GENETIC RESISTANCE OF SHEEP TO NATURAL INFECTION WITH GASTROINTESTINAL NEMATODE

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SUMMARY

During the 2-year period, from May (1995) or June (1996) to November, in Polish Wrzosówka Sheep flock, faecal samples from ewes and lambs were examined for gastrointestinal nematode eggs by the McMaster method.Faecal cultures were run to assess the composition of nematode burden. *Haemonchus contortus* proved to be the main species in parasite infections.The negative relationship between packed cell volume (PCV), examined in 1996 from ewes, and FECs was noticed. The individual differences were observed in nematode parasite egg output, while the differences in FECs between sire half-sibs groups were insignificant. The negative influence of faecal worm egg count on fleece weight of ewes and weight gain to 10 months of life and to 12 months of lambs' life was observed. The estimated correlations were r = -0.19, -0.34 and -0.29, respectively.

Keywords: nematode infections, haematocrit, resistance, productive records, sheep

INTRODUCTION

Gastrointestinal nematodes are an important cause of reduced production of meat, milk and wool in sheep. One of the strategies for control of nematode infection is the genetic improvement of the host resistance to nematodes. Resistance to parasite infection is influenced by both genetic and environmental factors.

The aim of this study was to determine the faecal egg counts following natural gastrointestinal nematode infection in group of sire half-sibs and to evaluate the relationship between FECs and packed cell volume (PCV), wool yield of ewes and liveweight gain of lambs.

MATERIAL AND METHODS

Polish primitive prolific Wrzosówka ewes, 2-5 years old, were examined during two years 1995-1996 (159 and 123 ewes, respectively). In 1996 136 lambs were also examined.The whole winter and in spring, during the lambing season ewes were kept in the sheep-fold, while in summer and early autumn they were pastured. The region in which the flock is located has a moderate temperature climate with a mean annual rainfall of 500-600 mm. Faecal samples were taken every month, first examination was conducted before grazing season, while the next during grazing season. Faecal worm egg counts (FECs) were estimated as the number of nematode eggs per gram of faeces (EPG) by a modified McMaster method (Bairden,1991). All faecal egg counts (FECs) were transformed by log (FEC+1) prior to analyses. In May 1996 all ewes were drenched with Systamex (1.3 mg kg^{-1}). Differential counts of third-stage larvae (L_3) was carried out on larvae collected from faecal cultures maintained at room temperature for 7-10 days. Infective larvae were identified to species or genus level according to Anon (1986). In 1996 blood samples were taken from ewes at the same time as faecal samples, excluding May, and percentage PCV was estimated using the micro haematocrit method.

The sire half-sibs groups (k_o=13.75) were selected from examined animals to evaluate the differences in transformed FECs between progeny of rams using the multi-trait ANOVA.
In the investigated flock sheep are sheared twice a year, in spring and autumn. In this study only the autumn shearing results were used. Weight gain of lambs were calculated on the basis of body weight at birth, at 10 month and 12 month of lamb life. The phenotypic correlation coefficients between performance and FECs were estimated with the two-way classification ANOVA (LSMLMW, Harvey,1990).

RESULTS AND DISCUSSION

FECs. In 1995 the highest prevalence and mean of FECs in ewes were noticed in July, and the lowest in October, while in 1996 the highest values of these parameters were in May, before the grazing season. In the end of May ewes were drenched, what resulted in the distinct decrease of infection intensity in June. Afterwards, the increase of FECs and prevalence in July and August was observed in the flock. By the end of both grazing seasons the percentage of infected animals decreased. It is known that prevalence of parasite infection reflects the different levels of resistance acquired by individual animals during their grazing history. In the case of lambs the prevalence was slowly increasing and reached twice higher value in November compared to August (Table 1).

Table 1. The natural infection with gastrointestinal nematode in examined flock

Date of sampling	Number of ewes		Prevalence (%)		Number of lambs	Prevalence (%)
	1995	1996	1995	1996	in 1996	in 1996
May	-	99	-	93.9	-	-
June	150	123	84.9	7.3	-	-
July	114	114	95.2	33.6	-	-
August	140	107	67.4	66.7	114	44.8
September	159	109	54.2	19.3	136	73.5
October	157	105	42.2	37.4	134	76.1
November	-	-	-	-	123	98.4

The highest faecal egg counts in faeces from ewes were observed during the highest level of natural nematode infection. In the whole experiment individual variability in FECs among sheep ranged from 0 to 26550 in July 1995 and from 0 to 24400 in August 1996. The similar pattern of distribution in both years confirms this tendency in egg output in the flock, in spite of anthelmintic treatment in 1996.Our results have confirmed those obtained by other authors who have observed the differences among animals in the patterns of egg output (Stear *et al.* 1994, Bishop *et al.* 1996, Bishop and Stear, 1997).

