THE GENETIC RESISTANCE TO COCCIDIA IN APPENNINICA SHEEP

F. Cecchi[1], R. Ciampolini[1], F. Macchioni[2], M. Biagetti[3], E. Ciani[1], G. Filippini[3], E. Mazzanti[1], M. Tancredi[1], P. Papa[3] and D. Deni[4]

[1]Dip. Produzione Animale, Università di Pisa, 56124 Pisa, Italy
[2]Dip. Patologia Animale, Università di Pisa, 56124 Pisa, Italy
[3]Istituto Zooprofilattico Sperimentale Umbria Marche, 06126 Perugia, Italy
[4]Istituto Zooprofilattico Sperimentale Lazio Toscana, 52100 Arezzo, Italy

INTRODUCTION

Coccidia are considered internal parasites *(Eimeria* spp) but are resistant and non-responsive to dewormers used for internal parasites in sheep. Practically all sheep tolerate a low level of coccidia with no adverse effects. A high level of coccidia, especially in lambs, damages the intestinal lining resulting in improper or reduced absorption of nutrients and weight loss. This damage can also result in bloody and dark diarrhoea, causing dehydration and death. In some cases, very little or no diarrhoea has been observed. Stress induced by changes in weather or sudden changes in feeding, such as from pasture to dry lot, will often result in a severe coccidia outbreak. Sheep reveal a large variability in the resistance to parasites due to a complex of environmental factors (above all nutritional state and hygienic conditions), and to genotype (breed membership, individual genotype), as well as to their interaction mainly with biological factors (sex, age, reproductive stadium and breeding systems and technologies). Concerning genetic factors, it is accepted long since that the genetic resistance to parasites in sheep changes depending on the breed and the genetic line (Gray *et al.* 1991; Baker *et al.*, 1992). As reported by other Authors (Gauly *et al.*, 2001; Yvore *et al.*, 1992; Filippini *et al.* 2006) *Coccidia* are characterized by interesting values of repeatability and heritability coefficients, therefore the aim of this research has been the identification by phenotypic evaluation of the most resistant subjects and the investigation of the pattern of coccidian infections in lambs during the first 9 months of age.

MATERIAL AND METHODS

Animals and sampling. A total of 108 subjects belonging to the Appenninica sheep breed (54 daughter-mother pairs) were selected from a farm situated in Tuscany (Italy); inspections were performed 4 times in year 2004 (April, May, September and November) during a 8 months period. At the beginning of sampling Mothers were 4-6 years old while daughters were 20-30 days old. One faecal sample from each animal was collected each time; faecal samples were analyzed in order to determine EPG (Eggs Per Gram) or OPG (Oocysts Per Gram) using the McMaster technique, modified by Hansen and Perry (1994). Moreover, *Coccidia* samples were analyzed in order to evaluate the presence of gastro-intestinal *Strongylids*, *Dicrocoelium* sp, *Moniezia* spp, *Strongyloides* sp. and *Trichuris* sp. At the same time as the faecal samples, blood samples were also collected from the animals to determine Packed Cell Volume (PCV); blood analyses were carried out directly in the field by means of micro-haematocrit equipment.
Statistical analyses. The average mean of parasitic burden of *Coccidia* were evaluated on 4 samples for each subject. Subsequently, we defined as "resistant" the adult female with an average value under 200 OPG and "not resistant" the adult female with an average value over 200 OPG. Four groups were thus defined: resistant subjects (R; n = 27), not resistant subject (NR; n = 27), daughters of the resistant subjects (DR; n = 27) and daughters of not resistant subject (DNR; n = 27). After subdividing the OPG in classes of values (0, <200, 200-600 e >600) their percentage distribution at different seasonal samplings in the four groups of subjects was evaluated. Differences in parasitical load and PCV among the four groups (R, NR, DR, DNR) were evaluated using a mixed linear model for repeated measures (subject as

random effect; sampling and groups with their interactions as fixed effects). All statistical analyses were carried out using the statistics package JMP of the SAS Institute (2002).

RESULTS AND DISCUSSION

Subdivision of animals in groups shows that mothers are more resistant to *Coccidia* than their daughters, with exception of the November withdrawal, while adult females result less resistant than daughters for most of the other parasitic groups (figures 1). As well known, coccidiosis is one of the most important endoparasitic protozoal infections in lambs. It can be a serious clinical problem in lamb rearing with reduced growth mainly between 4 and 8 weeks of age (Gauly et al., 2001; Amarante and Barbosa, 1992). Our results confirm that lambs are more sensitive to coccidial infection than adults, the highest counts being observed in April when lambs were 4-8 weeks old. As shown in table 1 in the first three samplings most of the daughters presented an OPG higher than 600 (from 69.23 to 84.62% in DR group lambs and from 54.45 to 91.67% in DNR group). In November, when the lambs reached 7 months of age the parasitic burden of *Coccidia* decreased markedly with an obvious increase of the subjects not infected (48% in the DR and 88.89 in the DNR) or with OPG lower than 200 (52 and 11.11% of the lambs respectively in the two groups). These results are consistent with those of O'Callaghan *et al.*, (1987). With respect to the other parasitic species, in May and September EPG for *Trichuris* were higher in lambs than in adult females, with statistically significant differences in May ($P<0.01$), while for all the other groups of parasites, included Strongylids, young lambs were always less infected than adult subjects. The adult females of the R group result significantly more sensitive to *Strongylids* in April and to *Dicrocoelium* in April and May with respect to the youngest subjects and particularly to the DR group. In May the adult females of R were more infected than their daughters and this trend was accentuated in November when this group was more infected than the other adult animals also; always in November, significant differences were observed for *Strongyloides* too. PCV was not affected by parasitic burden of *Coccidia*, while it resulted to be influenced by the other groups of parasites; this observation is confirmed by Ambrosini *et al.* (2001) who detected the lowest haematocrit value in those subjects more infected by haematophagic parasites. Though no differences between the two groups of adult animals in the *Coccidia* mean values were observed, an obvious difference in the distribution of animals based on parasitic burden still remains (table 1): the percentage of animals with less than 200 OPG varies from a maximum of 61.11 % in September to a maximum of 95.84 % in May, while such percentages are markedly lower in the less resistant subjects. Moreover, the adult animals more resistant to coccidia do not show OPG values higher than 600 in the first three samplings, even if the general OPG average is always low (102 OPG).

