynnertonii* stem bark exudates collection involved postgraduate students, experienced taxonomist from Tropical Pesticide Research Institute (TPRI) and small holder farmers.

Results

During the exudates collection, students engaged small holder farmers and individuals selling *C. swynnertonii* exudates. Individuals selling exudates are important actors in the livestock farming chain in the rural areas. They stock exudates which becomes scarce during the cold season. This is a natural phenomenon to *C. swynnertonii* as described by both small holder farmers and exudate sellers. *Commiphora swynnertonii* tends to release more exudates during warmer seasons than during the cold season. Arusha experience cold weather in the months of April, May, June, July and August. Taxonomist from TPRI elaborated the scientific features used in the identification of *C. swynnertonii*. Individuals selling exudates and just happen to practice livestock farming. They were very useful in explaining the use of the products. It was established that exudates are mainly sold as a cure of human diseases. It was however, pointed out through discussion that they are aware that exudates are effective against ticks but only few individuals buy the product for this purpose. Apparently the knowledge is fading from generation to generation. This is because of the dependency on synthetic acaricides. Phytochemical screening of *C. swynnertonii* exudates using TLC analysis revealed the presence of terpenes. There are number of reports that have established that terpenes especially monoterpenes possess acaricidal and repellency activities (Born *et*

al., 2012). It is therefore suggestive that the acaricidal potency of *C. swynnertonii* exudates is induced by terpenes and it will be confirmed in the course of project implementation.

Discussion

Livestock farming is one of the major agricultural activities in Tanzania and is expected to contribute to the realization of the country's development goals i.e., National Growth and Reduction of Poverty (NSGRP). Apparently contribution of livestock industry to the Gross Domestic and National Domestic product is below its potential (United Republic of Tanzania, 2010). This is due to low growth rates, high mortality rates, low reproductive rates and poor quality of the final products from the industry. This implies that small holder farmers constituting 60% of Tanzania rural households engaged in livestock keeping are also suffering. Livestock to such communities means food (beef and milk), business (hide selling), fertilizer (manure) and traction (plough). Prior to 1984, the central government provided free dipping services in rural Tanzania. As part of the structural adjustment, dipping services were transferred to district councils. These collapsed totally in 1985. Once dipping stopped, much of the cattle population in northern Tanzania were naïve to the range of TBDs. Thus herds across the region dramatically declined (Kivaria, 2006). Empowering small holder farmers to efficiently harness available resources such as *C. swynnertonii* exudates will effectively manage tick manifestation and thus tick borne diseases.

The spillover benefits of the project are expected to take shape as *C. swynnertonii* acaricidal agents get in use. *Commiphora swynnertonii* will become a commercial plant and thus, farmers will benefit by selling stem bark exudates. Small factories will be erected to process acaricidal agents, thus creating employment to youth. Street vendors are already selling exudates for the management of human diseases and livestock flies and ticks. Preliminary discussion with street vendors in Arusha have indicated that value addition to *C. swynnertonii* exudates will increase their income. Involvement of smallholder farmers and street vendors in the implementation of the project creates a platform in which both stakeholders are engaged in understanding livestock farming challenges and collaboratively address the challenges.

Conclusion

This paper demonstrates sustainable utilization of natural resource for the management of infestation and thus livestock diseases. This innovation is more applied to small holder farmers. It also elaborates the importance of grooming postgraduate students in addressing challenges facing the society. The project is a collaboration between scientists and small holder farmers and is being implemented as a participatory action when researchers are learning from farmers and *vice versa*.

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