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Selection of spontaneous genotypes with high pastoral value and for multiuse systems

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SUMMARY – Sardinian spontaneous pastures show a remarkable biodiversity. This botanical patrimony could be valorised in land multiuse systems, such as sward reconstitution, whose degradation is often caused by human activities. Improvement of firebreak management with sward re-establishment employing local genotypes is our contribution to the VEGETATIO project (PIC INTERREG IIIA). According to the presence or absence of livestock, genotypes should have a high or scarce growing rate. Another purpose is the rediscovery of traditional plants in order to be able to provide local populations with additional income. This paper shows the results of a two-year study. After the assessment of botanical composition, some genotypes were collected and evaluated regarding their valorisation.

Keywords: Biodiversity, environment improvement, genotype valorisation, multiuse system.

RESUME – *"Sélection de génotypes spontanés ayant une haute valeur pastorale pour des systèmes multi-usage". Les pâturages spontanés de la Sardaigne montrent une remarquable biodiversité. Ce patrimoine botanique peut être valorisé dans le système multi-usage, par exemple pour la reconstitution de la couverture herbacée, dont la dégradation est souvent causée par l'activité humaine. L'amélioration environnementale des pare-feu avec un enherbement employant génotypes locaux est notre contribution au projet VEGETATIO (PIC INTERREG IIIA). En présence des animaux ces génotypes devraient avoir de hautes productivité et valeur pastorale, et peu de croissance en leur absence. Un autre but est la redécouverte des plantes traditionnelles, pour donner une opportunité supplémentaire de travail aux populations locales. Cette étude montre les résultats d'une recherche biennale. Une fois la connaissance de la composition botanique acquise, nous avons collectionné et évalué quelques génotypes pour leur valorisation.*

Mots-clés : *Biodiversité, amélioration du territoire, valorisation de génotypes, système multi-usage.*

Introduction

In Sardinia, spontaneous pastures show high biodiversity (Spanu *et al.*, 1997; Vargiu *et al.*, 2002); most species are palatables, numerous officinals, all with landscape value especially in the flowering period. This botanical patrimony could be valorised for pastoral purposes or different usages in the multiuse system; many species could be employed in the craftsmanship, gastronomy, herbal medicine, environmental restoring and protection, or simply to improve the amenity of countryside.

The Department of Vegetable Production Research of AGRIS is involved in VEGETATIO project (PIC INTERREG IIIA) that aims to protect the territory from fire risk in a sustainable way. The studies were addressed to improve firebreaks management, where vegetation is usually removed with scrapers, causing serious problems of soil erosion (Caredda *et al.*, 2002), and to rediscover traditional plants used until recent time to the local populations. The paper reports two-year (2006 - 2007) results regarding the valorisation of local genotypes with covering capacity to re-establish the sward in firebreaks. Genotypes should be characterized by high productivity and pastoral value in grazing conditions and by scarce growing without grazing. The first step was the site characterization regarding botanical composition, followed by genotypes collection and evaluation for different uses.

Materials and methods

The studied firebreak (about 20 metres wide and 1.5 km long) is located in central Sardinia (Uatzo forest, Tonara, NU), altitude 764 - 448 m a.s.l., high slope condition with a maximum of 35%, soil loam or loamy-sand on schistose substratum, absence of limestone and pH 5.7 – 6.3. Sward is not continuous; several bare areas are present because of rocks or scarcity of soil. Vegetation is periodically removed with a scraper.

First the floristic list (Pignatti, 1982; Arrigoni, 1976-1991) and biological and chorological spectrum were determined. In spring, vegetational *facies* were defined using floristic lines method (Daget and Poissonet, 1969). Specific contribution of every species was obtained through 48 linear analyses. Pastoral value was calculated using the specific index of each species in the lines (Roggero, 2002).

Genotypes collection activity was conducted in firebreak during the summer 2006. The following autumn, in the experimental farm of Ussana (south Sardinia, CA), the collected species were grown in bench and evaluated for biological cycle and herbage growing pattern for pasture uses. Grazing was simulated cutting the herbage from 20-25 cm until the reproductive phase in order to preserve seed yield. Some genotypes were repeatedly cut, while others with scarce growing were never cut.

In the same autumn, some genotypes of legume species (*Trifolium cherleri, T. resupinatum, T. spumosum* and *T. glomeratum*, *Medicago polymorpha* and *M. arabica*), deriving from a past collection activity (Vargiu *et al*., 1999; Vargiu *et al*., 2000) but present in this site, were sown in the firebreak area. Sowing was made after minimum tillage, in plots of 60 m^2 for single genotypes and 400 m^2 for its mixture. Observations were addressed to the covering capacity.

