The use of herbal preparations for tick control in western Ethiopia

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ABSTRACT

Information on the traditional tick control methods used in Keffa, Illubabor and Wellega Provinces in western Ethiopia was obtained from 86 veterinary clinics and 865 peasant farmers through a questionnaire survey. Latexes of *Euphorbia obovalifolia* and *Ficus brachypoda,* juice of crushed leaves of *Phytolaca dodecandra* and *Vernonia amygdalina,* fruit juice of *Solanum incanum,* crushed seeds of *Lepidium sativum* mixed with fresh cattle faeces, juice of crushed leaves and bark of *Calpurnea aurea* and commercially available spice of *Capsicum* spp. mixed with butter, were used by peasant farmers to control ticks. Preliminary *in vitro* efficacy tests of these plant preparations were performed on engorged female *Boophilus decoloratus.* Preparations of *Capsicum* spp., *E. obovalifolia, S. incanum* and *F. brachypoda* were found to have 30–100 % killing effects. Subsequently, *in vivo* treatment trials of these preparations were conducted using indigenous *Bos indicus* cattle naturally infested with ticks. Results indicate that treatments at the rate of once per day for 5 consecutive days with the latexes of *E. obovalifolia* and *F. brachypoda* can reduce tick burdens by up to 70 % on cattle.

Key words: Ethiopia, herbal preparations, tick control, traditional tick control, western Ethiopia.

Regassa A **The use of herbal preparations for tick control in western Ethiopia**. *Journal of the South African Veterinary Association* (2000) 71(4): 240–243 (En.). National Animal Health Research Centre, PO Box 04, Sebeta, Ethiopia.

INTRODUCTION

At present, the application of acaricides by the use of dipping tanks, spray races, pour-ons, spot-ons, hand-spraying and hand-dressing is probably the most effective method to control ticks and the diseases they transmit. Despite their widespread use, acaricides have some deleterious effects. Development of acaricide resistance in ticks is reported worldwide, wherever acaricides are in use. The phenomenon is particularly rapid in 1-host ticks, even under conditions of minimum acaricide application [15]. Unwanted effects of acaricides on the environment can never be overlooked. Some acaricides tend to accumulate in livestock products and pose health hazards to the consumer[14]. They can be toxic to the operator, unless strict precautionary measures are taken[16]. Acaricides have already become unaffordable for most resource-poor small-scale producers[9]. Intensive acaricide application is also known to adversely affect endemic stability to tick-borne diseases[7]. All these undesirable effects and limitations discourage dependence on acaricides.

In an attempt to identify alternative methods, a number of unconventional tick control appraoches have been reported, including host resistance[3], release of sterile males[4,13], pasture spelling[19], tick vaccines[12], tick parasites[10] and the use of plants for the control of ectoparasites[5,6,11,18]. However, none of these have been successfully applied in large-scale control schemes.

In Ethiopia several plants are known to have medicinal uses[2,17]. The objectives of the present study were to obtain information on the various traditional tick control techniques practised by peasant livestock owners in the Wellega, Illubabor and Keffa Provinces in western Ethiopia, and carry out some preliminary investigations that may lead to the identification of potentially promising techniques for large-scale tick-control activities.

MATERIALS AND METHODS

Study area

The survey was conducted in Wellega, Illubabor and Keffa Provinces, which constitute *c.* 20 % of the total area of Ethiopia. The area is located roughly between 33° to 37°E and 5° to 11°N (Fig. 1). The greatest part of the 3 provinces consists of highlands, while some areas towards the east are lowlands. The vegetation cover is mainly broad-leaved forest, with cultivated areas in the highlands and grasslands in the lowlands and river valleys. Two major climatic types are distinguished: the highlands, which have rainfall almost throughout the year, and the lowlands that receive rain mainly between May and September.

Livestock

The livestock population in the area comprises 3.4 million cattle, 2.7 million sheep, 1.7 million goats and 0.2 million equines. Most of the cattle are *Bos indicus,* belonging to the Horro, Abigar and Sheko breeds[1]. Some Borana and Friesian crosses are kept on dairy farms.

