

**First record of the invasive species
Centaurea diffusa Lam. (Asteraceae) in high altitude
wetlands, Valle de Uspallata, Mendoza**

**Primer registro de la especie invasora *Centaurea diffusa* Lam.
(Asteraceae) en humedales de altura, Valle de Uspallata, Mendoza**

Solana Tabeni *, Erica Elizabeth Scheibler, Lorena de Jesús Bonjour

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Nota científica

ABSTRACT

Centaurea diffusa is an invasive species whose distribution in Argentina covers the Pampean region. We report for the first time its presence in high altitude ecosystems at the Uspallata Valley in the province of Mendoza, Argentina. We provide a description of the specimens, photographic material and information about their habitat requirements and management status in Argentina and in America.

Keywords

white knapweed • Asteraceae • adventitious species • Mendoza

Instituto Argentino de Investigaciones de las Zonas Áridas
(IADIZA). CCT-CONICET Mendoza. UNCuyo. Gobierno de Mendoza.
Av. A. Ruiz Leal s/n. Parque General San Martín. C. C. 507. C. P. 5500. Mendoza.
Argentina. * stabeni@mendoza-conicet.gob.ar

RESUMEN

Centaurea diffusa es una especie invasora cuya distribución en Argentina abarca la región pampeana. Se reporta por primera vez su presencia en ecosistemas de altura pertenecientes al Valle de Uspallata en la provincia de Mendoza, Argentina. Se brinda una descripción de los ejemplares, material fotográfico e información sobre sus requerimientos de hábitat y estado del manejo en Argentina y en América.

Palabras clave

abrepuño blanco • Asteraceae • especie introducida • Mendoza

INTRODUCTION

Asteraceae constitute the largest family of flowering plants, with more than 1,600 genera and 23,000 species. They are widely distributed throughout the world except the Antarctic region, inhabiting mainly grassland, shrub and mountain ecosystems (2).

Within the Asteraceae family, the genus *Centaurea* includes about 250 species, native to Eurasia, particularly from the Irano-Turanian and Mediterranean regions (16). They are herbaceous or shrub plants, annual, biannual or perennial. Some are ornamental species, others are associated with cereal crops, or naturalized as weeds, and others with medicinal uses (16).

Some introduced species in Australia and North America have expanded into croplands (*C. diffusa* Lam., *C. diluta* Aiton, *C. maculosa* Lam., *C. melitensis* L. and *C. solstitialis* L.) (16); their management and eradication are currently a challenge, in the face of the threat posed by its expansion in soil quality, biodiversity and the health of watersheds (8, 12).

In Argentina, the genus *Centaurea* is represented by nine introduced species (7). *Centaurea diffusa* (white knapweed) is recognized for being a species with ecological attributes of invasive plants in North America, as it can colonize disturbed sites, resist competition with native plants and expand successfully. It inhabits, mainly, arid and semi-arid ecosystems, being able to tolerate a wide range of environmental conditions. The presence of *C. diffusa* in North America has been recorded from 500 to more than 900 meters above sea level, where it can occupy different habitats ranging from roadsides and degraded soils by industrial activities to crops and pastures (13, 18).

The presence of *C. diffusa* in Argentina has been so far reported in the Pampas region (Buenos Aires, Córdoba and La Pampa) between 0 and almost 1000 m a.s.l. (7, 11, 17). The time of introduction to the country, as well as its causes, are unknown. In North America, the first records of its introduction into croplands date from 1907 (United States) and 1936 (Canada) (18). The introduction of *C. diffusa* in America occurred accidentally, by the

entry of bags of alfalfa seeds from Asia Minor or Germany, contaminated with this species (9).

Objective

Report the first record of *C. diffusa* for the flora of Mendoza, and its presence in semiarid high altitude ecosystems in west Argentina.

MATERIALS AND METHODS

The examined material was collected in riparian areas from Uspallata stream (Department of Las Heras, Uspallata locality, Mendoza province, Argentina). The description is based on six individuals collected during a vegetation sampling conducted in February 2019. The specimens were deposited in the MERL herbarium (Mendoza Ruiz Leal) IADIZA CONICET Mendoza, with the following numbers: MERL 63753, MERL 63754, MERL 63755. The taxonomic identification was made through specific bibliography with species keys (7).

