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Use of insecticide-treated nets to protect cattle against insects of veterinary and medical importance in Ghana

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Zusammenfassung

Bei einer in Kenia durchgeführten Untersuchung konnten Milchkühe durch Umzäunung der Stallungen mit Insektizid behandelten Polyesternetzen (Höhe 150 cm) wirksam gegen Tsetsefliegen und Übertragung von Trypanosomen geschützt werden (Bauer et al., 2006). Außerdem deutete sich an, dass in der Umgebung der Stallungen die Belästigung durch Fliegen und Stechmücken merklich zurückging. Diese Beobachtungen sollten auf dem Gelände der Rinderfarm der Universität Kumasi im Waldgebiet Ghanas in einem Pilotversuch überprüft werden, und es sollte untersucht werden, ob solche Netze zum Schutz gegen human- und veterinärmedizinisch wichtige Insekten zum Einsatz kommen können. Ein mit zwei Zebubullen besetzter Versuchsstall (6 m x 7 m, Fig. 1) wurde mit einem mit Deltamethrin imprägniertem Polyesternetz (Höhe 100 cm) umzäunt und der Anflug medizinisch wichtiger Insekten über einen Zeitraum von sechs Wochen gemessen (Anflug von Stechmücken an Menschen, Einflug von Fliegen in monokonische Fallen, Fang Blut saugender Mücken in mit Duftstoffen versehenen Mückenfallen). Als Kontrollen dienten drei weitere Ställe: ohne Netz mit Zebubullen, Netz ohne Imprägnierung mit Zebubullen, ohne Netz ohne Zebubullen. In dem mit Insektizidnetz geschütztem Stall wurden deutlich weniger medizinisch und veterinärmedizinisch wichtige Insekten gefangen als in den Kontrollstallungen.

Introduction

The successful protection of dairy cattle in Kenya with a 150 cm high fence of insecticide-treated mosquito netting (Bauer et al., 2006) against tsetse-transmitted trypanosomosis inspired a pilot trial near Kumasi, in the forest zone of Ghana. Observations of the participating farmers during the first trial in Kenya had also indicated a reduction of the mosquito populations. This time, a deltamethrin-treated fence of 100 cm height was tested for its potential to protect cattle against mosquitoes, biting and nuisance flies of veterinary and medical relevance. In areas of high densities of these insects the use of nets may have additional human health benefits by controlling vectors of diseases, such as sleeping sickness, malaria or leishmaniasis.

Project Description and Results

The trial site was the cattle research farm of the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana; N 6° 41'; W 1° 32'. Four identical experimental pens A, B, C and D (Fig. 1) each measuring 6 m x 7 m were constructed at a distance of about 500 m from each other in locations with similar vegetation. Half of each pen was covered with corrugated iron sheets. Chicken wire at a height of 100 cm to protect the nets surrounded each pen.

Pen A served as control without net and animals; B was protected with an untreated net; C had no net and D was protected with the deltamethrin treated net (polyester, 25 holes/inch^2, height 100 cm). B, C and D had two zebu bulls which were rotated between the three pens at weekly intervals. Effects of the treated netting on fly and mosquito populations were compared at weekly intervals during six weeks in October and November 2005.

Human landing catches were carried out once a week from 6pm to 6am (12 h) within and 20 m outside the four pens. Fourteen mono-conical traps developed to catch tsetse flies and other nuisance insects were placed 20 to 30 m away from the four pens and at watering places between the pens. Four odour-baited battery-driven mosquito traps designed to catch anthropophilic mosquitoes (BG-Sentinel® Mosquito Traps, BioGents GmbH, Regensburg) were operated within the four pens once a week from dusk to dawn (12 h) a day before the human landing catches. Digital pictures of all animals were taken twice per week in order to count and compare the number of nuisance insects for each bull.

Main results are summarized in Table 1. Two *Anopheles* species were caught on human bait, *A. gambiae* (probably sensu stricto), which is the main vector of malaria in the area, and *A. ziemanni*, which generally is regarded as zoophilic. The monthly biting rate (MBR) of 140 estimated for *A. gambiae* inside the protected pen D was about 60% of that of B and C (255 and 210, resp., both with cattle), but only 23% of that of A (605, without cattle). Examination of *A. gambiae* and *A. ziemanni* for infections with *Plasmodium* spp. by using ELISA tests are in progress. Numbers of Culicinae (*Culex* spp., *Mansonia* spp.) caught inside pen D were about 31% of that of A, B and C.

Table 1: Total numbers of insects caught on human bait, in mono-conical traps and mosquito traps.
A control pen, no net, no animals;
B with two zebus, protected with untreated net;
C two zebus, no net;
D two zebus, protected with treated net.

Pens		A	B	C	D
Human landing catch					
Anopheles gambiae s.l.	Inside	121	51	42	28
	Outside	31	37	45	33
Anopheles ziemanni	Inside	18	57	28	32
	Outside	175	125	117	77
Culicinae	Inside	379	514	348	128
	Outside	520	650	405	321
Mono-conical traps (outside pens)					
Muscinae		65	389	498	37
Stomoxyinae		16	599	587	27
Tabanidae		7	6	3	5
Mosquito traps (inside pens)*					
Anopheles	*gambiae*	3	4	1	4
	ziemanni	1	4	10	6
Culicinae		127	388	266	128
Ceratopogonidae		0	1529	817	441
Phlebotominae		112	389	260	171

* Mosquito traps were operated for only 4 nights in Pen A instead of 6 nights in Pens B, C and D.

The majority of insects caught by the mono-conical traps were Muscinae and Stomoxyinae (house and stable flies). A strong increase of the catches observed near pens B and C during weeks three and four may be attributed to the excellent breeding conditions in cow dung and remnants of fodder, which were regularly removed from the pens and deposited nearby. Fly densities did not increase at the protected pen D, where numbers of Stomoxyinae only reached 4.6% of that of B and C. Very few flies were caught near A, where no cows were kept (2.7% of B and C). Evaluation of digital photographs of selected body parts showed significantly fewer biting and nuisance flies per zebu in pen D (14.1) than in B (47.2) and C (49.7). The untreated net of pen B was not an effective physical barrier for the flies. No tsetse flies were caught indicating their low density or even absence in the study area.

The odour-baited mosquito traps turned out to be less efficient than the human landing catch. They mainly attracted Culicines, but only few *Anopheles*. However the traps provided useful information on Ceratopogonidae (biting midges) and Phlebotominae (sandflies), both of relevance in human and veterinary medicine.
Clear effects of the insecticide-treated fence were recorded for almost all groups of insects, but results differed depending on the catching method. Irritation of cattle by high numbers of flies and mosquitoes may affect productivity leading to lower weight gains or milk yields. Protecting livestock therefore not only reduces disease transmission but also increases animal production and income. Considering the importance of nuisance and biting flies the use of insecticide-treated fences is likely to have far-reaching benefits for livestock keepers and pastoral communities. Further experiments will be necessary to investigate the potential of insecticide-treated fences as an efficient protection against vectors of medical importance.

Selected Publications

- Bauer B et al. **2006**. Evaluation of a preliminary trial to protect zero-grazed dairy cattle with insecticide-treated mosquito netting in Western Kenya. Trop. Anim. Hlth and Prod., 38, 1, 29 – 34.

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- Vestergaard Frandsen/AS, Kolding, Denmark, Lausanne, Switzerland

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Figure 1: Experimental pen with two zebus protected with deltamethrin treated net.