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Noutfia A., Mrabet R., El Mourabit N., Ayadi M., El Othmani S.

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Characterization of a local germplasm of sulla (*Hedysarum coronarium*) in the north of Morocco

A. Noutfia, R. Mrabet, N. El Mourabit, M. Ayadi and S. El Othmani

INRA. Agronomic National Research Institute. 78. Bd. Sidi Mohamed Ben Abdallah, Tangiers (Morocco)
e-mail : ali_noutfia@yahoo.fr

Abstract. In the west-northern region of Morocco, the sulla (*Hedysarum* spp) an endemic forage plant is subject to severe genetic erosion that needs a special attention to preserve and to valorise this patrimony. In this context this study was carried out to collect and characterize local germplasm. Thirty ecotypes were collected and compared with Italian and Spanish varieties. Agronomic assessment showed that 80% of collected ecotypes were creeping types and 20% were upright ecotypes. They were conducted as monocropping and gave yield exceeding 10 tons per hectare of dry matter. Plant chemical analysis indicated that the local germplasm showed a higher protein content than Italian and Spanish varieties: 25.9, 23.1, and 14.1%, respectively. For the cellulose content, no significant differences were found among ecotypes (20% of DM). As conclusion, since local germplasm presented better productivity indexes it is evident to conduct a breeding program for development of this crop as strategic feed resource for the region.

Keywords. Evaluation – Sulla – Northern Morocco – Chemical composition – Dry matter yield.

Caractérisation du germoplasm local de sulla (*Hedysarum *spp) dans le Nord ouest du Maroc

Résumé. Dans la région du nord ouest Marocain, le sulla (Hedysarum *spp*) plante fourragère endémique est soumise à une forte érosion génétique qui nécessite une attention particulière à la préservation et à la valorisation de cette ressources Dans ce contexte, cette étude a été réalisée pour collecter et caractériser le germoplasme local de cette espèce. Vingt-cinq écotypes ont été collectés et comparés avec des variétés italiennes et espagnoles. L'évaluation agronomique a montré que la plupart des écotypes collectés sont de types rampants (80%) et quelque uns de types verticaux (20%). Les rendements du Sulla en monoculture ont été généralement supérieurs à 10 tonnes de matière sèche par hectare. L'analyse chimique a indiqué que le matériel génétique local montre une teneur en protéines plus élevée que les variétés italiennes et espagnoles respectivement (25,6%, 23,1% et 14,1% de MS). Pour la teneur en cellulose, les trois origines ont un niveau identique (20% de MS). En conclusion, le matériel génétique local montre une meilleure productivité en termes de rendement en matière sèche et de composition chimique ce qui appelle à la mise en place d'un programme de sélection pour l'exploitation de cette ressource et son intégration dans l'amélioration du calendrier alimentaires des troupeaux dans cette région.

Mots-clés. *Evaluation – Sulla – Nord du Maroc – Rendement en biomasse – Composition chimique.*

I – Introduction

Phytogenetic resources are valuable assets necessary to maintain the ecological balance. In this context, natural populations of sulla (*Hedysarum* spp) are of great interest that can be exploited in the recovery of degraded areas in the northwest region of Morocco. In order to preserve this important genetic potential, a program of exploration and collection of local sulla was initiated in 2009 in Tangier, which houses a large genetic diversity of this species but is under strong and continuous genetic erosion (Triffi-Farah *et al*., 2002, Noutfia *et al*., 2010). The use of sulla by small ruminants showed good performance by either pasture in monoculture or in mixtures with other legumes for use as hay or silage (Leto *et al*., 2002; Moll *et al*., 2008). Used as hay or silage, sulla showed no difference in production performance or quality of milk and sheep's and goat's

cheese (Leto *et al*., 2002 and Molle *et al*., 2003). This performance is due firstly to its moderate content of condensed tannins and its relatively high content of energy (Molle *et al*., 2008). Also, the sulla is well known for its high nutritional value especially its protein content. In order to characterize and preserve the local sulla germplasm, a collection and assessment were conducted during the campaigns 2009 and 2010 through the following steps: (1) Collection and characterization of the genetic diversity of local sulla ecotypes; (2) agro morphological and chemical characterization by comparison with Spanish and Italian varieties.

II – Material and methods

1. Agro morphological assessment of the collection

Surveys and collections have to be spread over the two crop years 2009 and 2010. The methodological approach adopted is to cover a greater morphological diversity based on criteria related to earliness, size of pods and the vegetation bearing. The accessions collected in 2009 were sown (September 2010) in the field of experimental station Bougdour in Tangiers for an initial assessment. This was made on the basis of morphological criteria, DNA extraction and biomass yield in comparison with some Italian varieties.

