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Moehringia argenteria Casazza & Minuto (Caryophyllaceae), a new species from the Maritime Alps (Italy)

Gabriele Casazza & Luigi Minuto

Abstract

CASAZZA, G. & L. MINUTO (2008). *Moehringia argenteria* Casazza & Minuto (Caryophyllaceae), a new species from the Maritime Alps (Italy). *Candollea* 63: 261-267. In English, English and French abstracts.

A new species of *Caryophyllaceae*, *Moehringia argenteria* Casazza & Minuto, is described from the Argentera Massif in the Maritime Alps in Italy. Its morphology, distribution and habitat are given with reference to bioclimatic, biogeographical and phytosociological aspects. The characteristics are also presented to enable comparison with most closely related species such as *Moehringia sedoides* (Pers.) Loisel., *Moehringia intermedia* Panizzi and *Moehringia muscosa* L. growing in neighbouring areas but showing different morphology and ecology.

Key-words

CARYOPHYLLACEAE – *Moehringia* – Maritime Alps – Taxonomy

Résumé

CASAZZA, G. & L. MINUTO (2008). *Moehringia argenteria* Casazza & Minuto (Caryophyllaceae), une espèce nouvelle des Alpes Maritimes (Italie). *Candollea* 63: 261-267. En anglais, résumés anglais et français.

Une nouvelle espèce de *Caryophyllaceae*, *Moehringia argenteria* Casazza & Minuto, est décrite du Massif Argentera des Alpes Maritimes en Italie. Sa morphologie, sa distribution et son habitat sont présentés avec des références aux aspects bioclimatiques, biogéographiques et phytosociologiques. Sont aussi données les caractéristiques permettant la comparaison avec les espèces les plus voisines comme *Moehringia sedoides* (Pers.) Loisel., *Moehringia intermedia* Panizzi et *Moehringia muscosa* L. croissant dans des secteurs proches, mais présentant une morphologie et une écologie différentes.

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Introduction

In the late 19th century nomenclatural issues about the group *Moehringia* Loisel. in the Maritime Alps were still unclear. Some botanists gave those plants living on calcareous cliffs the generic name of *M. dasyphylla* Balb. and for a long time they did not distinguish between different taxa such as *M. sedoides* (Pers.) Loisel. from the Ligurian Alps and *M. intermedia* Panizzi from Provence. Only recently did deep taxonomic investigations shed more light on this issue (HIND, 1988, 1993).

In our study on the Maritime Alps flora (CASAZZA & al., 2005) and more specifically in the study on the distribution of genetic population patterns in *M. sedoides* and *M. lebrunii* Merxm. (MINUTO & al., 2006a), we observed significant morphological and ecological differences between the typical specimens of *M. sedoides* and those obtained from the Argentera massif (Cuneo, Italy).

Specimens from this area were first collected and observed as early as the 19th century by Boissier and Reuter, who identified them as *M. sedoides*. No other specimens of this small plant have been collected until we found it again in 2006.

For this paper we carried out a detailed morphological study of both old and new field-collected specimens. A comparison was undertaken with most closely related taxa (*M. sedoides*, *M. intermedia* and *M. muscosa* L.) growing in neighbouring areas (MINUTO & al., 2006a; FIOR & KARIS, 2007). The study was complemented with ecological, chorological and palynological data. We propose a new taxon having species status for the populations of the Argentera massif.

Materials and methods

Morphological observations and measurements were undertaken on the general dimensions of the vegetative and reproductive parts of the plant.

For the pollen grain study, Erdtman's acetolytic technique (ERDTMAN, 1960) was used, and the grains were immersed in glycolatine for light microscope examination (Leica DM2000 + Leica IM 4.0 software) and sputter-coated with gold for scanning electron microscopy.

Seeds were collected fresh or from herbarium specimens. As we noted that seed exomorphology can vary during seed development, care was taken to examine seeds from mature and dehiscent capsules. Seeds (*ca.* 10 per taxon) from both herbarium and fresh material were air-dried on SEM stubs, sputter-coated with gold, viewed with a Philips 515 SEM at an acceleration voltage of 22 Kv, and photographed with a Nikon Coolpix 5400 digital camera.

The observation data were compared with those already available in literature (HIND, 1988, 1993; MINUTO & al., 2006b) for the most closely related taxa (*M. sedoides*, *M. intermedia* and *M. muscosa*).