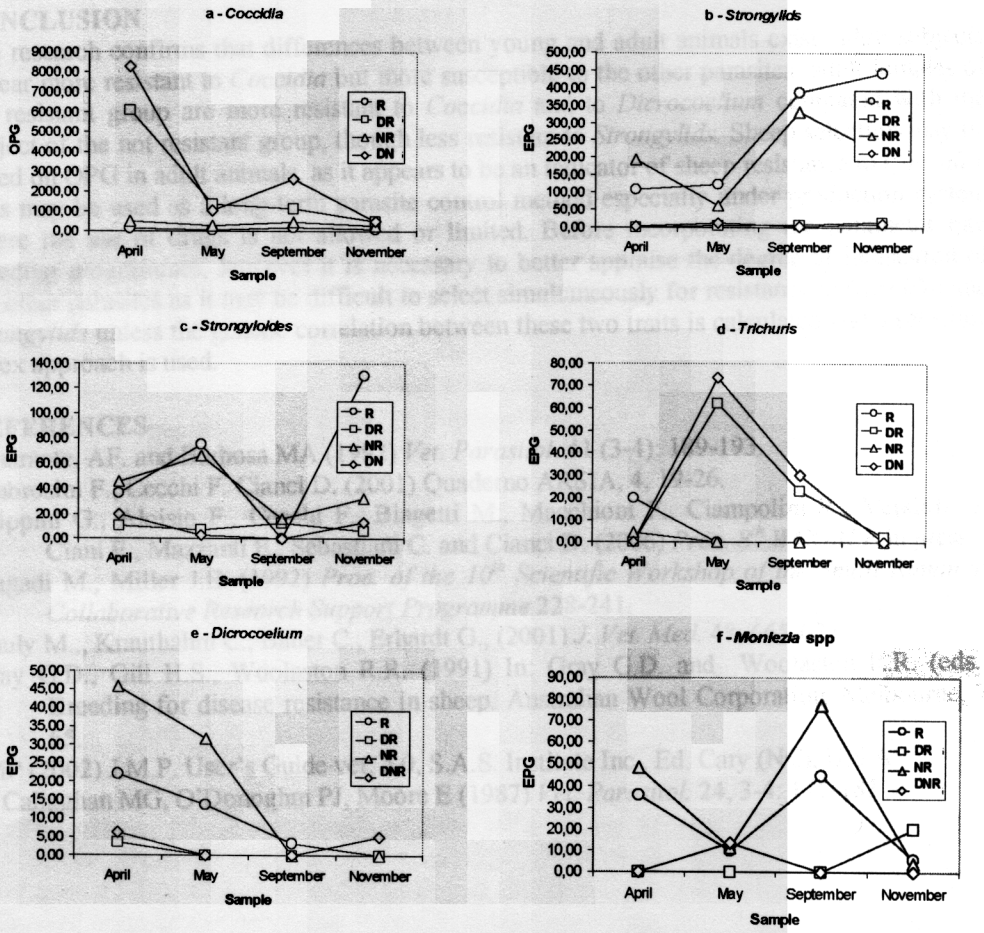

Figure 1. Trend of the parasitic burden in four withdrawals and in four groups.

Table 2. Distribution of animals in different groups based on differences in parasitic burden of *Coccidia*.

	OPG	R (%)	DR (%)	NR (%)	DNT(%)
April	0	37.04	0.00	9.52	4.17
	<200	40.74	0.00	4.76	0.00
	200-600	22.22	16.00	38.10	4.17
	>600	0.00	84.00	47.62	91.67
May	0	41.67	0.00	21.05	0.00
	<200	54.17	3.85	31.58	0.00
	200-600	4.17	11.54	31.58	45.45
	>600	0.00	84.62	15.74	54.45
September	0	11.11	3.85	6.67	0.00
	<200	50.00	3.85	26.67	11.11
	200-600	38.89	23.08	53.33	27.78
	>600	0.00	69.23	13.33	61.11
November	0	15.00	48.00	35.71	88.89
	<200	50.00	52.00	21.43	11.11
	200-600	10.00	0.00	35.74	0.00
	>600	25.00	0.00	7.14	0.00

CONCLUSION

The research confirms that differences between young and adult animals exist; adult subjects appear more resistant to *Coccidia* but more susceptible to the other parasites: adult females of the resistant group are more resistant to *Coccidia* and to *Dicrocoelium* compared with the subject of the not resistant group, though less resistant to *Strongylids*. Sheep selection may be based on OPG in adult animals, as it appears to be an indicator of sheep resistance to *Coccidia*. This may be used as a long-term parasite control method especially under production system where the use of drugs is not allowed or limited. Before incorporating the parameter into breeding programmes, however it is necessary to better appraise the degree of infestation of the other parasites as it may be difficult to select simultaneously for resistance to *Coccidia* and *Strongylids* unless the genetic correlation between these two traits is calculated and a selection index approach is used.

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