POTENTIAL EFFECTS OF NEEM AGAINST FLEAS AND TSETSE FLIES OF VETERINARY IMPORTANCE IN MOROGORO, TANZANIA

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ABSTRACT

The potential of Azadirachta indica (Neem) in the control of ectoparasites of verterinary importance was investigated. Neem seed kernels were obtained from ripe fruits, sun-dried and ground into fine powder. Water extracts of the kernels (NSKE) were prepared by soaking known weights of the powder in known volumes of tap water for 24h.

Two experiments were carried out to study the effect of NSKE on domestic animal fleas and tsetse flies. In the first experiment, ten goats which were heavily infested with C. felis were sprayed with 1% (W/V) NSKE at the rate of 1g/kg body weight, while similarly infested goats were sprayed with tap water. Flea population densities on each animal were determined weekly for 14 weeks consecutively.

In the second experiment, two sites (A & B) were selected at the Dakawa Miombo woodland where tsetse populations were shown to be dense. Three Epsilon traps treated with 4% (W/V) NSKE, 2% of the same stuff, and tap water respectively, were set in each of the two sites. Acetone was put in site B traps to serve as an attractant. Captured flies were collected for 4 consecutive days, at 24h intervals while the traps were rotated daily in order to minimize systemic errors associated with trap positions.

Results showed that mean population densities of fleas were significantly lower in the experimental than control animals every week. It was also observed that more tsetse flies (mostly female Glossina pallidipes) were attracted to water treated traps than to NSKE treated traps, and that traps treated with 2% NSKEattracted more flies than those treated with 4% extract. In addition, traps with acetone attracted much more flies than those without acetone.

It was preliminarily concluded from these studies that NSKE was potentially repellant/insecticidal against livestock flea ectoparasites and that the stuff was significantly repellant against tsetse flies.

Key words: Ctenocephalides felis, Glossina, Neem, Goats

INTRODUCTION

Fleas are important ectoparasitic pests of animals and vectors of human and animal diseases in many countries including Tanzania. Diseases transmitted by these insects include

myxomatosis, sylvatic plague, salmonellosis, brucellosis and murine typhus. The insects also play an important role as intermediate hosts of various parasites such as Dipylidium caninum (dog tape worm), Hymenolepis diminuta (rodent tape worm) and Dipetalonema reconditum (dog filarial worm). In addition, fleas are responsible for causation of ill-health and loss of animal productivity, especially in developing countries where control strategies are not carried out regularly (Kilonzo 1986, Fagbeni 1983, Kilonzo et al. 1996).

Several investigations have revealed that Ctenocephalides felis is the commonest flea ectoparasite of domestic mammals in Tanzania and elsewhere and that dogs, goats, pigs, cats and sheep are the preferred hosts of this flea species (Kilonzo, 1980, 1986, 1996; Cooper 1967; Verhulst 1976).

Despite the heavy infestation of these animals, most farmers in Tanzania do not have a habit of carrying out flea control strategies regularly. This is probably attributable to ignorance, negligence or poverty. In fact, the sanitary status in and around animal barns in most areas is highly favourable for flea breeding and hence facilitates infestation of such animals with the insects. In most modern farms (e.g. institutional farms) however, small mammal houses are mostly cemented or provided with raised wooden floors where the animals sleep. They are also kept clean, and flea infestation is generally less than in farms where animals sleep on dusty floors. This difference was clearly observed during our field collection of parental fleas for the current study (Kilonzo et al. 1997 – Personal observations). In some modern farms, control of ectoparasites, mostly using acaricides, is also carried out regularly or occasionally.

Chemical methods have, in most occasions, been applied in flea control strategies. Although most of the commonly available insecticides are effective against livestock fleas in Tanzania (Kilonzo 1993), they have several disadvantages including large costs, contamination of the environment, toxicity to man, animals and other non-target organisms, and possible development of resistance among the flea populations. Search for alternative flea control methods which are effective, safe, economically and socially feasible and sustainable and which are environmentally, friendly, is therefore desirable. Various natural products including plants such as neem, could be suitable candidates for such alternative.

Tsetse flies, the major vectors of animal and human trypanosomiasis in Africa, are responsible for substantial losses of animal productivity, as well as animal and human lives. As such, the insects play a remarkable role in hindering the development of livestock industry and other sectors of the economy in the continent.

