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African Insect Science for Food and Health

Arthropod Pathology Unit

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Biopesticides as effective tools for the control of ticks

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MINISTRY OF LIVESTOCK, SOMALILAND

Introduction

Ticks and tick-borne diseases cause great economic loss to livestock in the world and have adverse effects on them in several ways and even leads to their death. Ticks parasitise a wide range of vertebrate hosts and transmit a variety of pathogenic agents than any other group of arthropods. The most common species in the East African region include *Rhipicephalus appendiculatus*, *Amblyomma variegatum* and *Rhipicephalus decoloratus*, while in Somaliland, *Rhipicephalus evertsi* followed by *Hyalomma truncatum*, *Amblyomma variegatum, Rhipicephalus appendiculatus* and *Rhipicephalus pulchellus.*

Fig 1**: From left 1. The red-legged tick (*Rhipicephalus evertsi*) 2. Hairy bont-legged tick (*Hyalomma* sp.) 3. Tropical bont tick (*Amblyomma variegatum*) 4. Brown ear tick (*Rhipicephalus appendiculatus*)**
Photo: Daktaridudu

Economic importance of ticks

Ticks cause physical injury as they attach to the body of the host for a bloodmeal and subsequently cause serious physical damage to livestock. This can result to irritation, unrest, and weight loss if the ticks are many. There is also direct injury to hides due to tick bites, loss of blood due to feeding and lesions on the teats of cows may affect milk production. Across Africa, ticks and tick-borne diseases cause an annual loss of 168 million USD and lead to the death of 1.1 million cattle every year.

Rhipicephalus evertsi, a two-host tick also known as the red-legged tick, transmits *Theileria*, *Babesia*, *Borrelia*, *Rickettsia* sp. *Hyalomma* sp. transmits the virus that cause the life-threatening Crimean-Congo hemorrhagic fever. *Rhipicephalus appendiculatus*, a three-host tick also known as brown ear tick, transmits *Theileria parva*, *Babesia* spp. and other protozoan and viral diseases (including Nairobi sheep disease and louping ill). It is the principal vector of East Coast fever.

Current management strategies and associated challenges

In the recent past, control of ticks has been mainly based on the use of chemical acaricides, such as pyrethroids, organophosphates and amitraz. However, this chemical-based approach has been hit by a number of limitations such as non-selective killing of non-targeted organisms, resistance development in most of the ticks species, environmental hazards and toxicological risk factors, especially to the users.

In addition to being toxic, they are costly and high residue levels are usually present in the milk and meat of the animals exposed to them. Treatment with acaricides is very costly considering the value of the cattle and cattle products. All these shortcomings make researchers to look for an alternate and absolute control method, such as use of biopesticides.

Potential for a biopesticide, *Metarhizium anisopliae*, for the management of ticks

Entomopathogenic fungi are being considered as a promising alternative to chemical acaricides in the management of ticks. They have no adverse effects on livestock, users and are environmentally friendly. *Metarhizium anisopliae* sensu stricto (Metsch) is among the entomopathogenic fungi that has received considerable attention in recent years. Scientists at *icipe* have discovered that *M. anisopliae* isolate ICIPE 7 is effective for the control of ticks and can be developed as a commercial biopesticide.

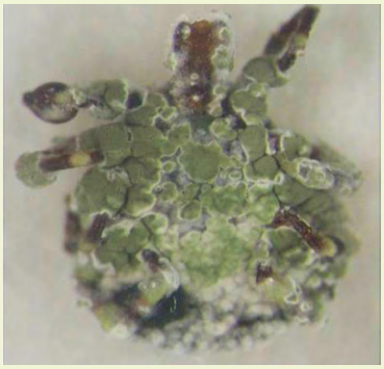

Fig. 2. *Metarhizium anisopliae* isolate ICIPE 7-infected tick

Case study1: Kilgoris, Transmara District, Kenya

Indigenous cows infested with ticks, especially *Rhipicephalus decolaratus* were selected and subjected to treatment with amitraz (recommended concentration of 0.2%), ICIPE 7 (1×10^9 conidia per ml), combination amitraz (0.1%) and ICIPE 7 (1×10^8 conidia per ml). An untreated group of cattle were sprayed only with water and 0.05% Triton X–100 + 15% canola oil. Treatments were applied once a week for four weeks. *Rhipicephalus decoloratus* ticks were counted on the three regions on each animal: head (head, ear, neck, the dewlap to the point of the sternum), shoulder (outer and inner foreleg from point of the sternum back to the start of the fore belly) and the back (ribs, tail and tail switch, udder and scrotum and hind legs). After application of treatments, each single group of cattle was allowed to graze separately on tick-infested grass throughout the experimental period. To determine the proportion of ticks infected with fungus, 8–10 ticks were collected from each cow in fungus-treated groups and control, and tested for fungus infection. The results demonstrated that ICIPE 7 is compatible with amitraz. Weekly application of treatments significantly reduced on-host tick population by 69.2% with ICIPE 7 alone, by 67.1% with ICIPE 7 + amitraz and by 94.9% with amitraz alone over the control after 4 weeks in the field.

Fig. 3: Field trials on efficacy of ICIPE 7 on cattle at Kilgoris, Transmara, Kenya

Case study 2: Hargeisa, Somaliland

A study to investigate efficacy of novel formulation of *M. anisopliae* isolate ICIPE 7 for controlling on-host ticks was conducted on a private farm situated 20 km from Hargeisa, Somaliland. Test-animals included cattle and camels. Two weeks after the single application of *M. anisopliae* resulted in 80.9% control of ticks on cows over control. On camels, *M. anisopliae* treatment resulted in 83.7% control of ticks over the control. *Hyalomma truncatum* (60.3%) was the predominant species, followed by *Amblyomma variegatum* (30.7%) and *Rhipicephalus pulchellus* (9%). The fungus was viable for a week in the field. Hence, application of *M. anisopliae* once every two to three weeks could be economical to achieve effective control of ticks on both cows and camels.

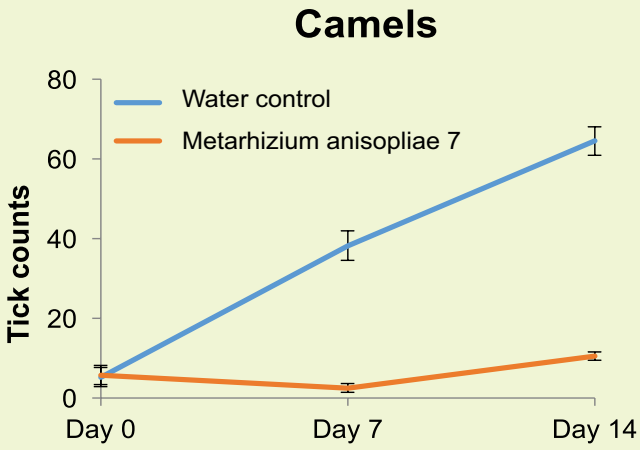

Fig. 3: Field trials on efficacy of ICIPE 7 on camel at Hargeisa, Somaliland

Recommendations

i. Biopesticides for tick control are effective either alone or integrated with acaricides
ii. More research on compatibility between entomopathogenic fungi and an acaricide need to be done to enhance efficacy
iii. Future studies should consider improving formulation of *Metarhizium anisopliae*, ICIPE 7
iv. Need for policy support to expedite registration and commercialisation of *Metarhizium anisopliae* isolate ICIPE 7

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