Predation of livestock ticks by chickens as a tick-control method in a resource-poor urban environment

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ABSTRACT

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The possible use of chickens as predators of livestock ticks was studied. Chickens were allowed to scavenge for 3 h among tick-infested cattle in a typical township backyard during the milking period. *Boophilus decoloratus, Hyalomma marginatum rufipes, Rhipicephalus evertsi evertsi* and *Otobius megnini* were recovered from the crops and gizzards at necropsy. The numbers of ticks ingested ranged from 0–128, with an average of 28,81 (± 8,42) per chicken. This study has confirmed that chickens are natural predators of livestock ticks and that chickens can be used as part of an integrated tick control plan in urban cattle-management systems in resource-poor communities in South Africa.

Keywords: Cattle, chickens, control, livestock, tick-control methods, ticks

INTRODUCTION

Cattle, which are an important source of milk, fuel and meat in the resource-poor peri-urban agricultural systems of small-scale farmers in South Africa, are periodically subjected to heavy tick infestations, especially of *Boophilus decoloratus*. This was confirmed during a study done at Botshabelo, a city located on the central highveld area of the Free State Province. Eleven different tick species were identified on cattle in the area and in June 1996, *Boophilus decoloratus* peaked at an average of 1133,06 ± 138,20 adult ticks per individual bovine (n = 50) (Dreyer 1997). A serological survey confirmed the presence of two tick-borne diseases, *Babesia bigemina* and *Anaplasma marginale.* Both haematogenous diseases can cause considerable economic losses in production and reproduction, causing deaths, abortions, decreased meat and milk production and unthriftiness (Ilemobade 1992). Other tick-related problems observed were abscesses caused by the *Hyalomma* spp., and open wounds at the aggregation sites of *Rhipicephalus gertrudae, R. follis* and *R. punctatus.* Some form of strategic tick control would be necessary to reduce the debilitatingly high tick numbers and other tick-related problems among livestock already in poor condition due to the overgrazed communal grazing and harsh sourveld winters (Dreyer, unpublished data 1995–1996). A variety of control methods, conventional and traditional (the application of used engine oil), are currently employed to control the large tick numbers. An intensive tick-control plan in these systems would be uneconomical, difficult to sustain and possibly harmful to the endemic stability of tick-borne diseases, such as anaplasmosis, that exist in some of the areas (Dreyer 1997). In recent years there has been an increased interest in alternative tick-control methods (Moran, Nigarura & Pegram 1996) that are environmentally friendly, relatively cheap and can involve

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farmers directly in tick management (Mwangi, Hassanali, Essuman, Myandat, Moreka & Kimondo 1995). One such alternative is the use of chickens as a biological control method for ticks.

Relatively little is known about birds as predators of ticks, and references are frequently based on single observations and non-quantitative reports (Petney & Kok 1993). The only bird species whose role in tick control has been evaluated extensively is the red-billed oxpecker, *Buphagus erythrorhynchus* (Moreau 1933; Van Someren 1951; Stutterheim 1976; Bezuidenhout & Stutterheim 1980). Ixodid ticks form the major food component of these free-living birds and an average of 408 ticks can be consumed on a daily basis (Bezuidenhhout & Stutterheim 1980). Chickens are also natural predators of ticks when they are kept in close association with livestock (Hassan, Dipeolu, Amoo & Odhiambo 1991; Hassan, Dipeolu & Munyinyi 1992). There are about three billion scavenging chickens in the villages of the developing world (Roberts 1995). These chickens serve many purposes such as nutrition for the family, a small cash flow, a sanitation service and a reserve for times of celebration or need. In such a husbandry system, chickens can play an important role in the biological control of ticks as part of an integrated tick-management plan (ITMP).

The aim of this study was to determine the feasibility and effectiveness of using chickens as predators of ticks within the existing livestock-management practices in a township environment in South Africa.

