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Dietary selection by goats and sheep in kermes oak shrublands of northern Greece: Influence of shrub cover and grazing season

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SUMMARY – Selection and nutritive composition of diets of goats and sheep grazing sparse (shrub cover 29%), moderate (shrub cover 40%) and dense (shrub cover 56%) kermes oak shrublands were studied in six periods (Oct., Nov., Mar., Apr., May, Jun.). Main dietary components for sheep were herbs (grass: 42% and forbs: 34%) for all rangelands, while browse occurred mostly in goat diets (>64%); however herbs contributed considerably (30%) in goat diets during April, May and June. Goat diets were lower in crude protein (CP) compared with sheep diets on the sparse shrubland in March and May but similar in the remaining periods. Goats selected forage lower in CP than sheep only in May on the moderate and dense shrublands but higher or similar in the remaining periods. No difference in *in vitro* organic matter digestibility (IVOMD) was found between goats and sheep on the sparse rangeland except for October (goats < sheep) and June (goats > sheep). However, major differences in IVOMD occurred on the moderate and dense treatments, as the forage selected by goats was more digestible than the forage selected by sheep.

Key words: Sheep, goats, grazing, plant-animal interactions, shrubland, Greece.

RÉSUMÉ – *"Sélection alimentaire des chèvres et des moutons sur des parcours broussailleux à base de chêne Kermès du Nord-Est de la Grèce : Influence de la couverture en broussaille et de la saison de pâturage". La sélection, la composition et la valeur nutritive de l'alimentation de chèvres et de moutons pâturant un parcours à chênes kermès sont étudiées durant six périodes (oct., nov., mars, avril, mai, juin) en relation avec trois niveaux de couverture du sol par les broussailles : clairsemé (29%) , moyen (40%), dense (56%). Dans tous les cas les plantes herbacées sont les principaux constituants de l'alimentation des moutons (graminées : 42%, autres plantes herbacées : 34%), alors que le pâturage des arbres fournit plus de 64% de l'alimentation des chèvres ; cependant pour celles-ci en avril, mai et juin les herbacées représentent environ 30% des rations. Les régimes des chèvres sont plus pauvres en protéines (CP) que ceux des moutons sur les parcours clairsemés en avril et mai mais semblables aux autres périodes. Les chèvres sélectionnent des aliments moins riches en protéines que les moutons en mai sur les parcours moyen et dense mais de richesse supérieure ou équivalente le reste du temps. Aucune différence dans la digestibilité* in vitro *de la matière organique (IVOMD) n'est observée sur le parcours clairsemé entre les chèvres et les moutons sauf en octobre (chèvres < moutons) et juin (chèvres > moutons). Cependant, des différences importantes de IVOMD sont notées sur les parcours moyen et dense, les aliments choisis par les chèvres sont plus digestibles que ceux sélectionnés par les moutons.*

Mots-clés : *Mouton, chèvre, pâturage, interaction plante-animal, parcours broussailleux, Grèce.*

Introduction

Kermes oak (*Quercus coccifera* L.) shrublands occupy a considerable part (1.6 million ha) of Greece's land area and are vitally important in small ruminant nutrition. Grazing relationships of sheep and goats on the kermes oak rangelands are relatively unknown. Further the effect of reductions of shrub cover, which is viewed as an improved technique (Liacos, 1982; Vallentine, 1990), on the grazing responses of sheep and goats has not been studied in detail. As foraging behaviour may be an important management tool of rangelands, a study of vegetative utilisation and animal responses to three kermes oak shrubland treatments (three levels of shrub canopy cover) was conducted in six periods. The study was designed to determine diet selection and feeding behaviour of sheep and goats grazing together in a sparse (shrub cover 29%), moderate (shrub cover 40%) and dense (shrub cover 56%) kermes oak shrublands.

Methods and materials

A 3 ha study area was selected in Humniko, Macedonia, northern Greece, at 40° 52' North latitude, 23° 33' East longitude, and 400 m elevation during autumn of 1991. The area was a dense shrub stand (50-80% canopy cover) composed mainly of kermes oak; other shrub species were *Cistus incanus, Phillyrea media, Juniperus oxycedrus, Carpinus orientalis, Colutea arborescens,* and *Fraxinus ornus*. The area was divided into 2 blocks and within each block three 0.5 ha pastures were assigned randomly to one of three treatments: (i) cleared by a bulldozer; (ii) slashed by a roller chopper; and (iii) control (for details see Papachristou *et al*., 1997). During October of 1993, when the study reported here started, the shrub cover of the three shrubland treatments was 29% (sparse shrubland), 40% (moderate shrubland) and 56% (dense shrubland), respectively.