About 160 million heads of cattle (30%) and 50 million people are at risk of being infected with trypanosomiasis in Africa (Msangi et al. 1997). In Tanzania alone, over 60% of the land is infested with tsetse flies. Subsequently, about 75% and 10% of cattle and human populations respectively, are at risk of trypanosomiasis infection (Kihamia et al. 1991; Mbise 1984).

The major species of tsetse flies widely found in Tanzania include Glossina morsitans, G. pallidepes, G. swinnertoni and G. austen: (Kihamia, et al. 1991). The most infested areas are those with suitable vegetation and favourable climatic conditions. These include Miombo and Mopane woodlands (suitable for G. morsitans), thorn savanna with Acacia, Combretum and/or Commiphora plants dotted irregularly over grassy plains (suitable for G. swinnertoni and G. pallidipes) and thicket vegetation (suitable for G. pallidipes).

Several established methods for tsetse control have been applied in many tsetse infested areas of Tanzania and elsewhere. The methods include use of insecticides, traps/barriers, environmental manipulation (bush clearing), burning and male sterile technique (MST). Despite the effectiveness of these methods on the insects, each one has some disadvantages. Most of them (methods) are destructive to the environment and are detrimental to non-target organisms. The sterile male technique is species-specific and has been successfully applied at Mkwaja Ranch in Pangani district against G.m. morsitans. However, the controlled focus was later on re-infested by flies from uncontrolled areas (Williamson et al. 1983). In Zanzibar where the method was recently introduced for controlling G. austeni, tsetse populations have been reduced substantially (Kilonzo 1997- Personal obsevation). However, sustainability of the undertaking and prevention of re-invasion from uncontrolled areas are essential.

Despite all the methods being applied for controlling/eradication of tsetse flies in the country, the insects and their associated problems still exist and play important roles in public and animal heath in the country. As in the case of fleas, search for alternative approaches for controlling tsetse flies in Tanzania and elsewhere is of utmost importance.

Azadirachta indica (Neem plant) has been shown to be potentially larvicidal against C. felis and Xenopsylla brasiliensis in Tanzania (Kilonzo 1991). It has also been proven to be effective against many insect pests of agricultural products and disease vectors elsewhere (Schmutterer 1981; Zebitz 1986; Wilps, 1986). According to Kaaya (1996), topical application of neem seed extract and neem seed oil causes high mortality of adult G.m. morsitans, G.m. centralis and G. pallidipes. The extracts also kill larvae of the G. morsitans groups, and cause deformities in adults arising from sub-lethally treated larvae and pupae. Similar treatment of pregnant female G.m. morsitans and G. pallidipes increase abortions (Kaaya 1996).

MATERIALS AND METHODS

Experimental Animals

Twenty young goats (mostly males), were acquired from farmers in Morogoro Rural and Kilosa districts, and grazed at the University (SUA) campus for about two weeks in order to get acclimatized. They were numbered and ear tagged accordingly. A well-ventilated shelter with a concrete floor, strong walls and rain-proof roof was provided by the University farm and rehabilitated so as to have separate rooms for experimental and control animals. Dry sand was put on the floor of the shelter to a depth of about 5cm to create suitable ecological features for fleas.

Each animal was cleared of all flea and tick ectoparasites by brushing its fur with a piece of cottonwool soaked in anesthetic ether and thoroughly scrubbing it with a shoe-shiner brush, as well as handpicking of visible arthropods. Each animal was then weighed and recorded accordingly.

Neem Material

Neem seed kernels were obtained from ripe seeds harvested from neem trees at the Rodent Research Unit, SUA. The kernels were thoroughly dried in the sun and ground into fine powder, using wooden mortar and pestle and a seaving pan of about 30mm mesh. Water extract of neem seed kernels was prepared by soaking a known weight of the powder in known volume of tap water so that the concentration of the suspension was 1% (W/V). After 24 hours, the suspension was thoroughly mixed up and filtered through a fine netting material or pan.

Experimental Fleas

About 20kg of litter which was heavily infested with adult and immature stages of C. felis was collected from a goat shelter belonging to a farmer at Kilakala ward in Morogoro municipality, and evenly spread on the floor of the experimental and control goat shelter. Likewise, adult fleas were collected from young goats at the same farm and used to infest all the animals at the rate of 250 fleas per animal.

Ten experimental goats were thoroughly sprayed with the NSKE at the rate of 1g/kg body weight. Ten control animals were similarly sprayed with tap water.

