

**PRELIMINARY RESULTS ON THE CONSERVATION OF
LAMYROPSIS MICROCEPHALA (MORIS) DITTRICH &
GREUTER (COMPOSITAE), A THREATENED ENDEMIC
SPECIES OF THE GENNARGENTU MASSIF, SARDINIA
(ITALY)**

**Gianluigi BACCHETTA¹, Giuseppe FENU¹, Efsio MATTANA¹ & Tiziana
ULIAN²**

1 Centro Conservazione Biodiversità (CCB), Dipartimento di Scienze Botaniche –
Università degli Studi di Cagliari, viale S. Ignazio da Laconi 13, 09123 Cagliari.

E-mail: bacchet@unica.it; gfenu@unica.it; mattana.ef시오@tiscali.it.

2 Seed Conservation Department, Royal Botanic Gardens Kew, Wakehurst Place,
Ardingly, W. Sussex RH17 6TN U.K.

E-mail: T.Ulian@kew.org.

SUMMARY: *Lamyropsis microcephala* (Moris) Dittrich & Greuter (Compositae) is a perennial species, narrow endemic of Sardinia (Italy) and known only in two sites of the Gennargentu massif. The aims of this study are to investigate characteristics of the ecology and biology of the species which might be important for its conservation and reassess its conservation status. Here we show the preliminary results of this study, with a focus on the abundance and distribution of the species, its reproductive capacity and the levels of threats. From the data collected in the field it appears that the population had been fragmented into two subpopulations. The total population covered an area of around 12 hectares and consisted of around 2500 individuals. The reproductive biology of the species, in particular the low production of fertile seeds and absence of plantulae (recruitment) in the field, seems to be one of the main biological causes of the threatened status of the species. Increases in extensive grazing and tourism, linked to the skiing and trekking activities, have been recognized as the major anthropogenic threats to the species. The preliminary results of this study confirm the conservation status of *L. m-icrocephala* as Critically Endangered. **Key words:** narrow endemic, conservation biology, seed viability, human disturbance, IUCN categories.

RESUMEN: *Lamyropsis microcephala* (Moris) Dittrich & Greuter (Compositae) es un endemismo de la isla de Cerdeña (Italia), sólo conocido de un par de localidades del macizo Gennargentu. El propósito de este trabajo es el de intentar conocer las características de la ecología y biología de la especie que puedan ser importantes de cara a su conservación. Mostramos los resultados preliminares, centrados en la abundancia y distribución de la especie, su capacidad reproductiva y sus posibles amenazas. De los datos obtenidos en el campo parece que la población original se ha fragmentado en dos subpoblaciones. La población total cubre un área de unas 12 Ha, incluyendo unos 2500 individuos. La biología reproductiva de la especie, en particular la baja producción de semillas fértiles y la ausencia de plántulas en el campo, parecen ser estar en la base de su situación como planta amenazada. El aumento del pastoreo extensivo y del turismo, unidos a las actividades deportivas de montaña, se muestran como las principales amenazas debidas a la actividad humana. Los resultados preliminares de este estudio confirman la posición de la especie como *En Peligro Crítico*. **Palabras clave:**

endemismo, biología de la conservación, viabilidad de semillas, alteraciones antrópicas, categorías IUCN.

INTRODUCTION

Lamyropsis microcephala (Moris) Dittrich & Greuter is a perennial rhizomatous suffrutex, narrow endemic of Sardinia. The species is known only in two sites of the Gennargentu massif and it is considered as one of the rarest paleoendemics of the island (CONTI & *al.*, 1992). The species is heliophile and mesophile and grows in catchment areas and small valleys subjected to intense soil erosion and on a glaucous metamorphic substrata (BACCHETTA, 2001). From the bioclimatic point of view (RIVAS-MAR-TÍNEZ & *al.*, 2002) it grows in the temperate submediterranean

bioclimate between the upper supramediterranean lower humid and the lower supramediterranean upper humid.