Results and discussion

In the firebreak, the numbers of botanical species (195, 28 of them with officinal properties) exhibit the high biodiversity of this area. Moreover, nearby, 23 endemic species were found. Numerous aromatic, gastronomic, medicinal, dyeing, etc. species have been found (Table 1).

Table 1. Officinal species (A= Aromatic, G= Gastronomic, L= Liqueur, M= Medical, D= Dyeing).

Achillea ligustica All. (M)	*Potentilla recta* L. (M)
Capsella bursa pastoris L. Medicus (G - M)	*Quercus ilex* L. (G - D)
Crateagus monogyna Jacq. subsp. *monogyna* (G - L - M)	*Quercus pubescens* Willd. (D)
Euphorbia caracias L. (D)	*Raphanus raphanistrum* L. subsp. *raphanistrum* (G)
Fumaria officinalis L. subsp. *officinalis* (M)	
Geranium robertianum L. (M)	*Reseda luteola* L. (D)
Helichrysum italicum (Roth) G. Don subsp. *Microphyllum* (A - M)	*Rubia peregrina* L. (D)
	Rubus ulmifolius Schott (G - L - M - D)
Hypericum perforatum L. subsp. perforatum (A - L - M - D)	*Rumex* sp. (G)
Lavandula stoechas L. (A - G - M - D)	*Senecio vulgaris* L. var. *tyrrhenus* (M)
Mentha aquatica L. subhyb. *piperita* (A - C - L - M)	*Sisymbrium officinale* (L.) Scop. (M - G)
Nasturtium officinale R. Br. (A - G - M)	*Smilax aspera* L. (M)
Papaver setigerum DC. (M)	*Stellaria media* (L.) Vill. subsp. *media* (M - G)
Papaver rhoeas L. subsp. *rhoeas* (G - L - M - D)	*Teucrium marum* L. (A)
Plantago lanceolata L. (M)	*Urginea marittima* (L.) Baker (M)

Biological spectrum (Fig. 1) points out the high presence of terophyte species depending on the Mediterranean climate conditions (drought in spring and summer), which favour annual seed production as a reproductive strategy. The relevant presence of phanerophyte species (9%) indicates the trend of scrub to reconstitute.

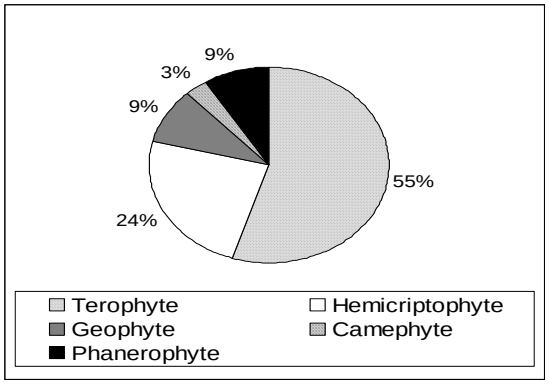

Fig. 1. Biological spectrum.

The mediterranean features of this area are confirmed by the chorological spectrum and mediterranean index (Figs 2 and 3) with 72% of mediterranean species. The chorologycal analysis shows a higher presence of widespread euri-mediterranean species (31%) in comparison with the less spread steno-mediterranean ones (29%).

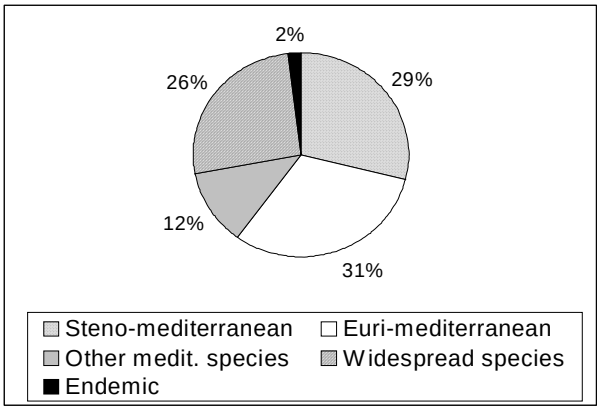

Fig. 2. Chorological spectrum.

