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Nutritive value of *Paliurus spina-christi* and herbaceous vegetation in Mediterranean shrub-lands of central and northern Greece

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Abstract. Christ's thorn (*Paliurus spina-christi* Mill.), a very common species in the Mediterranean region, usually forms shrublands of high species richness. Despite being a rather spiny shrub, it is browsed by goats, especially during spring and early summer. The objective of the present study was the comparative evaluation of the nutritive value of Christ's thorn and accompanying species of the herbaceous layer in shrublands of central and northern Greece. Vegetation sampling was performed during the flowering stage in May 2011. Dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined both in Christ's thorn and herbaceous vegetation. Forage DM production in the shrubland from central Greece was significantly higher compared to the one from northern Greece. Similarly, the CP and NDF contents of *Paliurus spina-christi* from central Greece were higher, while there were no statistically significant differences for the ADF and ADL between the two regions. The CP of the herbaceous vegetation was higher in central Greece, unlike the ADF of the herbaceous vegetation which was higher in the north. These differences, possibly related to genetic factors and different climatic conditions, have to be taken into consideration for obtaining optimal livestock productivity.

Keywords. Christ's thorn – Woody species – Forage quality – Mediterranean basin.

Valeur nutritive de* Paliurus spina-christi *et de la végétation herbacée dans des parcours arbustifs méditerranéens du centre et du nord de la Grèce

Résumé. *L'épine du Christ (*Paliurus spina-christi *Mill.) est une espèce très commune dans la région méditerranéenne. Il forme d'habitude des parcours arbustifs avec une richesse d'espèces élevée. Bien que ce soit un buisson assez épineux, il est utilisé par les chèvres, surtout pendant le printemps et au début de l'été. L'objectif de cette étude était d'évaluer la valeur nutritive de l'épine de Christ et des espèces qui l'accompagnent dans la couche herbacée, dans les parcours de la Grèce centrale et du Nord. L'échantillonnage de végétation a été réalisé pendant le stade floraison en mai 2011. La teneur en matière sèche (DM), en protéine brute (CP), en fibres au détergent neutre (NDF), en fibres au détergent acide (ADF) et en lignine (ADL) a été déterminée dans l'épine de Christ et dans la végétation herbacée. La quantité de DM de fourrage dans les parcours de la Grèce centrale a été significativement plus élevée que dans la Grèce du Nord. De même les teneurs en CP et en NDF de* Paliurus spina-christi *de la Grèce centrale étaient plus élevées que les teneurs mesurées au Nord, alors qu'il n'y avait aucune différence statistiquement significative pour les teneurs en ADF et ADL. La teneur en CP de la végétation herbacée était aussi plus élevée dans la Grèce centrale, alors que la teneur en ADF de la végétation herbacée était supérieure dans la région du Nord. Ces différences pourraient être liées aux facteurs génétiques et aux différentes conditions climatiques et doivent être pris en compte pour obtenir une productivité animale satisfaisante.*

Mots-clés. *Epine de Christ – Espèces arbustives – Qualité du fourrage – Bassin Méditerranéen.*

I – Introduction

Shrub-lands occupy large areas in the Mediterranean region and play a significant role in animal production (Le Houerou, 1993). It is well documented that more than 60% of goat diet comes from shrubs (Perevolotsky *et al.*, 1998). Ainalis *et al.* (1998) and Parissi (2001) suggested that some deciduous woody species are essential animal feeds especially during the dry season, due to their high nutritive value.

Christ's thorn (*Paliurus spina-christi* Mill.) is a very common deciduous shrub species in the Mediterranean region (Parlak *et al.*, 2011). It usually forms shrublands of high species richness. Despite the fact it is a rather spiny shrub, it is browsed by goats, especially during spring and early summer (Manousidis *et al.*, 2014).

Limited information is available regarding the nutritive value of this species although it has been reported to be superior to other shrubs (Temel and Tan, 2011). As a consequence, there is a lack of information about the nutritive value of various natural populations of the species. Thus, the objective of the present study was the comparative evaluation of forage production and of the nutritive value of Christ's thorn and accompanying species of the herbaceous layer in shrublands of central and northern Greece.

II – Materials and methods

The study was conducted in shrublands dominated by *Paliurus spina-christi*, in two areas located in central (Lamia) and northern (Evros) Greece. The climate of both study areas is classified as sub-Mediterranean, with a mean air temperature of 16.5°C and 14.7°C, respectively. Average annual rainfall in Lamia is 574 mm and in Evros 664 mm. Both areas are grazed mainly by goats and sheep.