Larval differentiation. Differentiation of larvae from faeces collected from the examined animals indicated that two of nematode species were dominant: *H. contortus* and *Trichostrongylus sp.*Other nematode species (*Cooperia sp.,Teladorsagia sp.,Nematodirus sp., Chabertia ovina* and *Strongyloides sp.*) occurred occasionally. The proportion of *H. contortus*

and *Trichostrongylus sp.* presence varied in different months. It was found that *H. contortus* was the dominant species during the highest level of gastrointestinal nematode infection.

PCV. In examined flock the overall mean PCV was 31.25% and ranged from 16% to 41% (Figure 1). The negative relationship between PCV and FECs was observed.The lowest PCV was noticed in August when *H.contortus* was the dominant species of nematode infection. *H.contortus* parazites within abomasum of the sheep and by its blood-suckling activity may cause severe anaemia and even the death of infected animals.

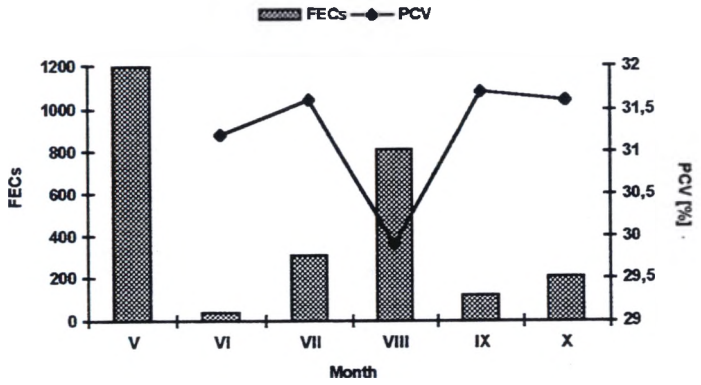

Figure 1. PCV in relation to gastrointestinal nematode egg count in faeces of ewes

The influence of sire on progeny resistance to nematode infections. The mean faecal egg counts in groups of sire half-sibs are shown on Figure 2. The differences in FECs between paternal progeny groups were insignificant, while the differences between years of sampling were significant. In 1996 all ewes were drenched and the obtained results could be the consequence of that treatment. It has been shown by Muggli-Cockett *et al.*(1991) that heritability for FECs had medium to high value.

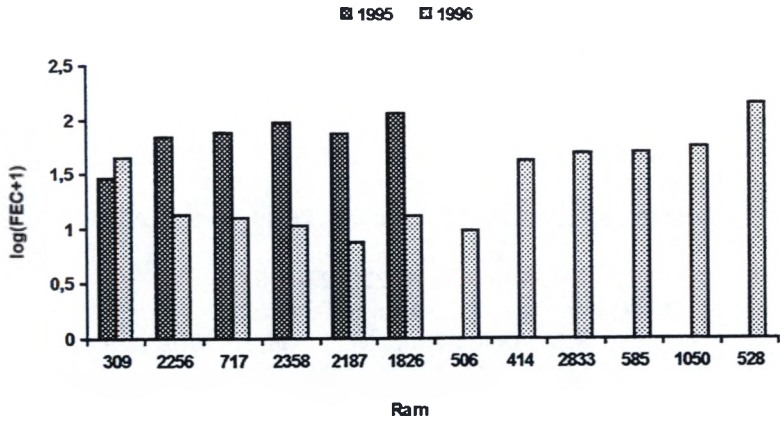

Figure 2. The mean FECs in paternal half-sibs groups

The influence of parasite infection on productivity.The estimated phenotypic correlations between fleece weight and faecal egg counts of nematode parasites in examined ewes were significant (Table 2). The genetic correlations between FECs and clean fleece weight obtained by other authors were posivite but insignificant (Eady *et al.*1994, Morris *et al.*1997).In statistical analysis we used fleece weight from autumn shearing to establish the influence of parasite infection on wool growth during grazing season.
The phenotypic correlations between liveweight gain of lambs and FECs were negative and significant. These results are in agreement with most published results. Whereas, the genetic correlations between mentioned traits have high negative values (Bisset *et al.*1994, Bishop *et al.*1996). Also regression coefficient of FECs on weaning weight estimated by Romjali *et al.*(1997) was negative and significant.

Table 2. Correlations between FECs and productive results

Traits	Number of animals	r_P
FECs - fleece weight	187	- 0.190*
FEC - lamb weight gain : from 0 to 10 months	123	- 0.344*
from 0 to 12 months	82	- 0.292*

* Coefficient significant at P<0.01

Experiment is underway and will include molecular analysis of MHC class II (DRB).

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