Morphological and agronomical evaluation of some Moroccan ecotypes of Bituminaria bituminosa (Tedera)

Shaimi N., Saidi N., Kallida R., Al Faiz C.

in

López-Francos A. (ed.), Jouven M. (ed.), Porqueddu C. (ed.), Ben Salem H. (ed.), Keli A. (ed.), Araba A. (ed.), Chentouf M. (ed.).
Efficiency and resilience of forage resources and small ruminant production to cope with global challenges in Mediterranean areas

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 125

2021
pages 593-596

Morphological and agronomical evaluation of some Moroccan ecotypes of *Bituminaria bituminosa* (Tedera)

N. Shaimi, N. Saidi, R. Kallida and C. Al Faiz

National Institute for Agricultural Research-CRRA-Rabat, Mohamed Belarbi Alaoui Street, P.O. Box: 6356, Rabat Instituts, 10101, Rabat (Morocco)

Abstract. Forage pastures and legumes have been widely collected in the past, evaluated and valorised as varieties by many breeders worldwide. Some species where however under investigated, in spite of their potential use in animal feed. Perennial legumes as *Bituminaria bituminosa* is among the species which require special interest, considering their good forage quality and their ability to tolerate drought. Ten ecotypes of *Bituminaria bituuminosa*, collected from different areas of Morocco mainly Middle Atlas, High Atlas and the Rif, were evaluated for two years under field conditions for the following morphological and agronomical traits: flowering date, plant height (cm), leaf number, stem number, seed length and width, head number, flower number/head, leaflet with (cm), leaflet length (cm), color of flowers, branch number, mean stem diameter (mm), thousand seed weight (g), dry matter yield (g/plant) and grain yield (g/plant). An interesting genetic variability among studied ecotypes was found. In fact, the differences for all measured traits was highly significant (P<0.001) among ecotypes. In terms of dry matter production potential, some ecotypes were very promising. Further investigation should be made to include more ecotypes from other regions of the country.

Keywords. *Bituminaria bituminosa* – Moroccan ecotypes – Evaluation – Genetic variability.

Evaluation agro-morphologique d'une collection marocaine de* Bituminaria bituminosa *(Tedara)

Résumé. *Les espèces fourragères et pastorales ont été largement collectées dans le passé et exploité par les améliorateurs de différents pays. Plusieurs écotypes ont été utilisés pour produire des variétés commerciales. Toutefois, Certaines espèces n'ont pas été suffisamment valorisé ont malgré leur utilisation potentielle dans l'alimentation animale. Les légumineuses pérennes telles que Bituminaria Bituminosa nécessitent un intérêt particulier, compte tenu de sa qualité fourragère et de sa capacité à tolérer la sécheresse. Dix écotypes de Bituminaria collectés dans différentes régions du Maroc ont été évalués pour deux années au champ. Les paramètres mesurés sont la date floraison à 50% d'épiaison, hauteur des plantes à l'épiaison, rendement en matière sèche, rendement en grain, poids de 1000 graines, nombre de tiges, nombre des feuilles, nombre des inflorescences, nombre de fleur/inflorescence, longueur et largeur de la feuille médiane, diamètre de la tige principale et la longueur et largeur de la graine. Une variabilité intéressante a été trouvée parmi les écotypes étudiés. En effet, IL'analyse de la variance a révélé un effet très hautement significatif des écotypes pour les paramètres étudiés (P<0.001). En terme de production en matière sèche, certains écotypes se sont montrés prometteurs. D'autres collectes devraient être effectuées afin de couvrir les régions qui n'ont pas encore étaient prospectées pour inclure d'autres écotypes.*

Mots-clés. Bituminaria bituminosa – *Écotypes marocains – Évaluation – Variabilité génétique.*

I – Introduction

Due to climate change and their impacts, in particular the predicted increase in seasonal variability, we need new genotype and plant which are tolerant to summer drought and increase pasture yield and quality. *Bituminaria bituminosa* L. (Tedera) is a good model of resilient perennial legume. It is a promising fodder plant that may provide a source of quality feed for livestock over summer and autumn.

Tedera is native to the Island of Lanzarote, which belongs to the Canaries archipelago in the Eastern North Atlantic, 100 km of the coast of Morocco. A large diversity exists in the Canary Islands with 3 botanical varieties (Var. *Albomarginata*, var. *Crassiuscula* and var. *Bituminosa*). The fourth variety var. *hulensis* is present in Israel (Real *et al.*, 2009). Recently a new variety (var. *Antiatlantica*) which is endemic to Anti-Atlas Mountains (Morocco) was found. B. *antiatlantica* is a rare and localized species, currently known only from Mount Tachilla and Djebel Imzi in Southern Morocco (Brullo *et al.,* 2017). It is known under several common names such as “bitumen trefoil” (because of the strong smell of bitumen when the leaves are crushed) or “tedera” in the Iberian Peninsula (Munôz *et al*., 2000).

In Canary Island, tedera is traditionally used for feeding goats and sheep after cutting and drying, it is a valuable source of summer-green feed and assumed to be tolerant to heavy grazing (Foster, 2015; Sternberg *et al.,* 2006). Its nitrogen fixation and drought tolerance properties making it suitable for low-input production systems.

Tedera is extreme drought tolerance and remains green in summer and autumn in Mediterranean-type climates with minimal loss of leaves (Hamilton, 1974., Fedorenko *et al.,* 2009., Foster *et al.,* 2013). However there are a few studies of this species in Morocco. In the present study, some morphological and agronomical features of 10 ecotypes of *Bituminaria bituminosa* collected from different regions of Morocco were investigated.