MATERIALS AND METHODS

The study was conducted in Botshabelo (29°15′S; 26°42′E) from January to April 1996. Botshabelo is situated in the Free State, 55 km to the east of Bloemfontein. Cattle are kept overnight in the enclosed backyards of their owners and are released after the morning milking to graze on the outskirts of the city.

Sixty percent of the livestock owners keep indigenous chickens (*Gallus gallus domesticus)*, with an average flock size of 9,4 (± 1,04; $n = 100$) (Dreyer 1997). Small quantities of maize are given to the chickens in the late afternoons when they are returned to their pens, but during the day they are allowed to scavenge for food in the backyards. In Botshabelo, chickens normally scavenge among the cattle for 3 or 4 h (06:00–09:00) before cattle are released onto the commonage for grazing. One livestock owner following the typical backyard system was visited once weekly for nine consecutive weeks (8 February to 11 April 1996), in the early morning before his chickens were released from the pen for scavenging. At the onset of the survey there was a total of 38 chickens in the flock, including all age groups. On each occasion two chickens, each ± 5 months old, were randomly chosen among those in the pen, marked and subsequently released with the other chickens into the backyard. They were allowed to scavenge within the yard for 3 h, while their pecking activities around and on cattle were observed. No tick counts were done on these cattle, but visual examination showed that animals remained infested throughout the study. Immediately after this period of scavenging, the two chickens were slaughtered, their digestive tracts removed and the contents of the crops and gizzards examined under a dissecting microscope. The ticks found in the crops and the gizzards were identified and counted separately. In the gizzards, where some ticks had undergone digestion, a scutum was counted as one tick (Bezuidenhout & Stutterheim 1980). A total of 16 chickens were slaughtered over the 9-week period.

RESULTS

The species and numbers of ticks recovered from the crops and gizzards of the chickens ($n = 16$) are presented in Table 1. A total of 461 ticks represening four different species were recovered. Only 19,8% of the ticks were engorged. The numbers of ticks recovered from a single chicken ranged from 0–128, with an average of 28,81 (± 8,42). A total of 97,4% of the 461 ticks consumed was *B. decoloratus*, with *R. evertsi evertsi* comprising 1,7% and *H. marginatum rufipes,* 0,65%. The nymphs found, belonged to *B. decoloratus.* A single *Otobius megnini* nymph was also recovered. Significantly more ticks ($t = 3,4$; $p < 0,002$), were recovered from the crops (28,38 ± 8,29) compared to the gizzards (0,38 ± 0,18).

Observations showed that the cattle acknowledged the presence of chickens and allowed them to feed on attached ticks. Predation was easier when most of the cattle were recumbent early in the morning, making the udders and dewlaps more accessible. The chickens also pecked ticks from the lower parts of the legs.

DISCUSSION

The results evidently show that chickens in Botshabelo are natural predators of livestock ticks. This is in accordance with the findings of Hassan *et al.* (1991), who recovered a total of 1 722 ticks from 16 chickens scavenging among cattle with high tick infestations, in a study done in Kenya. *Boophilus decoloratus* was the most numerous tick species recovered (97,4% of all ticks consumed), and this finding is consistent with the fact that *B. decoloratus* is the most abundant tick species on cattle in Botshabelo, constituting 86 % of the ticks recovered from cattle during an extensive survey in the area (Dreyer 1997). Another factor contributing to the large

TABLE 1 Numbers and species of ticks recorded from the crops and gizzards of chickens allowed to scavenge for ± 3 h among tick-infested cattle, excluding the single *Otobius megnini* found