The species grows between 1500-1750 m in two sites on the slopes of Mount Bruncu Spina (Figure 1). The first site is located above the Riu Aratu river's source and the second one on the north-western slope, below the top of the mountain (DIANA CORRIAS, 1977a). The species was described as covering an area of 100 m² in MONTMOLLIN DE & STRAHM (2005) and CAMARDA (2006) and the number of individuals had been estimated between 100-150 during earlier visits (BACCHETTA, *op. cit.*).

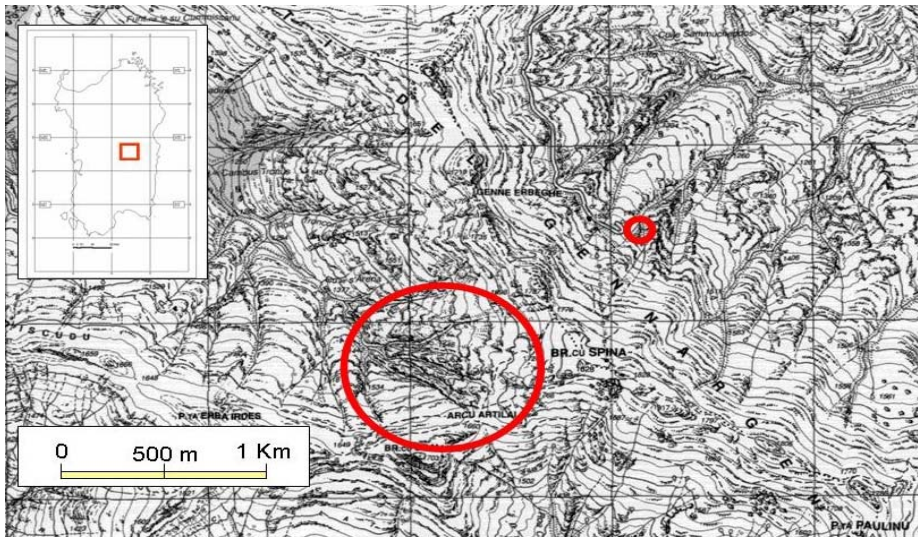


Figure 1– Distribution of *L. microcephala* in the two sites on Mount Bruncu Spina (40° 01' N, 9° 17' E; Datum WGS84) in the Gennargentu massif.

Seeds of the species showed low germination (around 20%) and the plants had a very slow vegetative propagation in studies carried out by CORRIAS (1977a; 1977b). For this reason, together with a narrow distribution, the low number of

individuals and the threats deriving from an uncontrolled and extensive grazing, *L. microcephala* has been considered as the Sardinian endemic at the highest risk of extinction (GREUTER, 1972; ARRIGONI, 1974).

More recently, the activities derived from increased tourism, due mainly to skiing on the north western slope of Mount Bruncu Spina, have threatened the conservation status of the species further (BACCHETTA, *op. cit.*).

Because of its rarity and the threats, the species was considered as Critically Endangered [CR = B1 ab(iii) + 2ab(iii)] by MONTMOLLIN DE & STRAHM (*op. cit.*) and was included in the Appendix of the directive DIR. 43/92/CEE and in several other proposals laws for the protection of the Sardinian flora, such as decision n. 17/2 of 12.04.2005 of the Regione Auto-noma della Sardegna. The species is also located within the Gennargentu and Oro-sei Gulf Regional Park, which was established by the regional laws 31/89 and 394/91. This is also an area which has been proposed as the Site of Community importance (SCI) "Gennargentu Mountains" (ITB021103).

However, despite the recognized threatened conservation status of the species, its rarity, and the legal measures taken, information on the ecology and biology of the species and the intensity of threats has not been completely investigated yet and the long-term conservation of the species has not been ensured on the basis of such information.

The aims of this study were to investigate characteristics of the ecology and biology of the species which might be important for its conservation and reassess the assigned IUCN conservation status on the basis of the information provided and the data already available in the literature.

The objectives of this study were to analyse the abundance and distribution of the species, its habitat and phytosociological associations, characteristics of the reproductive biology and demography, as well as to assess the intensity of the threats on the conservation status of the species.