In order to verify the differences in dimension of the studied specimens compared to the other species a statistical analysis was performed. Thirteen morphological characters (stem, internodes upper and lower, leaves, floral peduncle, bracteoles, floral pedicel, sepal, petal, seed length and width, strophiole length and width) were assessed and recorded 65 times each (5 measurements on 13 specimens randomly selected) for all the studied species from herbaria sheets. On a matrix created, Non Metric Multi Dimensional Scaling (NMDS) was performed with Primer v6 using Euclidean distance (CLARKE & GORLEY, 2006).

The material for this study came from our own samples and was deposited in GE. Other specimens for comparison were from GE, FI and G.

Results and discussion

Moehringia argenteria Casazza & Minuto **spec. nova** (Fig. 1)

Typus: ITALY. Cuneo: Passo del Porco, Vallone Chiapus, 2598 m, 44°10'41"N 7°19'13"E, 5.IX.2006, G. Casazza *s.n.* (holo-: GE; iso-: GE, FI).

Herba perennis, glabra, caespitosa; caules numerosi procumbentibus, flexuosis. Folia viridia 3,5-8 longa, 0,2-0,5 mm lata, oblanceolata vel spatulata, integra, apice acuto et basi in petiolo longe attenuata. Inflorescentia simplex, 1-3 flora, pedicellis 1,5-6 mm longis, bracteolis linearibus-lanceolatis. Flores tetrameri; sepala lanceolata, 1-2 longa, 1-1,5 mm lata, acuta, marginibus scariosis. Petala obovata vel spatulata, alba, 0,7-1,3 mm longa, 0,5-0,8 mm lata, basi unguiculate, apice obtusa. Stamina 8 antheris ellipsoideis, albis. Nectaria insertionem filamentorum staminum exteriorum superantia; filamenta antiseptala spallata. Nectaria cum labro. Capsula glabra, subglobosa. Semina 0,8 longa, 0,7 mm lata, reniformia, nigra; strophium magnum, album vel nigrum. Habitat in fissuris prope Mons Argentera in province biogeographica Alpina, Alpes Marittime. Floret julio-augusto.

Densely to laxly caespitose suffrutescent *perennial*. Stems arising from a rootstock, glabrous, never glaucous but always straw-coloured, sometimes fleshy, ± erect, 19-40 mm, producing little clumps; internodes clustered in lower part of stem, 2.5-4.4 mm, becoming longer towards apex, 3-8.5 (-11) mm. Leaves glabrous, never glaucous, sometimes fleshy, oblanceolate or spatulate, 3.5-8 × 0.2-0.5 mm, abaxial surface keeled, adaxial surface flat, apex acute or slightly rounded. Inflorescence a terminal 1-3 flowered cyme originating from apex of vegetative stem, usually denoted by a