RESULTS

The specimens described were collected in wetlands impacted by agricultural activities located in the region of the Uspallata Valley, Mendoza, Argentina (site 1: 32°37' S 69°22' W, site 2: 32°38' S 69°22' W). The city of Uspallata (1890 m a. s. l., 32°35' S, 69°21' W) is located in the depression of the Uspallata Valley, between the Cordillera Frontal and the Andean Precordillera, northwest of Mendoza province. The local climate is

markedly arid with high temperatures and scarce rainfall concentrated in the summer season (annual average 136.3 mm) (10). The vegetation of the Uspallata Valley is mainly formed by shrublands, dominated by *Larrea divaricata* and *Verbena aspera*. The predominant vegetation at the sites where the specimens were collected are mainly composed of: *Tessaria absinthioides*, *Baccharis salicifolia*, *Cortaderia rudiusscula* and *Proustia cuneifolia*, characteristic of riparian plant communities of the Uspallata stream (1, 10).

Morphological description of the individuals collected

Plants up to 50 cm in height, with long roots. Vertical stems, very branched, striated, divaricated, with short and stiff hairs at the angles, and set of woolly hairs and sessile glands along the stem. Leaves covered with short stiff hairs and weak long hairs. Basal leaves arranged in rosette, petiolate, obovate or elliptical, pinnate to bipinnate, pubescent, 3 to 8 cm long, and 1 to 3 cm wide, with narrow lobes and acuminate at the apex. Alternate stem leaves, sessile, smaller and pinnate. The upper most leaves are linear or linear-lanceolate. Yellowish phyllaries with brownish margins, sometimes with spots, with fringes on the sides and ending in a spine of 1 to 5 mm long. Heterogamous or subdiscoid capitula, fertile flowers in the central disc and larger neutral flowers in the periphery, solitary or in groups of 2-3, terminals or axillary, urceolate, 1.5-2 cm long. Obovoid or cylindrical involucre, 9-13 × 2-5 mm, 7-8 seriate. Coriaceous phyllaries, the external ovate, 3-3.3 × 3-4.5 mm, pectinate margin, apex subulate. The middle ovate

or narrowly ovate, 4-8 × 3.5-4 mm, margin of the upper half pectinate, with a differentiated terminal spine 1-4 mm long. The internal oblong, 9-10 × 1 mm, apex obtuse, sometimes finely serrate, membranous margin, not thorny.

Flowers with white or purple corolla. Brownish achenes, 2-3 × 1 mm, papus absent.

Based on the morphological attributes analyzed, the species described corresponds to *Centaurea diffusa* Lam. 1783 (table 1). In figure 1 (page 157), photographs of a specimen collected and analyzed in this study are provided.

Table 1. Morphological characters of the specimens collected in Uspallata Valley belonging to *C. diffusa*. In bold the main diagnostic characters used in the identification.

Tabla 1. Caracteres morfológicos y medidas de los ejemplares colectados en el Valle de Uspallata pertenecientes a *C. diffusa*. En negrita los principales caracteres diagnósticos utilizados en la identificación.

Characters	MERL 63753 (3 specimens)	MERL 63754 (1 specimen)	MERL 63755 (2 specimens)
Winged stems	no	no	no
Flower color	white	purple	white
Capitula surrounded by leaf bracts	no	no	no
Papus	absent	absent	absent
Phyllaries with terminal spine	yes	yes	yes
Height (cm)	33 - 29 - 50	26	29 -36.5
Basal leaves width (cm)	3.2 ± 0.2	No measures	2.2 ± 0.7
Basal leaves length (cm)	7.4 ± 0.2	No measures	6.9 ± 0.5
Upper leaves width (cm)	1.7 ± 0.5	0.8 ± 0.1	1.6 ± 0.6
Upper leaves length (cm)	2.4 ± 0.4	1.5 ± 0.2	2.9 ± 0.6
Size of involucre (mm)	9 -10 x 4 -7	4 - 8 x 5 -9	4 - 6 x 6-10
External Involucral bracts (mm)	2.1-3.3 x 1.1-1.9	2.2-4.5 x 0.6-1.5	2-3.7 x 0.7-1.1
Middle Involucral bracts (mm)	4.5-8 x 1-2	6-8 x 1.1-2	5.2-8 x 1-1.7
Internal Involucral bracts (mm)	7.5-9.2 x 0.8-1.4	8 -9 x 1.1-1.5	7-9 x 0.9-1.3
Number of flowers per capitula	28 ± 2	27	31 ± 2
External flowers length (cm)	1.4 ± 0.2	1.1 ± 0.1	1.4 ± 0.1
Central flowers length (cm)	1.1 ± 0.2	1.1 ± 0.2	1.1 ± 0.1
Size of achenes (mm)	2.5-2.7 x 0.9-1.2	2.3-2.9 x 1-1.3	2.3-2.5 x 0.9-1.3