2. Chemical composition

The studied collection consists in 30 different entries of sulla from two years of collections in the area, five Spanish varieties of the species flexusum and three Italian varieties. Each entry is sown in a plot of 9 square meters. The initial nutrient applied prior to sowing 0-100-100 consists of units of nitrogen, phosphorus and potassium respectively. The analysis concerned the determination of the composition of different forage ecotypes by analysis of crude protein (CP), crude fiber (CB), mineral matter (MM) and fat (MF).

III – Results and discussion

1. Agro morphological assessment of the collection

Following the various outputs of exploration undertaken in the area, we could classify this collection in three groups (Table 1).

Table 1. Characteristics of different collected accessions of sulla in the North west of Morocco

Group	Number of accessions	Description of collection sites
Group 1	11	Moderately deep heavy textured soils in flat topographys
Group 2	13	Roughed topography
Group 3	6	Eroded roughed topography
Group 4	8	–

In fact, the sulla feared poor drainage and research ecotypes tolerant of such conditions would be of great importance for some marginal sites in the area. Accessions of Sulla showed a fairly large morphological variability as shown in Table 2. The level of dry matter yield obtained is comparable to variety Irpina with 7.5 tons/ha dry matter, but it is significantly lower than the Carmen variety with about 9 tons of dry matter per hectare.

Table 2. Morphological characteristics of local ecotypes of sulla

Main criterion choice	Accession number	Main stem height (cm)	Main plant height (cm)	Leaflets number per sheet	Internodes number of the main stem
Spreading habit	13	< 5	<10	5 - 7	3
Broad panicle	2	30.09	35.11	7 - 9	7 - 9
Late flowering	13	28.17	32.12	7 - 9	5
Waterlogging tolerance	2	42.71	52.7	7 - 9	9

Spanish ecotypes, whose seeds were shelled (naked), showed a fairly homogeneous lifting while several local ecotypes presented a very low or no emergence. And seven local entries and the variety of Tunisia were eliminated by their very low rates emergence. So we raised the lack of nodulation in all ecotypes (observation made on several plants). This problem was partially solved by the application of nitrogen to the branching point. The observations have shown a healthy behaviour of all ecotypes especially against the attacks of the powdery mildew widespread in the area. The flowering period started early for the ecotypes in the beginning of the second decade of April and lasts until late May. The different ecotypes showed a bloom over several weeks. The high density observed in two fields of sulla (in the area) has hinted that it would be determinant in the regulation of plant growth in height (erect) while low densities favour the lateral growth. To elucidate the issues and the lack of nodulation on the low germination of some ecotypes, an investigation should be undertaken by studying the possible effect of decortications pods on seed germination and dormancy of the event of some seeds and ways to overcome this dormancy for a better crop establishment. Moreover, the on going work on the isolation and characterization of strains of Rhizobium inoculating sulla in this region (El Mourabit *et al*.; 2010) may soon shed light on the reasons for the absence of nodulation in the experimental site Bougdour.

2. Chemical composition

From these results, we see that except the crude protein content, different ecotypes showed similar values for MM, CB and MG. These levels are comparable to those advanced by Leto *et al*. (2002). For nitrogen content, local ecotypes showed values comparable to Italian varieties and those reported by Molle *et al*. (2008). However the Spanish varieties have recorded the MAT value significantly lower and close to the sulla-oat mixtures. For local ecotypes, there is considerable variability in the CP content ranging from 10 to 30% of MS reflecting genetic variability within this collection.

Table 3. Chemical composition of different entries of sulla in Tangier in% DM

	CP	MF	MM	CB
Local ecotypes	25.95 ± 6.84	3.58 ± 1.83	11.57 ± 3.25	22.00 ± 4.40
Italian varieties	23.14 ± 1.56	4.48 ± 1.28	10.16 ± 0.91	22.73 ± 3.83
Spanish varieties	13.88 ± 3.16	6.54 ± 7.48	10.60 ± 1.71	20.71 ± 3.74

CP: crude protein; MF: fat; MM: minerals; CB: crude fiber.

III – Conclusion

The two years evaluation of the plant material of local sulla show a great production level of this species closely similar to some Italian varieties. They indicate also the existence of significant variability of the CP content of different ecotypes that deserves to be confirmed by further analysis and reflecting significant genetic variability. The results also highlight the technical requirements for the conduct of the culture of sulla including low or no emergence of some ecotypes, the absence of nodulation of different ecotypes in some areas that are searchable as constraints in order to better exploit this resource

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