Vegetation and animal responses measurements in 1993 were made during October and November; measurements in 1994 were taken during March, April, May and June (see Papachristou, 1997). A herd of locally obtained native sheep and goats was divided into three study herds to determine animal-plant interactions, as well as grazing interactions between the two animal species. Diets of the animals were determined by the bite-count technique (Papachristou, 1991). Four sheep and four goats in each herd were observed and bites were counted for each forage category (browse, grass and forbs) in each pasture and period. Hand plucked samples were collected concurrently with bite records and analysed for nutritive value determination. The experimental design was a split-plot in time with an incorporated randomised complete-block design. Data of grazing trials were subjected to an ANOVA test and the protected LSD test was used for detecting difference ($P < 0.05$) among treatment means.

Results and discussion

Both sheep and goats tended to have a constant preference on forage categories in the three shrublands. Goat diets contained a greater portion of browse than grass or forb while the diet selected by sheep contained fewer browses and more herbs (Table 1). Grasses contributed more than 10% to the goats' diet in the sparse and moderate shrublands. Their maximum contribution of 32% was recorded on the sparse shrubland during May. The contribution of grass to the sheep diet was more than 31% on all shrublands and in all grazing periods. The proportions of forbs consumed by goats were relatively high from April to June (Table 1). Forbs contribution to the sheep diet was about two times more than that of goats for the same period. The kermes oak (the dominant species) was consumed only by goats while *Cistus incanus*, *Phillyrea media*, *Juniperus oxycedrus*, *Carpinus orientalis*, *Colutea arborescens* and *Fraxinus ornus* were consumed by both goats and sheep (see Papachristou, 1997).

Table 1. Diet composition by percent browse, grass and forbs for sheep and goats on sparse moderate and dense kermes oak shrublands† in six periods

Shrubland††	October		November		March		April		May		June	
	Goats	Sheep	Goats	Sheep	Goats	Sheep	Goats	Sheep	Goats	Sheep	Goats	Sheep
Browse†††												
Sparse	86.2	33.9	68.3	27.6	75.9	12.5	46.5	26.5	53.7	35.6	56.0	15.8
Moderate	86.4	31.1	78.9	22.9	77.4	18.7	66.9	28.7	62.8	23.8	68.4	11.2
Dense	87.5	42.2	85.2	36.4	90.2	28.3	76.6	25.8	51.0	20.4	65.0	5.0
Grass††††												
Sparse	9.9	50.8	22.7	49.1	15.5	35.5	31.9	38.5	32.1	34.7	19.8	38.5
Moderate	9.9	45.3	15.7	50.7	17.5	33.9	17.8	39.1	23.8	47.6	17.0	39.9
Dense	9.6	35.2	9.1	42.9	7.5	31.6	14.7	37.3	35.7	47.0	24.3	52.5
Forbs†††††												
Sparse	3.9	15.3	9.0	23.3	8.6	52.0	21.6	34.9	14.2	29.7	24.2	45.6
Moderate	3.7	23.7	5.4	26.4	5.1	47.4	15.3	32.2	13.4	28.6	14.3	48.9
Dense	2.9	22.6	5.8	22.4	2.3	40.1	8.7	36.9	13.3	32.6	10.7	42.5

†Sparse: 29% shrub cover; Moderate: 40% shrub cover; Dense: 56% shrub cover.
††$LSD_{0.05}$ = 6.28.
†††$LSD_{0.05}$ = 5.86.
††††$LSD_{0.05}$ = 5.09 to compare pasture x animal x period means.

Both goats and sheep selected diets similar in crude protein (CP) content on the sparse shrubland during October, November and June (Fig. 1), however, during March, April and May sheep selected diets higher in CP content than did goats. In the moderate shrubland CP content of the goats' diet was higher than that of sheep during November and March but lower in May. In the remaining periods no differences between goats and sheep were found. In the dense shrubland, goats selected diets higher in CP than did sheep from October to April (Fig. 2); however, during May they selected diets lower in CP than did sheep and similar during June. During May, the CP contents of sheep diets on the three shrublands was higher than did goats' diet. These high levels were related to the comparatively higher amounts of herbs in their diets. In the remaining periods, sheep diets had a relative high CP content on the sparse and moderate shrublands but not on the dense shrubland. On the contrary goats maintained diets higher in CP content than did sheep on the dense shrubland during the entire year.