The information derived will be extremely important to understand the causes of the threatened conservation status of *L. microcephala*. This will help to identify more targeted and adequate conservation measures both in situ and ex situ and suggest sustainable management recommendations to ensure the species conservation in the future.

MATERIAL AND METHODS

The first step on the study of *L. microcephala* was to review all the information available in the literature and analyse the herbarium specimens conserved in the Department of Botanical Sciences of the University of Cagliari (Herbarium CAG). The compiled information was then complemented with observations and data obtained during field surveys carried out between July 2004 and January 2007.

In order to record the data *in situ* (abundance and distribution, habitat and phyto-sociological associations, phenology and demography, threats) we followed the protocols used for the AFA (Atlas Flo-ra Amenazada) project in Spain (ALBERT & *al.*, 2003) and the Interreg IIIB GENMEDOC project in the Mediterranean basin (BACCHETTA & *al.*, 2006).

During fieldwork in 2004 and 2006, we collected data on the abundance and the distribution of *L. microcephala* in the two sites of Mount Bruncu Spina. We measured the perimeters and we estimated the area of occupancy of the species. We sampled the individuals along an altitudinal gradient using a transect in order to look for distribution patterns. We then characterized the population, estimated the number of individuals and collect data on habitat, species composition and phenology.

Specifically, for the analysis of the vegetation, we applied the methods used for

the phytosociological surveys by the Sigmatis school of Zürich-Montpellier in both sites (BRAUN-BLANQUET, 1951).

During the two field expeditions in 2006 we collected the germplasm, after obtaining the permits from the Ministero dell'Ambiente e della Tutela del Territorio e del Mare, as required by the European and national laws for the species listed in the appendices of the Habitat Directive, following articles 9 and 10 of DPR 357/97 modified by DPR 120/03.

During the seed collecting expeditions, the mature fruiting heads of the reproductive plants were collected and taken to the Germplasm Bank of Sardinia (BG-SAR). Here, the cypselas were processed, characterized and selected, before conserving them in the Bank. The procedures and protocols described in BACCHETTA & *al.* (*op. cit.*) were followed.

The quality of the seeds was then checked at the Millennium Seed Bank, in the Seed Conservation Department of the Royal Botanic Gardens, Kew, U.K, where viability tests were carried out. The X ray analysis followed the protocols described by TERRY & *al.* (2003), whilst Tetrazolium Testing adhered to protocols of MOORE (1985), LEIST & *al.* (2003) and ISTA (2006).

Finally, the conservation status of the species was reassessed by using the information in the literature and the preliminary results obtained. For this purpose, the IUCN criteria of version 3.1 (IUCN, 2001 and 2003) were used by following the guidelines of version 6.1 (IUCN, 2006).

RESULTS

From the data collected in the field it appears that the population in Mount Brunco Spina had been fragmented into two subpopulations (Figure 1), one loca-

ted in the north-eastern slope of the mountain, in the municipality of Fonni, and the other one on the south-western slope, in the municipality of Desulo.

The total population covered 12 hectares, but the two subpopulations differed in size and abundance of individuals. The first population, on the slope in Fonni, consisted of 50 individuals and extended over a small area of 50 m². This part of the population was next to the recently built skiing slope, at 1585 m of altitude and on a steep slope at 35° degree (mean). We consider this was a part of a larger population that used to reach the upper part of the slope, now used for skiing. This subpopulation was highly threatened, because of the low number of reproductive individuals, the reduction in habitat and the threatened conservation status of its individuals. The subpopulation in Desulo had a wider distribution and covered an area of about 12 hectares, on the upper part of Rio Aratu. The plants distributed between 1450 and 1700 m, along areas subjected to seasonal drainage generally in catchment areas or in moderate hygrophilic conditions. Here the species was distributed on a gentler slope at 20° degree (mean). The sampling during 2004 did not reveal any altitudinal distribution pattern and we estimated around 2500 individuals.