Ticks and tick-borne diseases

The common ticks of livestock in western Ethiopia include *Amblyomma cohaerens, A. variegatum, Boophilus decoloratus, Rhipicephalus bergoni, R. evertsi evertsi, R. lunulatus* and *Hyalomma marginatum rufipes*[8]. Tick infestation levels are generally low in indigenous *Bos indicus* cattle compared to *Bos taurus* breeds and their crosses. Tick-borne disease outbreaks are not common in the western region of Ethiopia, although anaplasmosis, heartwater and babesiosis are known to exist[8].

Questionnaire survey

To obtain information on the different traditional tick control methods practised by peasant farmers in western Ethiopia, questionnaires were circulated *via* the Provincial Agricultural Development Offices to all veterinary clinics in the Wellega, Illubabor and Keffa Provinces and through them to peasant farmers who volunteered to disclose their knowledge of traditional tick control techniques, including the identity of the materials, preparation and methods of application, and responses were collected. Plant materials were subsequently used for *in vitro* and *in vivo* testing.

In vitro *testing*

The *'in vitro'* testing was done in Bedele Regional Veterinary Laboratory, western Ethiopia. All tested herbal preparations, with the exception of *Capsicum* spp. (a commercially available spice), were collected from the field around Bedele town, where the laboratory is situated. Prepara-

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Received: April 2000. Accepted: October 2000.