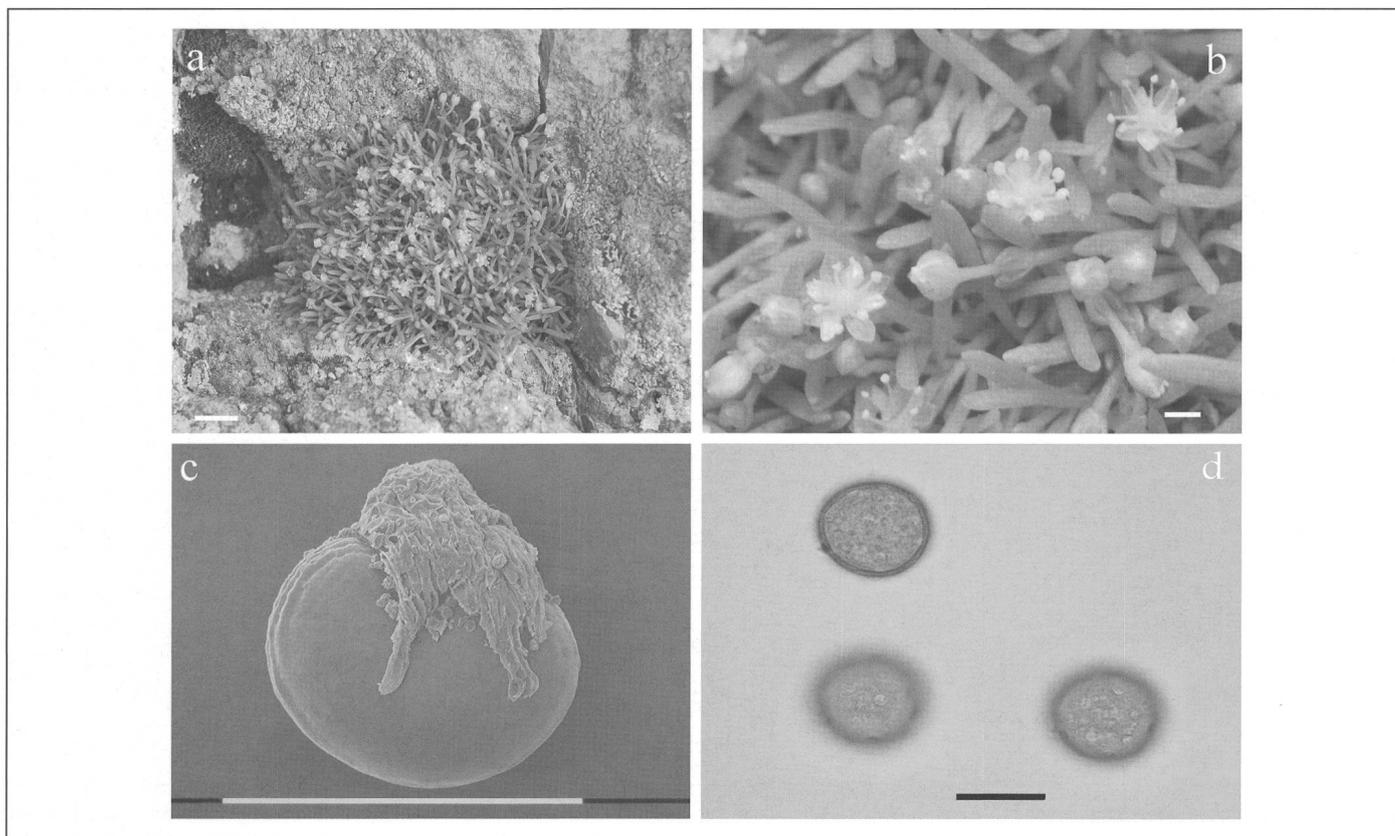


Fig. 1. – *Moehringia argenteria* Casazza & Minuto. **A.** Plant shape (bar: 1 cm); **B.** Flower detail (bar: 1 mm); **C.** Seed with strophiole (bar: 1 mm); **D.** Pollen detail (bar: 1 μ m).

long peduncle, 2.5-10 mm, glabrous; bracts absent; bracteoles 1-1.8 mm; pedicels \pm erect in bud becoming recurved in fruit, 1.5-5(-8) mm; bracteoles lanceolate, 1-1.5 mm long. *Flower* 4-merous, sepals lanceolate, 1-2 \times 1-1.5 mm, acute, lower surface keeled, margin scarios, 0.1 mm; petals patent, 0.7-1.3 \times 0.5-0.8 mm, shape from narrow to claw-like; antisepalous stamen filaments with distinct shoulders and a prominent lip, papillate on the shoulders and on the lip; nectaries narrow U shape; styles 2. *Capsule* subglobose 2 \times 2.5 mm. *Seeds* black, reniform (crassuloid type), shiny with no papillae, 0.8 \times 0.7 mm; testa smooth, hilar ridge evident near the hylum; strophiole 0.5 \times 0.5 mm, hyphal, whitish but sometimes blackish. *Pollen* pantoporate, with radial symmetry, medium size (P and E = 22.6-24.8 μ m, \times = 23.5 \pm 1.6), with 20-22 pores 2.4-2.8 μ m in diameter, well-defined margin, depressed and with densely grouped thick spinulose papillae in the operculum; tectum with minute perforations, surface uniformly granulate and with verrucae; exine 1.62-2.25 μ m thick, the ectexine having unbranched infratectal columellae, frequently perforate in upper half connected to foot layer, endexine < 0.3 μ m.

Distribution and habitat. – Only 3 populations have been recorded. They are located in the valley north of the Mercantour massif within the Maritime Alps, around Mt. Argentera: Passo del Porco, Altopiano del Baus, Passo Brochan (Fig. 2). The recorded populations are strictly linked to altitudes of more than 2600 m. *Moehringia argenteria* is endemic to the sub-alpine and alpine bioclimatic belts in the Alpine chorological sector; it grows on gneiss rocks untouched by the ice sheet during the recent past.