The experimental and control animals were kept in separate partitions of the experimental shelter but they grazed together. Population densities of fleas on each animal were determined weekly for 14 weeks except on Day 56 which was skipped due to lack of necessary reagents. The exercise was accomplished by thoroughly brushing each animal with a piece of cottonwool slightly soaked in ether, scrubbing the animal with a brush, counting all the fleas falling onto a white cloth on which the animal was laid, and releasing the insects in the animal shelter after the former recover from ether anaesthesia.

Sites for Tsetse Trapping

The field study was conducted at Makulunge hill area, 26km North of Dakawa ranch headquarters in August 1997. Two sites, designated A and B, on the foot of Kilandili hill area were chosen for the field trials' following a preliminary tsetse trapping exercise which indicated that the two sites had high tsetse concentration in the focus.

The two trapping sites, A and B, are located within a similar habitat type at the edge of a thicket (fringing the hill bottom) and the wooded grassland. The dominant woodland (Miombo) tree species at the two sites include *Acacia nigrescens, Afzelia quenzensis, Bauhinia varregata, Cassia abraviata, Combretum spp, Commiphora africana, Grewia bicolor, Markhamia lutea, Pseudolachnostylis maprouneifolia and Euphobia ingens (*Mbuya et al. 1994). Presence of elephant spoors at site B and artefacts of other large host animals in site A suggested that the two sites were favourable for tsetse flies concentrations.

Experimental Procedures

Three Epsilon traps were treated (sprayed) with either 2% NSKE, 4% NSKE or tap water (Control), and deployed at each of the two trapping sites. The treatments were set on issoceles triangles measuring 16x16x19.4m (site B) and 10x10x11m (site A). Such arrangement allowed the flies to make a choice among the traps. Small aliquots (about 10ml) of acetone contained in small test tubes or Bijou bottles were placed in all the traps at site B to serve as adour attractant. The traps were set between 15.30 and 17.30 hours and checked

at the same time on the following day. All the captured insects were collected, counted, and identified to species level. The traps were rotated among positions each day in order to minimise systematic errors associated with positions (FAO, 1992).

RESULTS

Flea Infestation of Experimental and Control Goats

The flea indices were significantly lower on experimental than on control animals on each day of counting except Day 0 when such densities were the same prior to spraying of the goats (Table I and Figure. I). A total of ten animals (7 control and 3 experimental) died during the course of the study. Pathological analyses carried out at the Faculty of Veterinary Medicine showed heavy infection with Haemonchus worms in most of the carcasses. In addition, the flea infestation on the dead animals, especially those in the control group, was high.

Species and Numbers of Insects Captured in Sites A and B

The following species of flies, among several others, were trapped: Glossina pallidipes, G. morsitans, Tabannus spp., Musca domestica and Periplaneta spp. Average numbers of tsetse flies per trap per day in site A (without acetone) were 13.3, 11.7 and 5.3 for traps treated with water, 2% NSKE and 4% NSKE respectively. Corresponding data in site B (with acetone) were 85.0, 71.0, and 56.0 respectively (Table 2 and Figure.2).

Table 1: Population densities of Ctenocephalides felis on goats treated with neem seed extract.

Days after Treatment	Numbers of animals infested					
	Experimental animals			Control animals		
	No. animal treated	No. fleas collected	Flea index	No. animals Treated	No. fleas collected	Flea index
Day 0	10	2500	250	10	2500	250
Day 7	10	890	89	10	2329	232.9
Day 14	8	533	66.6	10	1512	151.2
Day 21	8	1196	149.5	9	2203	244.8
Day 28	8	1456	182	9	2298	255.3
Day 35	8	878	109.8	8	1937	242.1
Day 42	7	1001	143	8	1762	220.3
Day 49	7	752	107.4	8	2838	354.8
Day 63	7	933	133.3	7	2407	343.9
Day 70	7	1583	226.1	7	2870	410
Day 77	7	2003	286.1	4	2411	602.8
Day 84	7	2201	314.4	4	2245	561.3
Day 91	7	1644	234.9	3	863	287.7

Table 2: Mean numbers of tsetse flies trapped in sites A and B

Trap No.	Concentration of NSKE (%)	Mean fly nos./trap/day	
		Site A	Site B
1	0 (Control)	13.3	85.0
2	2.0%	11.7	71.0
3	4.0%	5.3	56.0

