

Variation in forage quality and chemical composition among Italian accessions of *Bituminaria bituminosa* (L.) Stirt.

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Abstract: Native *Bituminaria bituminosa* (L.) Stirt. accessions from central and southern Italy were evaluated for chemical composition to assess their nutritional value as forages. The germplasm was evaluated subjectively *ex situ* for intensity of 'oil' smell and analysed for fibre fraction, crude protein and water-soluble carbohydrate contents as well as furanocoumarin (psoralen and angelicin) concentration. Total phenolics and their antioxidant activity were also evaluated. The quality parameters indicated this species as a good forage source, showing nutritive values similar to those of other wild legume species. Psoralen and angelicin contents ranged from 2.8 to 5.4 and from 2.3 to 4.7 mg g⁻¹ dry weight respectively, while total phenolic concentrations were between 11.2 and 13.5 mg g⁻¹ dry weight. Correlations among forage quality parameters, chemical components and climatic features at sites of origin were also assessed.

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Keywords: nutritional value; *Bituminaria bituminosa*; psoralen; angelicin

INTRODUCTION

Although the majority of plant species in the Mediterranean area have an annual cycle,¹ interest in native perennial pasture species is arising owing to their ability to extend and regularise the grazing season, particularly when the winter yield potential can be expressed. Relative to annuals, perennials regrow more rapidly at the onset of autumn rains and are able to delay senescence in summer by better exploitation of residual soil moisture. In the Mediterranean rangelands, wild plants may represent an important feeding source for grazing animals.^{2,3} *Bituminaria bituminosa* (L.) Stirt. (syn. *Psoralea bituminosa* L.) is a perennial wild legume widely distributed in the Mediterranean basin, as reported in the checklists by Greuter *et al.*⁴ and Wiersema *et al.*⁵ This species shows good adaptation to different habitats, determined by its large intra-specific genetic variation.^{6,7} In harsh environments, such as in Israel, *B. bituminosa* has been reported to withstand intensive grazing by cattle, being the only species with green matter in late spring.⁸ In the Canary Islands a local ecotype called 'tedera' is traditionally used for feeding goats, either under grazing or as hay.⁹

Bituminaria bituminosa is usually considered of low palatability because of the strong smell that can be emitted by oil glands located on its foliage (whence its botanical name). Nonetheless, the 'tedera' population, for example, is reported to be of good

palatability,⁷ while high palatability and browse intake of the species throughout the year have also been reported.² The nutritive value of *B. bituminosa* in terms of forage composition and digestibility has proved similar to or even better than that of other wild legumes.^{3,10} However, the aerial part of this species may contain a high concentration of furanocoumarins, of which psoralen and angelicin are the most abundant compounds.^{11,12} A substantial proportion of the furanocoumarin content is located on the surfaces of leaves, fruits, embryos and young seedlings.^{12–14} These substances could be harmful to animals, being responsible for contact photodermatitis,¹³ in addition to possibly limiting forage intake.⁹ On the other hand, because they elicit skin photosensitisation, there is an increasing demand for furanocoumarins, which are widely used in cosmetics, for suntanning products and in dermatology for the photochemotherapy of some skin diseases.¹¹ The presence of other secondary compounds (e.g. phenolic components) in the forage of *B. bituminosa* has been associated with the prevention of grazing at the start of the vegetative season and hence with the grazing tolerance exhibited by the species in later periods.⁸ It is noteworthy that phenolic compounds may have health-promoting effects due to their antioxidant properties.

Bituminaria bituminosa is a totally novel species for Italian agriculture. This investigation was therefore undertaken as a first assessment of its variation in

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