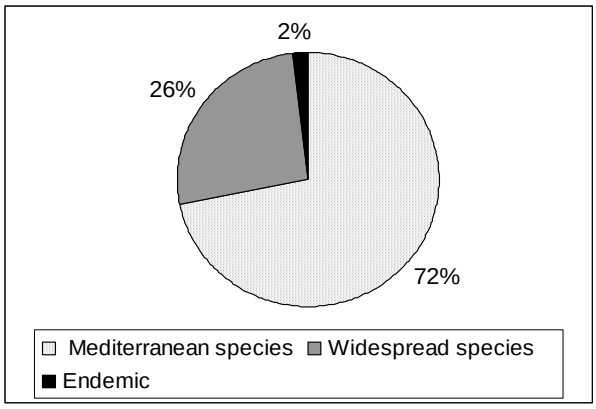

Fig. 3. Mediterranean index.

In the firebreak area the most represented species are *Trifolium cherleri* L. (13,7%), *Trifolium subterraneum* L. (4,9%), *Ornithopus compressus* (4,6%) and *Vicia cracca* L. (7%) in particular ecological conditions. In the most favourable conditions scrub regains slowly.

Four vegetational *facies* (Fig. 4) were found depending on the different ecological conditions (slope, shading, etc.). The first *facies*, located in a dominant plain area, is characterized by the prevalence of *Trifolium cherleri* L. (17.7%) and the presence of species with high specific index as *Trifolium subterraneum* L. (7.6%) and *Ornithopus compressus* L. (7.3%); moreover, the highest biodiversity was found: in a surface of 36 m^2 (6m x 6m) 76 species were counted. The second *facies* shows the highest percentage of bare soil (28.7%), because of soil erosion caused by high slope conditions; the presence of legumes *Trifolium subterraneum* L. (7.7%), *Trifolium cherleri* L. (5.4%) and *Medicago polymorpha* L. (5%) and grasses *Poa annua* L. (9.1%) and *Vulpia ligustica* (All.) Link (3.2%) is relevant. The third *facies*, characterized by scarce slope and deeper soil, comprises the more exigent species, such as *Vicia cracca* L. (27.1%) and *Rubus ulmifolius* Scott (7.5%); the presence of *Medicago polymorpha* L. (6.2%) is notable. In the fourth *facies*, with lower altitude, *Trifolium cherleri* L. (31.3%) is predominant; other legumes with high specific index such as *Trifolium incarnatum* L. (10.7%) and *Ornithopus compressus* L. (5.3%) are present; notwithstanding the high slope the sward covers almost the whole surface (6.7% of bare soil).

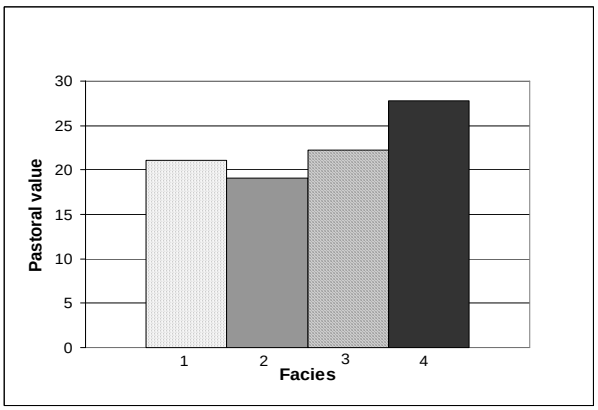

Fig. 4. Pastoral value.

Regarding the vegetative growing pattern of the collected genotypes sown in bench (Fig. 5), some grasses such as *Briza maxima*, *Cynosurus echinatus*, *Dasypyrum villosum* are the earliest. In legumes the first cut was made 45 days later. Regarding flowering period, genotypes showed a great variability.