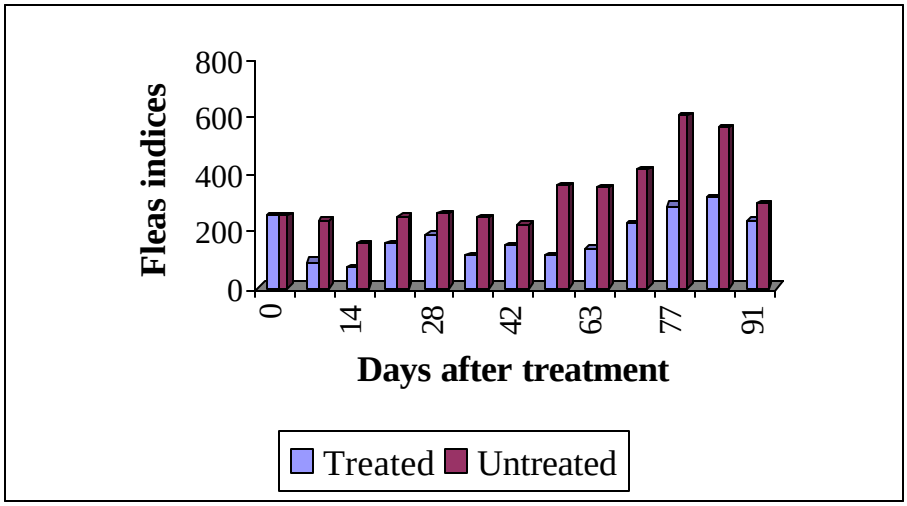

Figure 1: Fleas infestaion of neem treated and non-treated goat

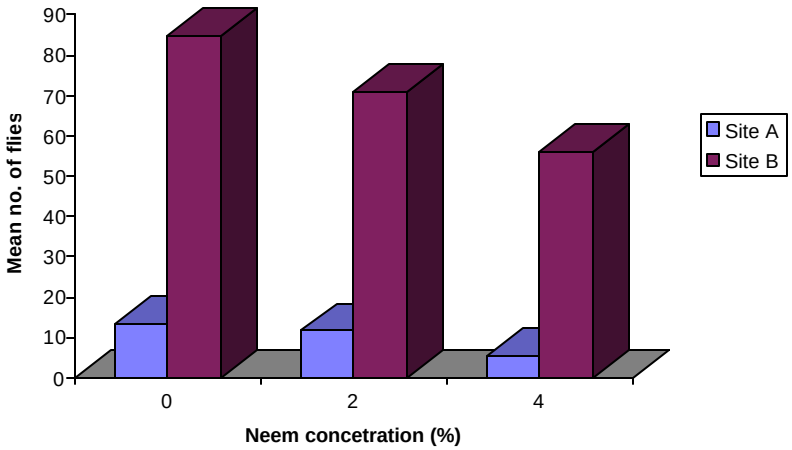

Figure 2: Mean tsetse fly number stapped in sites A and B

DISCUSSION

Effects of Neem on Fleas

The fact that all the animals were initially infested with equal numbers of fleas, equally exposed to a highly infested shelter, and grazed together all the time, suggests that the insects had equal chances of infesting all the goats. The observation that the population densities of fleas were significantly lower on experimental than control animals from Day 7 to Day 91 can be attributed, at least partly, to lethal or repellant effects of the NSKE on the flea species in question. The large number of control animals that died in the course of the experiment can be attributed to heavy flea infestations in addition to Haemonchus infections. Before the observations can be affectivity applied by farmers however, further research to establish whether NSKE is repellent or insecticidal against livestock fleas, the active ingredients responsible and the main period of activity on the animal body is desirable.

The current observations further indicate that G. pallidipes is the commonest species of tsetse fly in the study area, a fact which is mostly attributable to the prevailing thicket habitat in the area.

Traps treated with acetone contained significantly more flies than those without. This is consistent with reports by other researchers that tsetse flies are attracted by various odours which are associated with some compounds including animal urine and acetone (Muangirwa et al. 1997).

The present results have revealed that NSKE repels tsetse flies. The observations therefore preliminarily suggest that animals can be sprayed with NSKE so that tsetse flies visiting such hosts are repelled before feeding and consequently fail to transmit trypanosomes from one animal to another. Furthermore, flies which will tolerate the repellence effect of NSKE, may be killed since NSKE is also fatal (Kaaya 1996). However, further research to determine the active ingredients responsible for the repellent effect and their optimum concentration(s) need to be undertaken.

CONCLUSION

Basing on the current observations and those of Kaaya (1996), it can be justifiably argued that neem seed extracts are either repellent or fatal against the commonest livestock fleas in Tanzania, and that the materials are both toxic and repellent against common East African species of tsetse flies. They can therefore be considered for inclusion in integrated Pest Management (IPM) programmes against tsetse and fleas in future.

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