GENETIC RESISTANCE TO GASTRO-INTESTINAL PARASITES IN CREOLE GOATS BRED UNDER A HUMID TROPICAL CLIMATE

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SUMMARY

The purpose of the research carried out by the INRA in Guadeloupe (F.W.I.) since 1993 on genetic resistance of Creole goats to gastro-intestinal nematodes, is to introduce this new trait into breeding schemes for grazing small ruminants. The problems of criterions, objectives and environment of the selection are set. The presented experiment has been running since 1996, with a known status of 20 sires up to now. Genetical variability of resistance increases with the age of kids: the highest is observed at 8 months for square-root-transformed faecal egg counts and at 10 months of age for packed cell volume. Liveweight of kids bred on infected pastures presents a genetic variability in contrast to liveweight of heavily treated kids. Genetic relationship between FEC and growth in infected pastures seems to be favourable.
Keywords: gastro-intestinal parasite, genetic resistance, creole goat

INTRODUCTION

Internal parasites represent the main disease constraint for small ruminants under tropical environments (Faugère *et al.* 1991). They induce high mortality rates before weaning and losses of production during fattening (Aumont *et al.* 1997). Including a genetic resistance to gastro-intestinal parasites (Mandonnet *et al.* 1997) in integrated control plans may improve goat meat production in the lesser Antilles. The objectives of this study are firstly to verify the existence of genetic variability in Creole goat resistance to natural infection by gastro-intestinal nematodes and secondly to test its evolution with age (from the suckling period to the end of fattening) and physiological status of the does (periparturient period). The question was to determine the most suitable period to test the resistance of goats, in terms of genetic and epidemiology. The study was conducted in the experimental flock of 220 reproductive does of the INRA-Domaine de Gardel farm. The resistance, estimated by the fecal eggs count (FEC) and packed cell volume (PCV) was determined on grazing fattening kids aged 3 to 11 month. At the same time, the resilience was estimated through the genetic variability of growing rate of treated or untreated grazing kids. Genetic relationships between resistance, resilience and growth were calculated.

MATERIALS AND METHODS

Experimental design. Genetic variability was assessed through the sire/offspring relationship within the Creole experimental flock of INRA-Gardel. Kids grazed on irrigated pasture between 3 and 11 months of age. Males and females were reared separately. Within each flock (200 animals), one half of the kids (treated animals) were drenched against strongylosis (ivermectin) every 3 weeks whereas the other half (infected animals) were only drenched every 7 weeks with levamisole. Faecal egg counts (FEC) were determined 6 and 7 weeks after the drenching of infected animals. Blood samples were collected for packed cell volume measurement, on each animal (infected or treated) every seven weeks. Live weight were monthly recorded at drenching and in the middle of infection period.

Statistical analysis. FEC were square root transferred to normalize the distributions. Analysis of variance was fitted with significant main effects of season of birth, sex, type of birth/type of rearing, treatment (infected or drenched), and any significant interaction. Variance components were estimated by MIVQUE0 using a sire model.

RESULTS AND DISCUSSION

Parasitological results. Three breeding periods are achieved yet corresponding to 3 climatic seasons (wet, medium and dry). Twenty sires have been characterised with 11 to 34 offsprings, for at least 2 periods. The 730 kids of the experiment were mainly infected with *Haemonchus contortus*. The proportion of *Trichostrongylus colubriformis* reached 20-40% during the dry season. The mean age of the kids was 4.6 months for the first sample, 6.3 for the second, 8.9 for the third and 10.6 for the fourth. FEC of treated animals were zero or near zero.

Environmental factors. There was a marked effect of season on parasitological measurements (Figure 1). Kids born during the dry and medium seasons had the same parasitological evolution: decrease of FEC and PCV coming to a normal level. Kids born during the wet season lead to an opposite evolution of FEC and their PCV was stable all over the fattening period. This result imposes to keep each buck during the 3 successive mating periods to take into account a potential interaction between season and genotype.