The vegetation community of *L. microcephala* was described as a perennial grassland coenosis, with hemicryptophytes and caespitose chamaephytes being dominant. However, this aspect of the vegetation has not been further investigated. From a floristic point of view, the species grows in association with other Sardinian endemic taxa: *Astragalus genargentus* Moris, *Thymus catharinae* Camarda, *Festuca morisiana* Parl., *Viola corsica* subsp. *limbarae* Merxm. & Lippert, *Glechoma sardoa* (Bég.) Bég., or sarde-corse such

as *Myosotis soleirolii* Godr., *Crocus minimus* DC., *Plantago subulata* subsp. *insularis* (Gren. & Godr.) Nyman, *Poa balbisi* Parl., *Carlina macrocephala* Moris subsp. *macrocephala*, *Lamium garganicum* subsp. *corsicum* (Gren. & Godr.) Arcang. and *Scrophularia oblongifolia* Loisel. subsp. *oblongifolia*. From a syntaxonomic analysis of such coenosis it was possible to include this plant community in the class *Carici-Genistetea lobelii* (Klein 1972) Pignatti & Nimis 1980 em. Arrigoni 1986 and the order *Carici-Ge-*

nistetalia lobelii (Klein 1972) Pignatti & Nimis 1980.

The preliminary results on the phenological studies showed that the flowering season started in the end of June and finished in the middle August, while the fruiting season began in the end of July and ended in September. The fruiting season of the subpopulation in Fonni started nearly a month later with respect to the subpopulation in Desulo. The differences in phenology might be due to the different aspects of the slopes, facing northeast in Fonni and therefore being more shaded.

Accession No	Site	Collection date	No of sampled individuals	No of collected seeds
284/06	Rio Aratu (Desulo)	12/08/06	100	906
352/06	Su Pisargiu (Fonni)	20/09/06	30	26

Table 1. Accessions conserved in the Germplasm Bank of Sardinia (BG-SAR).

The seed material collected was processed manually in order to eliminate aborted diaspores (Table 1). The cypsels were separated from the fruiting head and the pappus was removed from each cypsel (Figure 2). Subsequently these were dried in the dry room and conserved at –

25°C in the Sardinian Germplasm Bank (BG-SAR). It was not possible to measure their moisture content (mc) due to the low availability of seed material. This method is destructive and thus it would have reduced the amount of material to be conserved in the Bank.



Figure 2- Cypselas of *L. microcephala*, after processing and removing the pappus.

A subsample of 116 seeds (Figure 3) was analysed under X rays and checked for empty seeds or seeds infected by parasites. We found the majority of the seeds were viable (76%) and contained a well developed endosperm, whilst the remaining seeds were empty or contained em-

bryos which had not developed fully or had been attacked by parasites. This result, together with the low number of fertile seeds found for each individual, confirmed that the species has difficulty with sexual reproduction, as found previously by DIANA CORRIAS (1977a; 1977b).

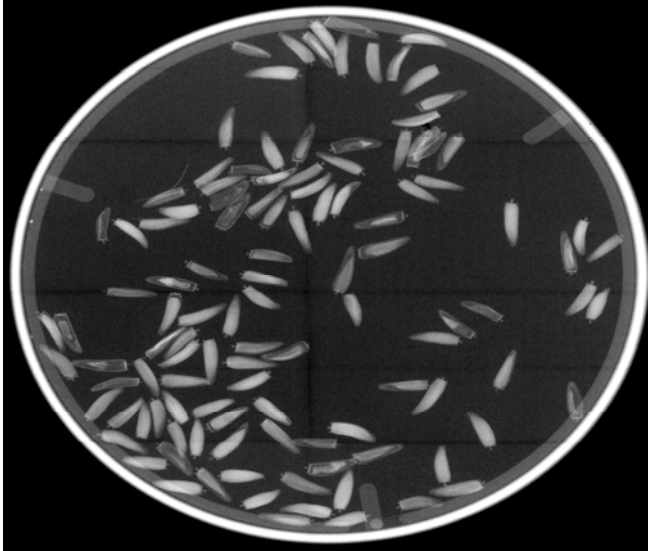


Figure 3 – Photo of cypselas (seeds) of *L. microcephala* under X rays.