II – Material and methods

Ten ecotypes of *Bituminaria bituminosa* were collected from different area of Morocco mainly North of Morocco, middle Atlas. Seeds of collected material were pre-germinated in petri dishes and trasplanted six weeks after in the field. Each ecotype was sown in a 1-m row of four plants and replicated twice. Row spacing was 0.2 m. The experience was carried out during 2017-2018 at the experimental field of El Koudia (Rabat; Morocco) under semiarid type climate on a loamy soil. The total rainfall was 624.5 mm.

The measured variables were flowering date at 50% of heading**,** plant height (cm), leaves number, stem number, seed length and width, heads number, flower number/head, leaflet with (cm), leaflet length (cm), color of flowers, branch number, mean branch diameter (mm) using a vernier caliper, 1,000 seed weight (g), dry matter yield (g/plant) and grain yield (g/plant).

For dry matter yield (g/plant), samples were collected in March 2018 from 3 plants per ecotypes. Plant sample were oven dried at 60°C until a constant weight was achieved. Seeds were collected weekly at maturity. The 1,000 seed weight was calculated from the average weight of 4 replicated subsamples of 100 seeds for each accession.

The data were analyzed using Genstat v18 software.

III – Results and discussion

The values of morphological and agronomical traits of *Bituminaria* are given in Table 1. An important genetic variability was observed for Moroccan ecotypes of Tedera. In fact, the differences for all measured traits was highly significant (P<0.001) among ecotypes.

Table 1. Averages, standard errors and coefficients of variation of morphological and agronomic traits of 10 *Bituminaria* ecotypes

Morphological and agronomical traits	Mean	SE	CV
Flowering date (day from 1st January)	147	± 1.3	1.1
Plant height (cm)	58.8	± 3.7	7.5
Leaves number	136.1	± 13.13	11.8
Stem number	19.3	± 2.4	22.2
Seed length (cm)	1.38	± 0.07	6.1
Seed width (cm)	0.29	± 0.02	8.1
Heads number per plant	77.8	± 8.2	17.4
Flower number/head	17.37	± 3.9	27.5
Dry matter yield 1st year (g/plant)	94.5	± 3.46	12.3
Dry matter yield 2sd year (g/plant)	361.7	± 27.8	9.4
Grain yield (g/plant)	21.7	± 1.3	7.5
Leaflet width (cm)	2.83	± 0.26	11.4
Leaflet length (cm)	6.01	± 0.37	7.6
Mean branch diameter (mm)	6.91	± 1.3	23.4
1,000 seed weight (g)	23.85	± 0.5	2.8

According to the results, average plant height was 58.5 cm and it ranged from 43 cm to 71 cm. Flowering date varied between 131 to 164 days. Number of flowers per head varied from 9 to 24 flowers and varied also within the same ecotype. Average number of leaves per head was 136, ranging from 64 to 190. It ranged between 64 and 190. It was noted that leaves remained green till seed maturation, without any irrigation in summer, which is one of the most specific character of Bituminaria. Tedera is one of the rare species which can stay green in summer and offer plentiful roughage high in quality. Average seed length and width was 1.38 cm and 0.29 cm respectively. Seed length varied from 1.1 cm to 1.9 cm while, seed width was between 0.28 cm and 0.32 cm. The thousand seed weight varied from 18 g to 28 g. Dry matter yield per plant for the first and the second year was in average 95 g/plant and 362 g/plant respectively. Grain yield showed a big variation and ranged between 7 g/plant and 35 g/plant.

IV – Conclusion

An interesting variability among studied ecotypes was found. These results open the way to test these ecotypes and evaluate their production under normal sward densities.

These preliminary results are very encouraging in view of the valorisation of *Bituminaria* as perennial forage legume for marginal rainfed areas.

Bituminaria is mostly evaluated for grazing. Animals prefer graze its leaves and fresh sprouts, so chemical prosperities of leaves and stems must be analyzed.

References

Brullo S., Brullo C., Cambria S., Cristaudo A. and Gado G D., 2017. *Bituminaria antiatlantica* (Psoraleeae, Fabaceae), a new species from Morocco. PhytoKeys. (85): 109-124.

Fedorenko D., Dolling D.,Loo C., Bailey T. and Latta R., 2009. Lucerne guidelines for Western Australia. Principles for integrating a perennial pasture into broadacre dryland farming systems. DAFWA Bulletin 4785.

Foster K., Ryan M.M., Real D., Ramankutty P. and Lambers H., 2013. Seasonal and diurnal variation in the stomatal conductance and paraheliotropism of tedera (*Bituminaria bituminosa* var albomarginata) in the field. Functional Plant Biology. Add informations…

Foster K., 2015. Drought resistance and recovery mechanisms of tedera (*Bituminaria bituminosa* var.albomarginata). Thesis. University of Western Australia, School of Plant Biology, Faculty of science. No. pages?

Hamilton D., 1974. Alternatives to dry annual pastures for steers over summer and later effects on liveweight gain during winter. Proceedings of Australian Society of Animal Production. 10, 99-102.

Munôz A., Ortiz-Dorda J. and Correal E., 2000. Morphological and molecular characterization of *Bituminaria bituminosa* accessions from South East Spain and the Canary Island. Cahiers Opt. Medit. 45, 103-107.

Real D., Correal E., Mèndez P., Santos A., Rios S., Sternberg M., Dini-Papanastasi O., Pecetti L. and Tava A., 2009. *Bituminaria bituminosa* C.H. Stirton.

Sternberg M., Gishri N. and Mabjeesh S.J., 2006. Effects of grazing on *Bituminaria bituminosa* (L) Stirton: A Potential Forage Crop in Mediterranean Grasslands. Crop/Forage/Soil Management/Grassland Utilization. J. Agronomy & Crop Sciences 192, 399-407.