Tick control measures from nature

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Scientists from the Universities of Zimbabwe and Greenwich delved into the possibility of using fever tea (*Lippia javanica*) for cattle tick control in Zimbabwe. Here are their findings.

Figure 1: Ear damage by ticks

Figure 2: Heavy tick infestation

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Ticks species, particularly those in the genus *Rhipicephalus*, are a major burden for livestock. Although their impact on productivity is global, the effects are mostly felt in developing countries where they rank high in affecting livelihoods and where their systematic control is relatively high cost and not widely available.

In 1988 researchers identified ticks and tick-borne diseases (TBD) as one of the most important health and management challenges in Africa, ahead of tsetse fly and trypanosomiasis.

Damages

Ticks inflict direct damage to the skin and open up lesions for opportunistic secondary infections (*Figure 1* and *2*). Under heavy infestations, they can cause toxicosis and paralysis to the animal. The most severe effects of ticks in Africa, specifically, are the TBDs babesiosis, theilerioses, cowdriosis and anaplasmosis.

Control

While many intervention techniques have been developed and applied with varying degrees of success, it remains clear that a comprehensive method for tick control still needs to be realised, especially for resource-constrained farmers. Conventional methods involve the use of commercial acaricides under intense dipping programmes. In Zimbabwe, the Department of Veterinary Services (DVS) has the mandate to ensure that acaricides are available for dipping countrywide, but with increasing costs of sourcing the acaricides and the macro-economic challenges, this has not been working efficiently, especially in remote areas.

This is not a uniquely Zimbabwean problem. It applies to most developing countries where techniques available are better suited to commercial livestock farmers. Such control strategies are associated with high and unsustainable costs and do not reach target beneficiaries because of inaccessibility of some communal livestock areas. There is also a lack of supportive infrastructure like refrigeration for some interventions like the use of vaccines, while labelling of some the acaricides is quite complicated (unfriendly) for illiterate and semi-illiterate farmers.

What alternatives or complementary approaches can be used for these farmers?

One possible answer lies in ethnoveterinary science involving the use of a widely available pesticidal plant species such as *Lippia javanica*.

Lippia javanica

The plant *Lippia javanica* belongs to the Verbenaceae family, which has 36 genera and approximately 1 035 species in tropical and subtropical regions. Of these, there are eight genera and approximately 40 species in southern Africa. *L. javanica* occurs abundantly in eastern and southern Africa including Botswana, Kenya, Malawi, Mozambique, Tanzania, South Africa, Swaziland, Zambia and Zimbabwe. It is a shrub commonly known as Lemon bush or Fever tea (*Lemoenbossie* in Afrikaans). Its principal habitat is in grassland on hillsides and stream banks, and as a constituent of the scrub on the fringes of forests, particularly Miombo woodlands.

The plant is well-known to many African tribes for its medicinal qualities. Different parts of the plant (the leaves, twigs and occasionally the roots) are used for different reasons. The Xhosa people are known to drink a weak infusion thereof as a substitute for tea and in a stronger infusion for the treatment of coughs, colds and bronchial problems. In Zimbabwe, it is now available on the market as a herbal tea. It is also said to be effective against fever, especially in cases of malaria, influenza, measles, and as a prophylactic against lung infections. (In these cases *L. javanica* is often mixed with another herb *Artemisia afra*.)

Lippia javanica as an acaricide

Plants are still a popular choice for pest management among resource-constrained farmers in southern Africa. It is a more environmentally-benign strategy, compared to the conventional commercial synthetic pesticides. In Zimbabwe, *L. javanica* and other plant materials were reportedly used by smallholder farmers as an acaricide.

Experiments were set up to validate this reported effect against cattle ticks in Mashona steers on-station at Henderson Research Institute, about 30 km from Harare. Laboratory experiments were conducted at the University of Zimbabwe, Harare. The on-station experiments showed that simple water extracts of *L. javanica* are acaricidal, even at low concentrations of 5% weight per volume.

Animals were sprayed with 5 ℓ of the extract with a knapsack sprayer once every week (*Figure 3* and *4*). There was no significant statistical difference between cattle treated with a commercial synthetic acaricide and those under *L. javanica* treatment. There was no development of clinical conditions of tick-borne diseases during the duration of the trials for cattle under treatment of the plant extracts. Efficacy experiments in controlled laboratory conditions also showed similar trends with tick larvae confirming the effects observed in the field. There were, however, numerical total tick count differences between cattle treated with the commercial acaricide and those treated with *L. javanica* with the commercial acaricide performing more effectively.

To optimise the efficacy of the plant, investigations with ingenious methods of improving extraction and application were carried out in laboratory bioassays and on-station cattle trials. Indications have shown that the use of boiling water and a surfactant increases the efficiency of extraction and ultimately the efficacy of *L. javanica*.

Toxicity is an important component of pesticide development. Safety experiments with mice models showed that *L. javanica* has potential deleterious negative health effects because some of the mice died after oral administration of the plant extracts. There is, however, no history of human consumption of fresh leaves of *L. javanica* as a herbal tea having negative effects on humans. Hence the likelihood of there being health problems using this plant to control ticks on cattle by topical application are negligible.

It can be concluded that there is sufficient acaricidal activity in *L. javanica* water extracts to be used to control ticks. There is, however, no clear policy and regulatory information regarding the use and promotion of pesticidal plants in Zimbabwe and most other African countries at the moment.

Conclusion

While future work needs to investigate the mechanism of action, and to further conduct comprehensive safety trials to fully complete the story, it can be concluded that *L. javanica* is a potential tick control measure that farmers can use alone or with other control methods for the control of ticks. With correct and sustainable harvesting, this could be a viable option for the resource-constrained farmers as the plant is easy to propagate and is not threatened.

To the future

The plant family the fever tea shrub belongs to is characterised by its aromatic nature. The biological activity reported in the genus is likely to be associated with the aromatic mono and sesquiterpene components in the plant's essential oils. These are currently being investigated and preliminary data suggest that their occurrence is highly variable among different provenances.

Figure 3: Preparation of Lippia javanica *extracts*

Figure 4: Animal spraying with Lippia javanica

This complements earlier findings on the geographic variability in the species but may complicate their use as efficacy could vary between different collections. The target is to determine which compounds are specifically responsible for the acaricidal effects and then to identify provenances of the plant that are high in these components to then select the elite materials for propagation, either commercially or locally by the farmers themselves.

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Animal photos courtesy Emmanuel Nyahangare.
Lippia javanica *photos © Prof Philip C Stevenson.*