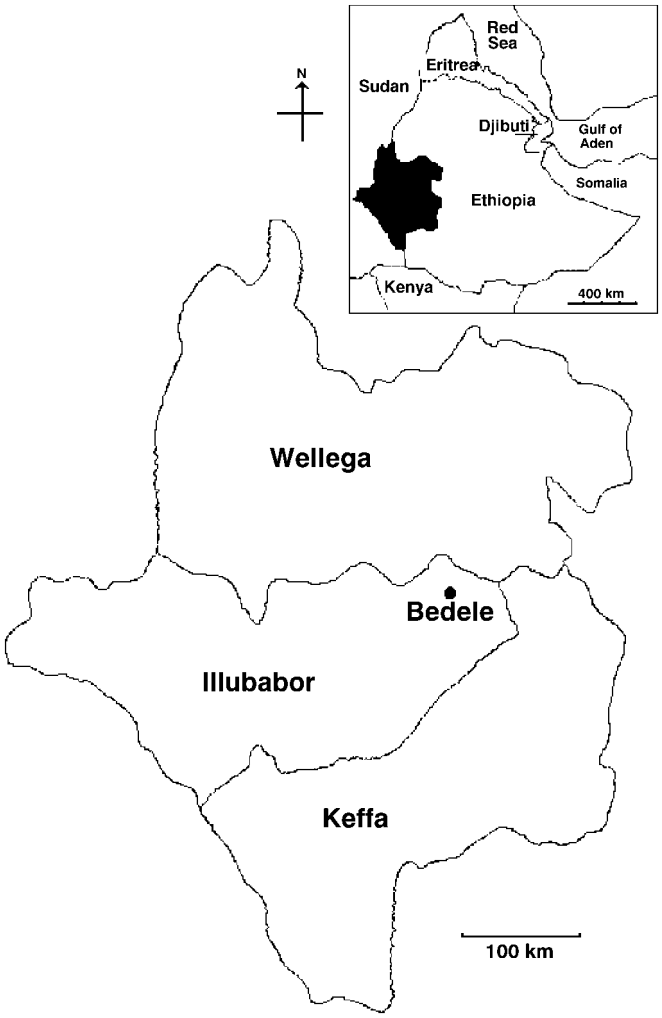

Fig. 1: **Study area.**

tions of plant materials were carried out in accordance with the information obtained in the questionnaire (Table 1). Engorged female *B. decoloratus,* collected from Borana and Friesian cross cattle kept on Chora dairy farm, near Bedele, were used in this test. The ticks were selected because they were available in sufficient numbers to observe the effects on egg laying and mortality. Twelve engorged female *B. decoloratus* were immersed in a sufficient volume of each plant preparation in a Petri dish for 1, 5, 10 and 20 minutes. Preparations of *Capsicum* spp. and *L. sativum* were directly smeared over the entire surface of each tick, as the consistency of the preparation did not allow immersion. All 12 ticks exposed to a particular plant preparation for a specific time were subsequently transferred to another Petri dish lined with filter paper and incubated at 28 °C and 85 % relative humidity. The procedure was repeated until all the plant preparations had been tested for the different time regimens. The untreated control group was similarly maintained. The ticks were observed daily and mortalities recorded.

In vivo *testing*

Two field trials were conducted on naturally tick-infested indigenous *Bos indicus* cattle maintained under a traditional management system by peasant farmers around Bedele town, Kere Dellilo village. The first trial involved 4 plant preparations that showed notable killing effects during the *in vitro* test. A sufficient volume of each plant preparation was smeared locally onto adult *A. variegatum* and *A. cohaerens* (the only ticks available in sufficient numbers on cattle in the study area) on a pair of cattle daily for 5 consecutive days. The same number of cattle was maintained in the control groups (Table 3). To monitor the number of ticks that attach and drop from cattle, sketches were used to roughly locate the positions of ticks on animals. Dynamics of ticks on the cattle were observed every day and final results were recorded on Day 6, 24-hours after the last treatment. Figures for total tick mortality were based on the sum of the number of ticks that detached every day from Day 2 post-treatment, and also dead ticks collected from cattle treated with *E. obovalifolia* on Day 6.

In the second *in vivo* trial, 2 plant preparations that exhibited the best killing effects during the first field trial (Table 4) were applied to adult *A. variegatum* and *A. cohaerens,* following the same procedures as for the 1st *in vivo* trial, but in this case on 7 cattle for 2 consecutive days. The control group consisted of the same number of cattle.

Table 1: **Plants and preparations used to control ticks.**

Scientific name	Preparation
Capsicum spp.	The commercial spice was mixed with butter fat
Calpurnea aurea	Juice of crushed leaves and bark
Lepidium sativum	Crushed seeds mixed with fresh cattle faeces
Vernonia amygdalina	Juice of crushed fresh leaves
Euphorbia obovalifolia	Latex
Solanum incanum	Fruit juice
Phytolaca dodecandra	Juice of crushed fresh leaves
Ficus brachypoda	Latex

RESULTS

The questionnaire survey revealed that treatments with various herbal preparations were among the most common traditional tick control methods practised by peasant farmers in the Wellega, Illubabor and Keffa Provinces in western Ethiopia. Responses obtained from 86 veterinary clinics and 865 peasant farmers are summarised in Table 1. Results of the *in vitro* and *in vivo* tests are shown in Tables 2, 3 and 4. In the *in vitro* test, *Capsicum* spp., *E. obovalifolia, S. incanum* and *F. brachypoda,* demonstrated better killing effects and were thus selected for the first *in vivo* trials, while the other preparations were not investigated further.

Mortality figures shown in Table 2 are based on tick deaths that occurred before completion of egg laying. In animals treated with *E. obovalifolia,* dead ticks were found glued to their attachment sites, owing to the sticky nature of the latex. Exposure of ticks to plant materials for more than 1–5 minutes did not appear to have had any effect on efficacy. *Capsicum* spp., which killed all ticks during the *in vitro test,* showed almost negligible acaricidal effect in the first *in vivo* trial, while *S. incanum* demonstrated low killing effects in both trials. On the other

Table 2: **Percentage mortality of engorged female *Boophilus decoloratus* exposed to various plant preparations for different time regimens in *in vitro* testing.**