Chicken	Organ	*Boophilus decoloratus*			*Rhipicephalus e. evertsi*		*Hyalomma m. rufipes*		Total ticks
		M	F	N	M	F	M	F	
1	Crop	–	4	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	4
2	Crop	3	7	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	10
3	Crop	–	–	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	0
4	Crop	–	23	–	1	3	–	–	
	Gizzard	–	–	–	–	–	–	–	27
5	Crop	1	13	–	–	3	–	–	
	Gizzard	–	–	–	–	–	–	–	17
6	Crop	31	93	2	–	–	–	–	
	Gizzard	1	1	–	–	–	–	–	128
7	Crop	–	2	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	2
8	Crop	–	47	–	–	–	–	–	
	Gizzard	–	1	–	–	–	–	1	49
9	Crop	2	19	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	21
10	Crop	3	25	1	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	29
11	Crop	–	2	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	2
12	Crop	–	42	–	–	–	–	–	
	Gizzard	–	–	–	–	–	–	–	42
13	Crop	1	2	–	–	–	1	1	
	Gizzard	–	–	–	–	–	–	–	5
14	Crop	4	61	–	1	–	–	–	
	Gizzard	–	–	–	–	–	–	–	66
15	Crop	–	4	–	–	–	–	–	
	Gizzard	–	1	–	–	–	–	–	5
16	Crop	1	51	–	–	–	–	–	
	Gizzard	–	1	–	–	–	–	–	53
	Total	47	*399*	*3*	*2*	*6*	*1*	*2*	
Totals of each tick species recovered		449			8		3		460

F = female; M = male; N = nymph

numbers of *B. decoloratus* consumed, might be the accessibility of the attachment sites of this species (dewlap, stomach and legs) for the chickens, as opposed to the less accessible attachment sites (perineum and inguinal area) of *R. evertsi evertsi* and *H. marginatum rufipes*.

Hassan *et al.* (1992) concluded that the interspecies differences in tick numbers recovered from chickens do not reflect a preference for a certain tick species, but is a reflection of the relative abundance of the tick species present on cattle, for a specific area. Similar observations have been made on two oxpecker species which prey exclusively on ticks (Stutterheim, Bezuidenhout & Elliot 1988).

The large number of unengorged ticks consumed (80,2 %) verifies the direct observation that chickens prey on ticks attached to the bodies of the cattle. Attached ticks are exposed, defenseless and of high nutritional value, and are therefore ideal prey items (Petney & Kok 1993). The size of ticks plays an

important role in the process of pecking of ticks on cattle by chickens (Hassan *et al.* 1991). Adult ticks are more easily visible and this might explain why no larvae and only a small number of nymphs and *B. decoloratus* males were preyed upon.

The results of this investigation are not conclusive enough to assess the role of chickens realistically as part of an integrated tick-management plan. The possible toxic effect on chickens of ingesting ticks that have been exposed to certain acaricides in an integrated control plan, needs to be evaluated. There is evidence that oxpecker numbers decreased where cattle dipping was carried out regularly (Van Someren 1951). However, not all acaricides are toxic to birds, and the use of chickens as a biological tick-control method can be incorporated with the strategic use of "chicken friendly" acaricides. The situation in the Botshabelo area is favourable for the use of chickens, because 31% of the farmers use no tick-control methods and 35% use traditional methods such as the application of used engine oil or Jeyes Fluid (disinfectant and cleanser; carbolic acid, coefficient 4:6) (Dreyer 1997).

To succeed in Africa, an integrated tick-control plan must be inexpensive, focused on the needs of the farmers and fit in with their local, social and environmental conditions (Dipeolu *et al.* 1992; Kaaya 1992). The existing management system of keeping and milking cattle in backyards makes the use of chickens as tick predators very feasible, without it requiring any major changes to husbandry and management. The art of scavenging for ticks is not inherited, but acquired by chickens, irrespective of breed (Hassan *et al.* 1992). Local chickens bred in backyards where cattle are kept, learn the art as chicks when they accompany their mothers for scavenging. Cows are milked twice daily for 2–3 h and chickens can be allowed to scavenge among the cattle during these periods. The numbers of ticks consumed in 3- and 4-h-release intervals were not found to be significantly different (Hassan *et al.* 1992), so farmers need to allow scavenging for only a 3-h period (i.e. during milking time) to get a significant reduction of ticks on their cattle.

