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Trypanotolerance. An individual not a breed character

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Summary

Ten animals from a reputedly trypanosensitive bovine breed, the Zebu, and ten from a reputedly trypanotolerant breed, the Baoulé, were exposed to natural trypanosome challenge in an area of high *Glossina* density. The ten Zebus and five of the Baoulés died within 6 to 11 weeks with heavy parasitaemia and severe anaemia. The five other Baoulés showed little or no parasitaemia, no anaemia and were all in good condition after weeks of exposure: Seven animals of a herd of Baoulé/Ndama crosses indigenous to the same area were followed concurrently and showed very rare or no patent parasitaemia. Clearly, only some individuals within a “trypanotolerant breed” are able to withstand natural fly challenge. Selection of trypanotolerant animals has to be done on an individual basis and not on the biometrical characteristics of the breed.

Key words: African trypanosomes; trypanotolerance; bovid; Zebu; Baoulé.

Introduction

Bovine trypanosomiasis is a major constraint to protein production in intertropical Africa (Mulligan, 1970). Vector eradication and prophylactic use of drugs have not succeeded in eradicating the disease while hopes of vaccination appear hampered by the extreme antigenic variability of trypanosomes (reviewed in Doyle, 1977; Roelants and Williams, 1982). Consequently, efforts are made to develop breeds of cattle which are more resistant to the disease (ILCA, 1979). The concept of “trypanotolerance” is mainly based, however, on

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geographical epidemiological observations showing that some cattle breeds can survive in *Glossina* infested areas (e.g. Baoulé, Ndama, Muturu, Lagune) but others cannot (e.g. Zebu, European breeds) while less attention has been devoted to the behaviour of individual animals (reviewed in Roelants and Pinder, in press).

We have shown that Zebus and Baoulés from the Southern part of Upper-Volta, were of similar sensitivity to syringe infection with *T. vivax*, *T. congolense* and *T. brucei brucei*, all the animals self curing the infection, while Zebus from outside the *Glossina* belt and Simmental/Ndama crosses were highly sensitive (Guidot and Roelants, 1982; Pinder et al., submitted). It thus appeared that Zebus from herds introduced in *Glossina* infested areas may acquire a certain degree of trypanotolerance. To evaluate the extent of this tolerance we have exposed such Zebus and Baoulés to natural infection in an area of high *Glossina* challenge and compared their behaviour to that of herd of Baoulé/Ndama crosses indigenous to that area.

Materials and Methods

Ten healthy, two-year-old male Zebus and Baoulés from the C.R.T.A. animal farm (Ferme Expérimentale de Banankélédaga) were moved in January 1982 to a ranch (Station Bovine de Samandéni) located 50 km north of Bobo-Dioulasso along the Black Volta river where they became naturally exposed to *Glossina*. Seven Ndama/Baoulé crosses from a herd maintained on this ranch for more than 12 years were taken for comparison. Average numbers of flies caught daily in 10 Challier-Laveissière (1973) biconical traps were 60 *G. palpalis*, 60 *G. morsitans submorsitans* and 1 *G. tachinoides* in the pasture used from January to April and 10 *G. palpalis*, 22 *G. morsitans submorsitans* and 10 *G. tachinoides* in the pasture used from April to July.

Once a week for 26 weeks (Tuesday, from 7 AM) clinical signs were recorded (Vohradsky, 1971) and jugular blood was examined for parasitaemia and packed cell volume (PCV) as a measure of anaemia (Murray et al., 1977).

Results

Parasitaemia and time to death are shown in Fig. 1. All Zebus showed heavy parasitaemia and died within 11 weeks. Five of the 10 Baoulés behaved similarly to the Zebus but the five others showed occasional or no parasitaemia and were in good health when the experiment was terminated after 26 weeks. The 7 Ndama/Baoulé crosses showed very rare or no detectable parasitaemia. The trypanosome species detected on microscopic examination were *T. vivax* alone (20%), *T. congolense* alone (20%) or both (60%). Upon mouse subinoculation *T. b. brucei* was also detected (15%). The four positive samples found in the Ndama/Baoulé crosses were *T. vivax*.

Anaemia is the most important pathological feature of bovine trypanosomiasis (Murray, 1979). The 10 Zebus and the 5 susceptible Baoulés developed anaemia with the appearance of infection and died with PCV values of about 16 (Table 1). This was accompanied by fever, listlessness and loss of weight.