Plant preparation	Exposure time (minutes) and percentage mortality			
	1	5	10	20
Capsicum spp.*	100	–	–	–
C. aurea (leaves)	10	0	0	30
C. aurea (bark)	0	10	0	0
*L. sativum**	17	–	–	–
V. amygdalina	0	0	0	0
E. obovalifolia	75	100	100	92
S. incanum	35	35	25	42
P. dodecandra	0	25	17	17
F. brachypoda	67	75	100	83
Control	0	0	0	0

*The consistency of the preparation did not allow different times exposure.

hand, preparations of *E. obovalifolia* and *F. brachypoda* demonstrated consistently high levels of efficacy (about 70 %) against ticks exposed to them during the *in vitro* and the first *in vivo* trials, and were therefore selected for the second *in vivo* test in which they did not cause high tick mortality.

No new ticks were found to attach either to the treatment or control groups during the whole period of the *in vivo* trials.

DISCUSSION

Although results of the *in vitro* test appeared to distinguish between the various herbal preparations with regard to their acaricidal effects, there is not enough evidence that the plants that were excluded at the *in vitro* stage would not have worked if applied to animals. Both *in vitro* and *in vivo* tests were performed only on a limited number of tick species, mainly for reasons of availability in sufficient numbers. *A. variegatum* was not available on animals treated with *F. brachypoda* and *Capsicum* spp. during the first *in vivo* trial. It would therefore not be fair at this preliminary stage to draw conclusions about the acaricidal effects of these plant materials when used on other tick species. Latexes of *E. obovalifolia* and *F. brachypoda* demonstrated similar high acaricidal effects when applied for 5 consecutive days. However, the frequency of application is obviously too high. The second field trial was therefore conducted to observe the effects of these plant preparations at a reduced rate of application, but results were not as good as in the first trial. Nevertheless, since results were reported only on observations 24 hours after the last treatment, no information was obtained as to the fate of the exposed ticks over the next days, and it is possible that these latexes may have gradual killing effects. Therefore, to obtain better information on the acaricidal effects of these plants, daily observation for a number of days following each treatment, is recommended before instituting the next treatment.

The killing effect exhibited by latexes of *E. obovalifolia* and *F. brachypoda* appears to be promising, as their use could probably reduce tick burdens while maintaining endemic stability to tick-borne diseases, especially if the reported level of tick reduction could be achieved at a reduced rate of treatment. However, further research to establish treatment frequency, mechanism of action, identification of active substance(s) and toxicity is recommended, before conclusive statements on the acaricidal activities and recommendations for use of these plants can be made.

The only side-effect observed was localised hair loss that involved areas of skin smeared with the latex of *E. obovalifolia* in cattle treated for 5 consecutive days. No such lesion was observed in animals treated either with the same material for 2 consecutive days or with other plant preparations. On the other hand, although no incidents occurred during this study, latex of *Euphorbia* was reported by the local people to be very irritant to eyes and damaged skin surfaces and could also be toxic if ingested. It is therefore advised that strict care should be taken when handling this material.

Table 3: **Mean percentage mortality of adult *Amblyomma cohaerens* and *A. variegatum* on a pair of cattle treated with different plant preparations for 5 consecutive days.**

Plant preparation	Percentage mortality in adult ticks	
	A. cohaerens	***A. variegatum***
F. brachypoda	71.5	No ticks
Capsicum spp.	5.5	No ticks
F. obovalifolia	68.0	100
S. incanum	11.5	0
Control	0	0

Table 4: **Mean percentage mortality of adult *Amblyomma cohaerens* and *A. variegatum* on 7 cattle treated with 2 plant preparations for 2 consecutive days.**

Plant preparation	Percentage mortality in adult ticks*	
	A. cohaerens	***A. variegatum***
F. obovalifolia	25.0[a]	35.9[a]
F. brachypoda	25.1[a]	35.6[a]
Control	3.6[b]	5.3[b]

*Means with different letters are significantly different ($P < 0.05$).