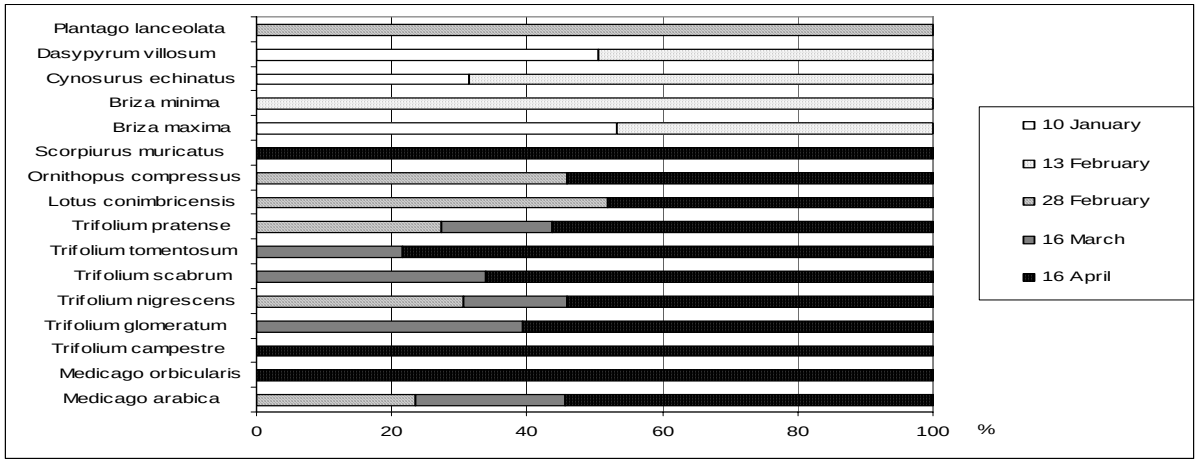

Fig. 5. Vegetative pattern (percentage on dry matter yield) during the 2007 of some genotypes.

Genotypes sowing in firebreak, in spite of seed losses due to the following rainfall, produced a closed sward, particularly in the plots of *Trifolium cherleri*, *T. resupinatum*, *Medicago polymorpha* and in the mixture. Depending on meteorological conditions, the scarce vegetative growing not allowed sward mowing in order to evaluate dry matter production. All the species reached the reproductive phase and constituted the seed bank necessary for the successive self-reseeding. In the following year, according to the observations carried out in winter, *Trifolium cherleri* and *T. resupinatum* showed the best regenerations of swards.

Conclusions

The great biodiversity of mountain pastures in Sardinia has been confirmed. Such biodiversity could be exploited to select different genotypes with high covering capacity suitable for sward reconstitution in the firebreaks, both in grazing condition (high pastoral value and productivity) and without grazing (scarce dry matter yield). Planting mixture, rather than single species, as it happens in spontaneous swards, appears to be more effective in reproducing natural conditions. From this point

of view, *Trifolium cherleri* and *T. resupinatum* seem to be particularly adapted, developing a dense sward also in the second year.

Furthermore, this preliminary investigation could permit to rediscover the traditional plants used for different purposes until recent time, that could give the possibility of extra-income to local population. Moreover, during flowering most of these species become interesting for recreational and tourist uses increasing the amenity of landscape.

It should be stressed that a well organized seed selection and multiplication would be essential for the availability of local genotypes.

References

Arrigoni, P.V. (1976-1991). *Le piante endemiche della Sardegna*. Bollettino Società Scienze Naturali, vol. 17-26.

Caredda, S., Franca, A. and Seddaiu, G. (2002). *Fire breaks over-sowing: An alternative tool for the wildfire risk reduction in Sardinia.* In: *Proc. of the 19th General Meeting of the EGF*, La Rochelle, France, May 27-30, 2002, pp. 908-909.

Daget, P. and Poisonnet, J. (1969). *Analyse phytologique des praires; applications agronomiques*. CNRS, CEPE Montpellier, Doc 48, pp. 66.

Pignatti, S. (1982). *Flora d'Italia*. Edizione Agricole.

Roggero, P.P., Bagella, S. and Farina, R. (2002). Un archivio dati di Indici specifici per la valutazione integrata del valore pastorale. *Rivista di Agronomia*, 2: 149-156.

Spanu, E., Arangino, R.and Vargiu, M. (1997). Forage yield and botanical composition of pastures grazed by milking ewes in Sardinia. In: *Proc. of the International Occasional Symposium of EGF*, Warszawa-Lomza, Poland, 19-23 May 1997, pp. 347-351.

Vargiu, M. and Spanu, E. (1999). Preliminary results of some forage species populations collected in Sardinia. In: *Proc. of the 4th International Herbage Seed Conference*, Perugia, Italy, 23-27 May 1999, pp. 282-286.

Vargiu, M., Spanu, E., Loche, F. and Salis, L. (2000). *Preliminary results of some forage legumes populations cultivated in three different Sardinian environments.* In: *Cahiers Options Méditerranéennes*, Vol. 45: 55-58.

Vargiu, M., Nonnoi, A., Spanu, E. and Usala, M. (2002). *Composition of pastures phytocoenosis depending on the biotic and abiotic characteristics.* In *Proc. of the 19th General Meeting of the EGF*, La Rochelle, France, May 27-30, 2002, pp. 826-827.