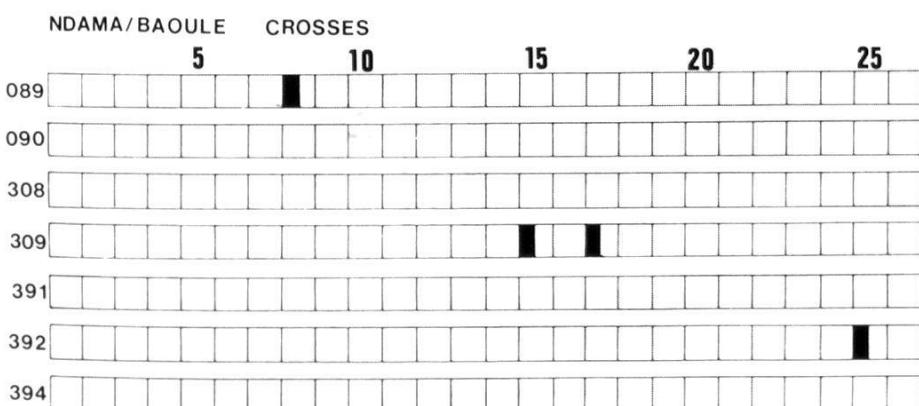
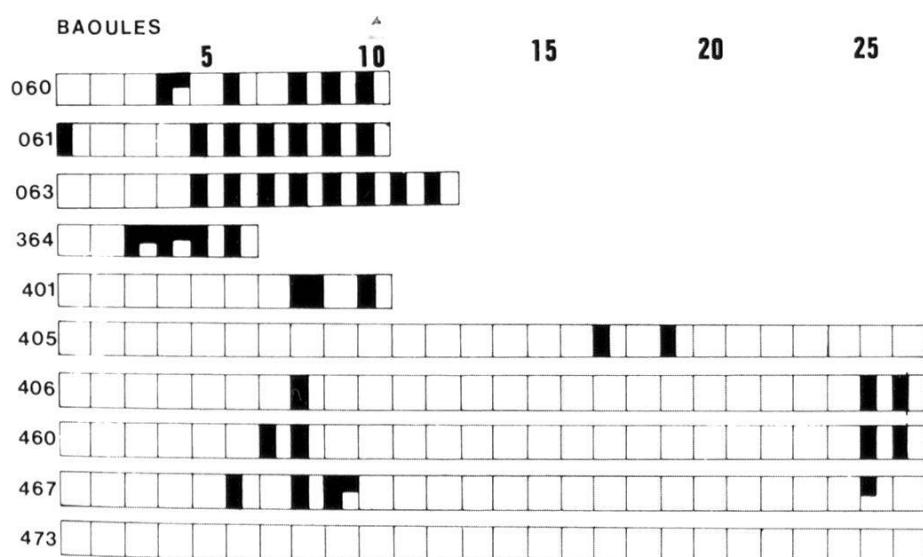
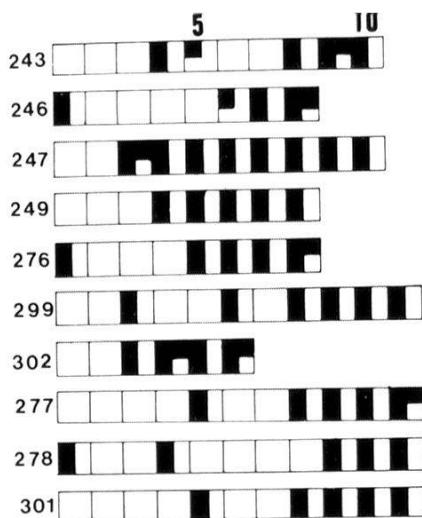


Fig. 1. Parasitaemia in jugular blood.

- = no detectable parasitaemia at the level of 10^3 organisms/ml
- = 10^3 – 10^5 /ml
- = 10^5 – 10^6 /ml
- = 10^6 – 10^7 /ml
- = $>10^7$ /ml

Boxes represent weekly examination, interruption of the boxes means that the animal has died. The observation was stopped after 26 weeks.

Table 1. Anaemia (PCV) in trypanosome infected animals*

	Start of experiment	Weeks of death	26th week
Zebus	32 (27-35)	17 (10-26)	-
Baoulés	35 (29-39)	16 (7-26)**	32 (28-37)***
Ndama/Baoulés	32 (29-41)	-	35 (29-44)

* arithmetic mean (range)

** animals no 060, 061, 063, 364, 401

*** animals no 405, 406, 467, 473, animal 460 PCV fell around 20-25 the 18th week of the experiment and remained at that level.

Necropsy showed typical signs of terminal trypanosomiasis (Fiennes, 1970). The five resistant Baoulés and the 7 crosses did not show anaemia (Table 1) nor symptoms.

Discussion

This study clearly demonstrates that within a herd of a so-called "trypanotolerant breed" there are both sensitive and resistant animals. Compilation of all the data reported in the literature corroborates this finding: approximately 40% of animals of breeds designated as trypanotolerant die under natural challenge conditions, while some animals of trypanosensitive breeds (about 10%) can survive such conditions (Roelants and Pinder, in press). Evidently, resistant animals have to be defined and selected on an individual and not a breed basis, as is done at present. This may be particularly important when only a few bulls are selected for reproduction.

Zebus and Baoulés from the same origin as those used in the present study did all self cure after needle challenge with isolates of *T. vivax* and *T. congolense* (Guidot and Roelants, 1982) or a clone of *T. b. brucei* (Pinder et al., submitted). Thus, only natural challenge appears to distinguish resistant from sensitive animals and is the only method of selection currently available. Whether challenge with captured infected flies would operate the selection is under investigation.

It remains to be proven that the resistant status of an animal can be transmitted genetically. Even in the herd of Ndama/Baoulé crosses maintained at the Samandéni ranch, whose adult animals appear quite resistant, many young calves die and it has been reported that about 20% of Baoulés of a herd maintained in a *Glossina* infected area die of trypanosomiasis before 6 months of age (Camus, 1980). Thus, it is possible that natural selection of resistant animals is made at each generation.

Those animals that survive do so with low infrequent or no parasitaemia.

This was also found by Murray et al. (1979). There is no evidence to support the claim that trypanotolerant animals maintain themselves in good condition while harbouring trypanosomes (Pagot, 1974). This apparent resistance to infection is not due to a more effective antibody response (Pinder et al., submitted). Moreover, serum of resistant animals failed to inhibit the infectivity of *T. congolense* for mice (Pinder and Van Melick, unpublished). Early events in the skin reaction at the location of the infected fly bite may be determinant (Akol and Murray, 1982) and it has not been excluded that trypanotolerant cattle are less attractive for *Glossina*.

Selection of individual resistant and sensitive Baoulés for studies on the genetics and the mechanism involved is under way.

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