The Tetrazolium test gave a high viability (90 %). Germination tests have been set up in order to evaluate the germination potential of the species at different envi-

ronmental conditions. These studies are still on going, however preliminary results showed 50 % germination at 20°C with a photoperiod of 8/16 h light/dark.

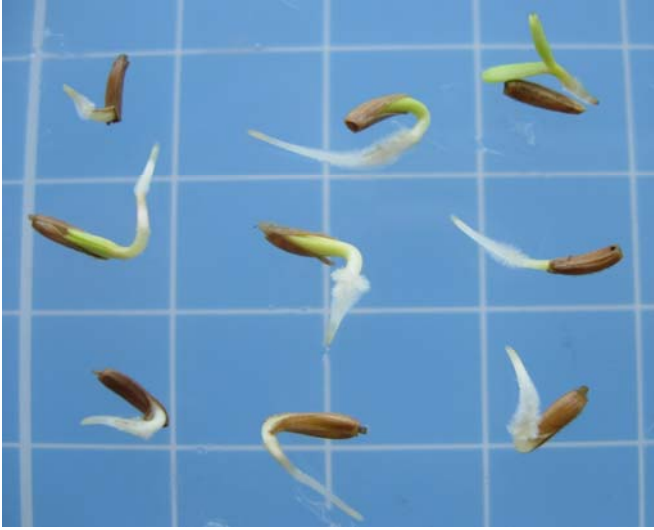


Figure 4 - Seedlings of *L. microcephala* on a centimetre paper.

Uncontrolled extensive grazing has been identified as the major threat to the population. During the last decades this seems to have increased and it went from being seasonal and monotype (sheep and goats) to continuous throughout the year and diverse with the inclusion of cows, pigs and horses. Impacts from herbivores were not identified here.

The other major threat to the population resulted from tourist activity, in particular from the development of the skiing infrastructure and trekking on Mount Bruncu Spina. The increase of trekking routes and intensity of tourists, and therefore trampling, are leading to an increase in the fragmentation of the population and its habitat.

These preliminary results allow us to confirm the conservation status of *L. microcephala* as Critically Endangered (CR) according mainly to the distribution criteria B of IUCN (IUCN, 2001; 2003 and 2006). The increase in threats and their intensity are likely to reduce the habitat and number of individuals of this species in the future. These threats may increase the risk of species extinction, unless

adequate and targeted measures of conservation are urgently undertaken.

DISCUSSION AND CONCLUSION

This study has allowed the characterization of the only known population of *L. microcephala*. The population was found to be fragmented into two subpopulations and estimated to cover an area of around 12 hectares where a total of around 2500 individuals grew. These data differ from those by CAMARDA (*op. cit.*), who estimated that the whole population probably consisted of eight to ten colonies, and only covered some 100 m².

Grazing and tourism, mainly linked to skiing activities, were identified as the main threats for the conservation of the species and have been considered as the main causes of both fragmentation of the population and the low number of individuals.

The germplasm collected allowed a more detailed analysis of the reproductive biology of the species to be carried out, and also identified the limits of its sexual

reproduction. This agrees with the study carried out by DIANA CORRIAS (1977a; 1977b), which found a low production of fertile seeds, a low germination percentage (20%) and the absence of seedlings in the field (recruitment). The same study suggested that vegetative propagation may be the main source of recruitment, but it had been found to be very slow. Our study confirmed a low production of fertile seeds, but we obtained higher percentages of seed viability and germination than reported by DIANA CORRIAS (1977a; 1977b). However, informations on the environmental conditions used during germination testing were not specified in the above study and therefore the results may not be comparable.

The preliminary results obtained from our study confirm the conservation status of *L. microcephala* as Critically Endangered. However, further information is still needed on demography of the species, its population dynamics, the rate of habitat fragmentation and its reproductive biology. Our ongoing studies will be extremely important to provide such information. This will help to identify more targeted and adequate conservation measures and contribute towards sustainable management recommendations to ensure the long-term conservation of the species.

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