No significant difference was shown between the live weights of infected and treated kids. Average daily gain for heavily treated animals was only 3 g per day higher than for infected kids. It can be assumed that the drenching did not prevent from larvae aggression. Potential growing rate at grazing could not be expressed in such experimental design. Resilience estimation was not achieved for bucks and the experimental design will be modified in that way.

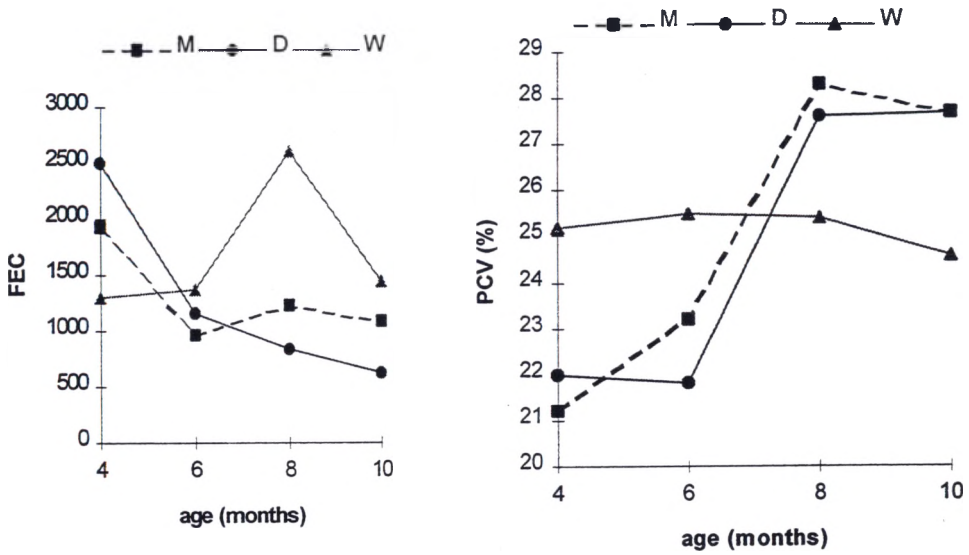

Figure 1: The effect of age and season of birth (Medium, Dry or Wet) on fecal egg counts (FEC, retransformed data) and packed cell volume (PCV).

Genetical variability. Repeatability between ages reached 0.27 and 0.28 for respectively for FEC and PCV. With the data set recorded up to now, an increase of genetical variance was shown (Table 1). Genetic variability was higher at 8 months of age for FEC and at 10 months of age for PCV. Sire correlations were maximum between 8 and 10 months. Theses repeatability and heritability estimates are similar to those recorded in Africa (Rohrer *et al.* 1991; Baker 1997), in Australia (Albers *et al.* 1987; Woolaston and Piper, 1996) for sheep and goats infected with *H.contortus*. Due to inbreeding in the experimental flock, variance estimations were certainly overestimated with this sire model and would be less important with an animal model. However, these results promise some possible improvements of resistance to nematode parasites in the humid tropics using FEC as a selection criterion.

Genetic variability on live weight (not tabulated) increased from birth to 150 days of age. Then it decreased from half for the infected kids and becomes nil for drenched ones. Drenching did not allow the expression of genetical potential. Sire correlations for FEC and average daily gain between weaning and 10 months averaged around 0.30. Selection for low excretion should not have any unfavorable effect on growth in infected environment.

CONCLUSION

These results seem promising for an integration of the resistance trait in breeding scheme but more data are required especially for the estimation of genetic parameters of resilience.

Table 1: Variance estimations for Fecal Egg Counts and Packed Cell Volume measures (SAS varcomp procedure)

Trait	FEC4[A]	FEC6[A]	FEC8[A]	FEC10[A]	PCV4[B]	PCV6[B]	PCV8[B]	PCV10[B]
sire variance	10,11	-1,32	26,06	10,42	0,30	0,14	0,31	1,10
dam within sire variance	-6,21	173,67	108,78	26,23	3,83	2,63	0,89	-0,86
residual variance	413,20	97,37	124,47	114,98	14,91	13,83	10,11	10,83

[A] FEC at 4, 6, 8 et 10 months of age. [B] PCV at 4, 6, 8 et 10 months of age

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