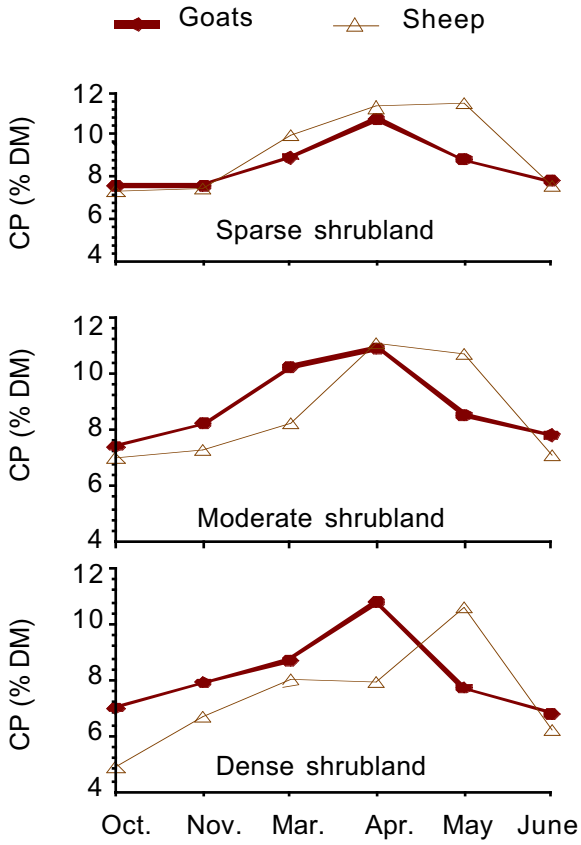

Fig. 1. Dietary crude protein (CP % DM) of goats and sheep grazing on sparse moderate and dense shrublands in six periods ($LSD_{0.05}$ = 0.72; Sparse: 29% shrub cover; Moderate: 40% shrub cover; Dense: 56% shrub cover).

Overall, no differences in *in vitro* organic matter digestibility (IVOMD) were found between sheep and goats' diets in the improved shrublands (Fig. 2). However, in the moderate shrubland IVOMD of sheep diets was lower than that of goats in November and March. In the dense shrubland, goats tended to select diets more digestible than sheep (Fig. 2). Although goats selected much larger amounts of browse (Table 1) and their diets contained substantially more lignin than did sheep (Papachristou, 1997), they were able to maintain higher or similar digestibility with sheep. This indicates that goats are good browsers that can use effectively fibrous forages (Morand-Fehr, 1989).

The reduction of shrub cover on the sparse and moderate shrublands did not result in a considerably higher diet quality compared to dense shrubland. However, the open form of the improved shrublands allowed both goats and sheep to have a higher bite rate compared to dense shrubland (see Papachristou, 1997). It is known (Schacht and Malechek, 1989) that such manipulation of woody stands increases forage intake rather than dietary nutritive value. This was especially true for sheep that indicated a higher bite rate (Papachristou, 1997) and consumed more herbs on the

improved shrublands during spring (Table 1). We concluded that animals on sparse and moderate shrublands benefited from high availability of herbs during spring and of browse from woody species that was within the grazing height of animals. However, there was a nutritional advance to goats in using the vertical stratum (browse) compared with sheep during the dry season.

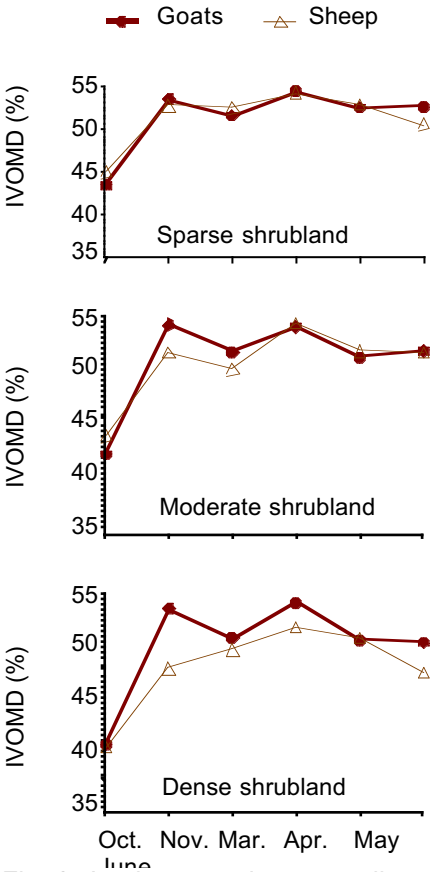

Fig. 2. *In vitro* organic matter digestibility (IVOMD %) of the diets of goats and sheep grazing on sparse moderate and dense shrublands in six periods ($LSD_{0.05}$ = 0.87; Sparse: 29% shrub cover; Moderate: 40% shrub cover; Dense: 56% shrub cover).

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