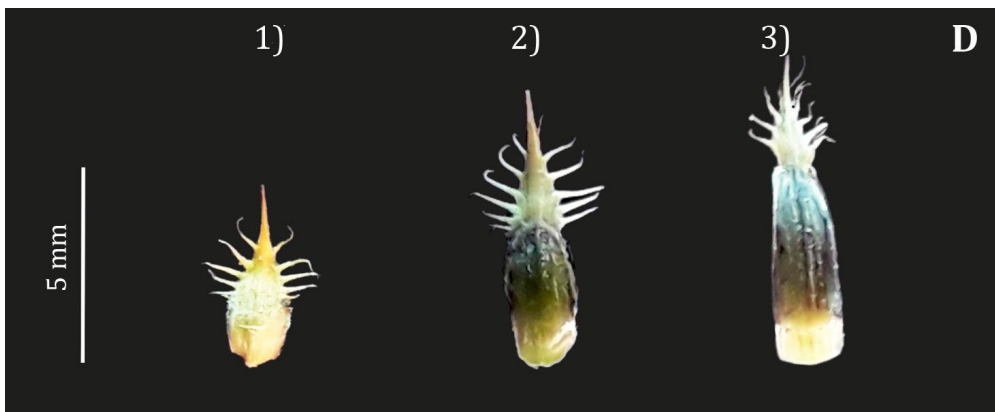
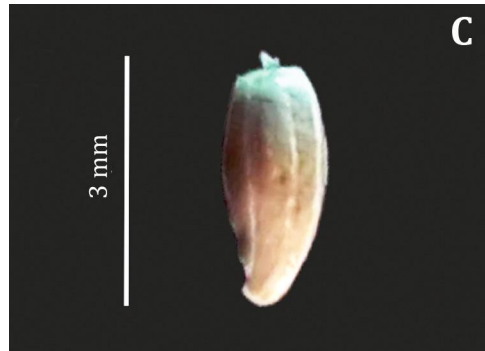


Figure 1. *C. diffusa* specimen collected in the Uspallata Valley and deposited in the MERL herbarium (IADIZA, CONICET - Mendoza).

A: plant. B: detail of branch with flowers. C: fruit. D: involucre bracts, 1) internal, 2) middle, 3) external.

Figura 1. Ejemplar de *C. diffusa* colectado en el Valle de Uspallata y depositado en el herbario MERL (IADIZA, CONICET- Mendoza).

A: aspecto de la planta. B: detalle de la rama florífera. C: fruto. D: detalle de los filarios, 1) interno, 2) medio, 3) externo.



DISCUSSION AND CONCLUSIONS

C. diffusa record in the province of Mendoza extends the distribution of this species towards the west in Argentina, as it was previously concentrated in the Pampas region (Buenos Aires, La Pampa and Córdoba). Additionally, based on records that indicated their presence at maximum altitudes close to 900 m a. s. l. in North America and Argentina (7, 18), the records obtained in this study extend their presence in high altitude ecosystems to more than 1800 m a. s. l. Regarding the ecosystems where *C. diffusa* has been mentioned in Argentina, these include agricultural ecosystems (La Pampa and Buenos Aires) and dry forests (Córdoba). The latter, considered as the environment with the largest number of exotic plants in the southern end of the Sierras Pampeanas Orientales, due to the impact of local anthropic activities (extraction of aromatic and medicinal plants, deforestation, fires and grazing) (11). In our study, *C. diffusa* was found in ecosystems that are characteristic of the central Andes of Argentina, coexisting with the native flora of the region in habitats near farmlands, roadsides and stream banks (Arroyo Uspallata). This is in accordance with the ecological aspects reported in the literature, that highlight its marked affinity for disturbed sites close to human settlements (15, 18). Although we suspect

that the possible sources of introduction are related to livestock activities that take place at the site studied, we do not rule out the possibility that other factors of high incidence in the Uspallata Valley, such as tourist activities, may have caused the unintentional introduction and dispersion, as reported in ecosystems of high altitude in dry Andes of Argentina (3). The aspects related to their management in agroecosystems are derived from studies carried out in North America. Due to the remarkable expansion of *C. diffusa* distribution, their management has been addressed at multiple levels, covering their ecological and economic impact and methods of biological, physical and chemical control (15). Recent studies indicate that the hybridization process plays an important role in the successful biological invasions, as noted in the hybrid populations of *C. diffusa* and *C. stoebe* present in the invaded range in western USA (4, 5). It is possible that hybridization occurs in Uspallata Valley, as in other regions of Argentina, where the impact of introduced Asteraceae has been partially addressed (6, 14). Future studies on molecular aspects of *C. diffusa* populations are necessary as much as those that address the ecological impacts of this non-native species in the structure and functioning of high altitude ecosystems

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