ACKNOWLEDGEMENTS

The contribution of Dr Julio J De Castro is highly appreciated. Prof. B L Penzhorn commented on the manuscript. Mr Danye Guta assisted in all the tests. The assistance of Messrs Abebe Mekonnen, Tadewos Kassa, Tucho Enkossa, Kahsay Negussie and Ejigu Zeben is gratefully acknowledged.

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Book review — Boekresensie

International animal health code – mammals birds and bees
(9th edition)

2000. Office International des Épizooties, Paris, 473 pp., soft cover. Price €45. ISBN 92-9044-494-0.

The 8th edition of the *International animal health code – mammals, birds and bees* was reviewed in the June issue of the journal. Published at irregular intervals of 3–6 years since 1968, from 1998 it was resolved that the code should be updated annually. Nevertheless, because the subject of disease control is under constant study, new diseases emerge, and printing takes time, the Code is always out of date by the time it appears. Producing it annually is a considerable advance, and since it is not possible for information to become widely available during the development stage, the current Code can be considered, for all practical purposes, the most up-to-date information that is generally available on the control of diseases. I have attempted to identify the more significant changes by comparing the 9th edition with the previous edition.

Improvements include a user-friendly list of List A and List B diseases as a Chapter 1.1.2 under general definitions and notification of diseases. The chapter on evaluation of veterinary services has been completely rewritten. It is much more comprehensive and specific. If rigorously applied, it is likely that many countries, including our own, would fall short of the required standards. The principles and guidelines are excellent, and provide goals for which every country should strive. If all veterinary services were able to achieve the standards indicated, animal health would be much less of a problem. Furthermore, the recommendations are practical and by no means impossible to achieve. The very brief chapter on Aujeszky's disease (pseudorabies) in the 1998 code has been replaced by a much more extensive chapter that covers all precautions required to prevent importation and spread of the disease. It is clear that to obtain disease-free status for Aujeszky's disease the requirements are very strict, and few countries, including South Africa, would easily achieve official free status. The chapter on bovine spongiform encephalopathy (BSE) has been rewritten, but in view of recent developments, including the finding that many countries imported cattle, beef and bone meal from Britain during the critical period, and some changes in case patterns for new variant Creutzfeld-Jakob disease in humans, the recommendations are likely to change again.

Chapters on zoonoses transmissible from non-human primates and *Salmonella enteritidis* and *S. typhimurium* in poultry have been moved to a special section 'Diseases not covered by List A and List B'. The chapter on zoning and regionalisation has been considerably abbreviated. This is probably a natural result of the fact that the concept as described in the 1999 Code was relatively new, and therefore warranted extensive coverage. In the recommendations for foot-and-mouth disease, the information relating to outbreaks in previously free countries is incorporated in the paragraph on infected countries, which is logical, because if an outbreak occurs the country is indeed infected. With respect to both free and infected countries, the recommendations refer to embryos derived *in vivo* rather than fresh or frozen. Recommendations with regard to the importation of *in vivo*-derived embryos from ruminants, horses and swine have been added for vesicular stomatitis. Trichinellosis has been moved from porcine to the multiple species List B diseases.

Various other minor changes, e.g. more specific instructions for control of bluetongue in regions adjacent to the global bluetongue zone, more emphasis on processes that destroy the spores of *Bacillus anthracis* as well as the free bacteria, and removal of references to ova with respect to African horsesickness were noted, and the immunofluorescent antibody test is no longer given as the prescribed test for heartwater.

The appendices have been rather extensively revised. An important addition is a chapter on surveillance and monitoring for BSE. Chapters on certain aspects, *e.g.* lagomorph embryos, have been omitted.

Recent events have shown that an outbreak of diseases can most unexpectedly disrupt the even tenor of life and expose veterinarians, both in the government services and in private practice, to a situation in which they will be expected to answer questions about not only control of the disease, but the implications of the outbreak and the control measures for their clients and for the economy. It is therefore very handy to have the latest Code available for easy reference.

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