In conclusion, this study has confirmed that chickens are natural predators of livestock ticks, and has also demonstrated that prospects are good for tick predation by chickens to make a positive contribution to low-cost, environmentally safe tick control in townships and rural villages in South Africa.

REFERENCES

BEZUIDENHOUT, J.D. & STUTTERHEIM, C.J. 1980. A critical evaluation of the role played by the red-billed oxpecker *Buphagus erythrorhychus* in the biological control of ticks. *Onderstepoort Journal of Veterinary Research*, 47:51–75.

DIPEOLU, O.O., MONGI, A.O., PUNYUA, D.K., LATIF, A.A., AMOO, A.O. & ODHIAMBO, T.R. 1992. Current concepts and approach to control of livestock ticks in Africa. *Discovery and Innovation*, 4:35–44.

DREYER, L. 1997. Occurrence and control of parasites on cattle in urban and peri-urban environments with specific reference to ticks. *Unpublished M.Sc. thesis, University of the Orange Free State.*

HASSAN, S.M., DIPEOLU, O.O., AMOO, A.O. & ODHIAMBO, T.R. 1991. Predation on livestock ticks by chickens. *Veterinary Parasitology*, 38:199–204.

HASSAN, S.M., DIPEOLU, O.O. & MUNYINYI, D.M. 1992. Influence of exposure period and management methods on the effectiveness of chickens as predators of ticks infesting cattle. *Veterinary Parasitology*, 43:301–309.

ILEMOBADE, A.A. 1992. Anaplasmosis, babesiosis and cowdriosis in the West African sub-region: distribution, economic importance and control measures, in *Recent Developments in the Control of Anaplasmosis, Babesiosis and Cowdriosis: Proceedings of a Workshop Held at ILRAD, Nairobi, Kenya, 13–15 May 1991,* edited by T.T Dolan. Nairobi: The International Laboratory for Research on Animal Diseases: 43–47.

KAAYA, G.P. 1992. Non-chemical agents and factors capable of regulating tick populations in nature: a mini review. *Insect Science Application*, 13:587–593.

MORAN, M.C., NIGARURA, G. & PEGRAM, R.G. 1996. An assessment of host resistance to ticks on cross-bred cattle in Burundi. *Medical and Veterinary Entomology*, 10:12–18.

MOREAU, R.E. 1933. The food of the red-billed oxpecker, *Buphagus erythrorhychus* (Stanley). *Bulletin of Entomological Research*, 24:325–335.

MWANGI, E.N., HASSANALI, A., ESSUMAN, S., MYANDAT, E., MOREKA, L. & KIMONDO, M. 1995. Repellent and acaricidal properties of *Ocimim suave* against *Rhipicephalus appendiculatus* ticks. *Experimental and Applied Acarology*, 19:11–18.

PETNEY, T.N. & KOK, O.B. 1993. Birds as predators of ticks (Ixodoidea) in South Africa. *Experimental and Applied Acarology*, 17:393–403.

ROBERTS, J.A. 1995. Assessing the scavenging feed resource base for sustainable smallholder poultry development. *Symposium of the African Network for Rural Poultry Development, June 1995, Addis Ababa, Ethiopia.*

STUTTERHEIM, C.J. 1976. The biology of the red-billed oxpecker, *Buphagus erythrorhychus* (Stanley, 1814) in the Kruger National Park. M.Sc. thesis, University of Pretoria.

STUTTERHEIM, I.M., BEZUIDENHOUT, J.D. & ELLIOTT, E.G.R. 1988. Comparative feeding behaviour and food preferences of oxpeckers (*Buphagus erythrorhynchus* and *B. africanus*) in captivity. *Onderstepoort Journal of Veterinary Research*, 55:173–179.

VAN SOMEREN, V.D. 1951. The red-billed oxpecker and its relation to stock in Kenya. *East African Agricultural Journal*, 17:1–11.