Vegetation sampling was performed during the flowering stage in May 2011. Ten transect lines of 20 m long were established in every study area. Samples for shrubs (leaves and thin twigs) were collected from two randomly selected shrubs across each transect. The sampling of forage was carried out in two 0.5 m x 0.5 m quadrates in each transect established in each study area. Plant material was clipped at ground level and placed in individual paper bags. All samples were oven dried at 50°C for 48 h, weighed and then ground in a mill to pass through 1 mm screen prior to analyses.

Nitrogen content was measured by the Kjeldahl method (AOAC 1990) and crude protein (CP) was calculated by multiplying N by 6.25. Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), Acid Detergent Lignin (ADL) were measured using the procedure described by Van Soest *et al.* (1991) with the ANKOM fibre analyzer (ANKOM Technology Corporation, Macedon, NY, USA), using sodium sulphite, but not α-amylase to the solution for the NDF determination. All analyses were carried out on duplicate samples and results reported on DM basis.

For all measured parameters differences between the study areas were calculated using one-way ANOVA (Steel and Torrie, 1980). All statistical analyses were performed using the SPSS® statistical software v. 18.0 (SPSS Inc., Chicago, IL, USA).

III – Results and discussion

Forage DM production was 42% lower in northern Greece compared to central Greece (Fig. 1). This difference in DM production could be attributed to the variability of climate and soil properties as well as to the differences in species composition (unpublished data).

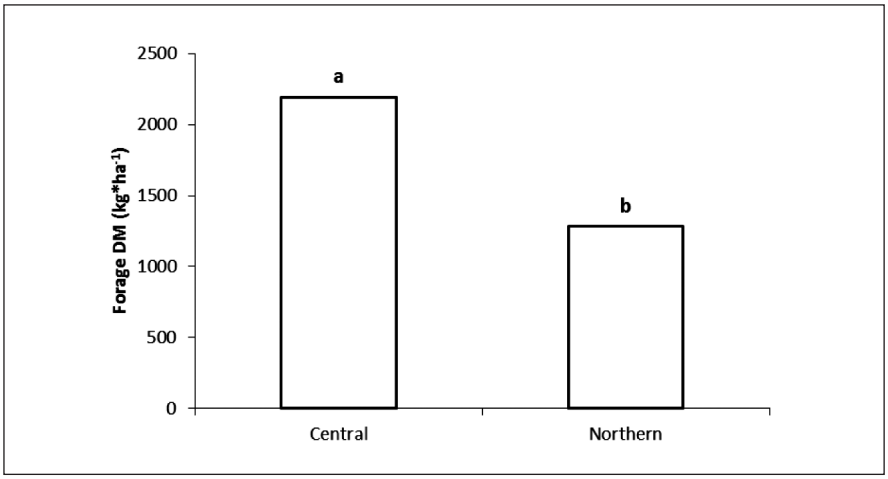

Fig. 1. Forage DM in *Paliurus spina-christi* shrublands of central and northern Greece. Means followed by the same letter are not significantly different (P≥0.05).

The CP and NDF contents of *Paliurus spina-christi* from central Greece were higher than the corresponding from the north, while there were no statistically significant differences for the ADF and ADL (Table 1). These differences in CP and NDF contents could be attributed to different climate and soil characteristics in the diverse growing habitats, as chemical compositions of plants are not the same in each region (Stephens and Krebs, 1986). Additionally, they could be related to genetic factors that control accumulation of foliage nutrients in the plants (Corleto *et al.*, 1994). It has to be noted that the CP content of Christ's thorn is very high, almost double than that in the majority of the non-legume woody species of the Mediterranean region (Ammar *et al.*, 2005; Gokkus *et al.*, 2011; Temel and Tan, 2011).

Table 1. Chemical composition (g*kg^{-1}) (Means ± SE) of *Paliurus spina-christi* of central and northern Greece

Effect	CP	NDF	ADF	ADL
Central Greece	249.9 ± 3.9 a	339.8 ± 4.5 a	156.5 ± 6.9 a	84.2 ± 2.7 a
Northern Greece	215.7 ± 3.9 b	289.5 ± 4.5 b	161.8 ± 6.9 a	80.2 ± 2.7 a

Means in the same column followed by the same letter are not significantly different (P≥0.05).

The CP of the herbaceous vegetation was higher in central Greece, unlike the ADF of the herbaceous vegetation which was higher in the northern region (Table 2). Differences in species composition might account for these differences (unpublished data).

Table 2. Chemical composition (g*kg^{-1}) (Means ± S.E.) of the herbaceous vegetation from *Paliurus spina-christi* shrublands of central and northern Greece

Effect	CP	NDF	ADF	ADL
Central Greece	154.3 ± 5.6 a	523.1 ± 12.7 a	326.4 ± 5.6 b	91.8 ± 3.1 a
Northern Greece	114.5 ± 5.6 b	522.8 ± 12.7 a	360.3 ± 5.6 a	90.3 ± 3.1 a

Means in the same column followed by the same letter are not significantly different (P≥0.05).

More specifically, the higher CP content found in the understory herbaceous vegetation of the Christ's thorn shrubland of central Greece is probably related to the higher percentage of legumes (15% *vs* 10% in northern Greece) as according to Bakoglu *et al*. (1999) legumes have higher concentration of CP than other species. No statistically significant differences were recorded for the NDF and ADL contents (Table 2).

IV – Conclusions

The results of the present study confirm that *Paliurus spina-christi* Mill. is an important deciduous shrub species in terms of animal feed due to its high CP content and to its relatively low NDF, ADF and ADL contents. The recorded differences in DM production and in chemical composition between the study areas in central and northern Greece could be related to genetic factors and different climatic conditions and have to be taken into consideration for obtaining optimal livestock productivity.

References

Ainalis A.B., Tsiouvaras C.N., Noitsakis B. and Papanastasis V.P., 1998. Growth dynamics of some woody fodder plants in relation to spacing and grazing. In: Papanastasis V.P. (Ed.), *Ecological Basis of Livestock Grazing in Mediterranean Ecosystems*. International Workshop, Thessaloniki, Greece, p. 80-85.

Ammar H., López S. and González J.S., 2005. Assessment of the digestibility of some Mediterranean shrubs by in vitro techniques. In: *Animal Feed science and Technology*, 119, p. 323-331.

A.O.A.C., 1990. Official Methods of Analysis. Washington DC, USA: 15th edn. AOAC, p. 746.

Bakoglu A., Koc A. and Gokkus A., 1999. Some characteristics of common plants of range and meadows in Erzurum in relation to life span, beginning of flowering and forage quality. In: *Turkish Journal of Agriculture and Forestry*, 23, p. 951-957.

Corleto A., Cazzato E. and Laudatio V., 1994. Quantitative and qualitative evaluation of tree and shrubby pasture species in Southern Italy. Fodder Trees and Shrubs. In: *Cahiers Options Méditerranéenes*, vol. 4, p. 129-134.

Gokkus A., Parlak A.O. and Parlak M., 2011. Change of mineral element content in the common shrubs of Mediterranean zone. I. Macronutrients. In: *Zemdirbyste (Agriculture)*, 98(4), p. 357-366.

Le Houerou H.N., 1993. Grazing lands of the Mediterranean basin. In: Coupland R.T. (Ed), *Natural grassland. Ecosystems of the World*, Vol. 8 B. Elsevier Science Publisher, Amsterdam, The Netherlands, p. 171-196.

Manousidis T., Abas Z., Kyriazopoulos A.P., Parissi Z.M. and Abraham E.M., 2014. Seasonal preferences of grazing goats in a Mediterranean oak-juniper rangeland. *In: Options Méditerranéenes, Series A* (this volume).

Parissi Z.M., 2001. Effect of clipping density and frequency on production and quality of ligneous species. Dissertation. Aristotle University of Thessaloniki, Thessaloniki, Greece. (In Greek, English summary).

Parlak A.O., Gokkus A., Hakyemez B.H. and Bayetekin H., 2011. Forage quality of deciduous woody and herbaceous species throughout a year in Mediterranean shrublands of western Turkey. In: *The Journal of Animal and Plant Sciences*, 21(3), p. 513-518.

Perevolotsky A., Landau S., Kababya D. and Ungar E.D., 1998. Diet selection in dairy goats grazing woody Mediterranean rangeland. In: *Applied Animal Behaviour Science*, 57, p. 117-131.

S.P.S.S., 2009. SPSS for Windows, version 18. SPSS Inc., Chicago, IL, USA.

Steel R.G.D. and Torrie J.H., 1980. *Principles and Procedures of Statistics*. New York, USA: McGraw-Hill, 2nd edn, 481 pp.

Stephens D.W. and Krebs J.R., 1986. *Foraging Theory*. Princeton University Press, Princeton, New Jersey, USA, p. 247.

van Soest P.J., Robertson J.B. and Lewis B.A., 1991. Methods for dietary fiber, neutral detergent fiber, and non starch polysaccharides in relation to animal nutrition. In: *Journal of Dairy Science*, 74, p. 3583-3597.

Temel S. and Tan M., 2011. Fodder values of shrub species in maquis in different altitudes and slope aspects. In: *The Journal of Animal and Plant Sciences*, 21(3), p. 508-512.