Ecology and phytosociology. – The new taxon is clearly distinguished on the basis of ecology. This taxon is to be found in crevices of siliceous (gneiss) and sub-vertical cliffs above 2600-2700 m, never exposed to ice erosional and smoothing processes. In this habitat, the snow persists all winter long and marked daily and annual thermal variations are recorded. From a phytosociological point of view, *M. argenteria* is characteristic of the alliances *Saxifragion pedemontanae* Barbero & Bono 1967 (in particular the association *Galio tendae-Saxifragetum florulentae* Guinocet 1938) and *Androsacion vandellii* Br. Bl. & Jenny 1926 (in particular the association *Androsacetum vandellii* Br. Bl. 1926). The plant generally

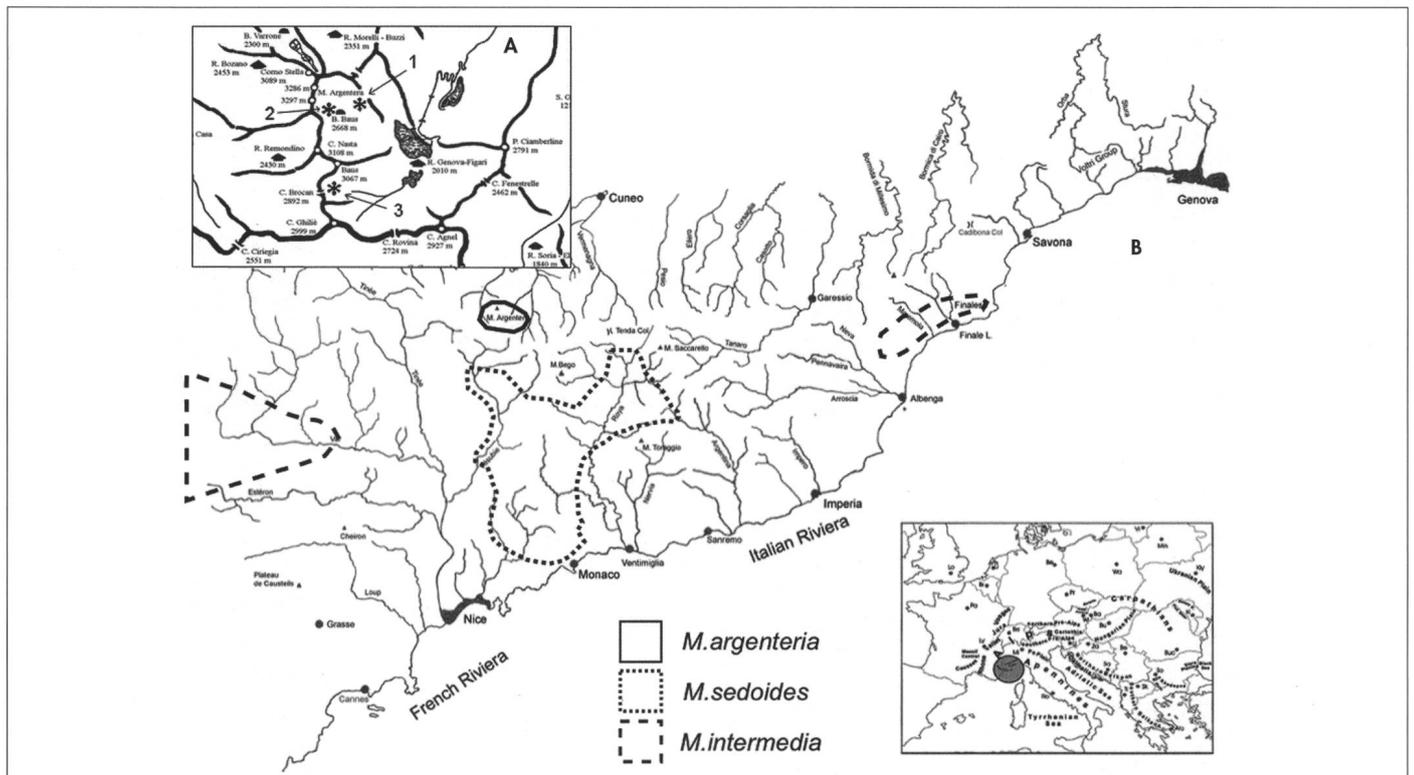


Fig. 2. – Distribution of *Moehringia argenteria* Casazza & Minuto. **A.** Location of the three population recorded around Mt. Argentera: 1. Passo del Porco, 2. Altopiano del Baus, 3. Passo Brochan. **B.** The distribution patterns of *M. sedoides* (Pers.) Loisel. (dotted line) and *M. intermedia* Panizzi (striped lines) are also reported.

cohabits with *Silene cordifolia* All., *Saxifraga florulenta* Moretti, *Galium tendae* Rchb. f., *Artemisia eriantha* Ten., *Androsace vandellii* (Turra) Chiov., *Eritrichium nanum* (L.) Gaudin, *Saxifraga pedemontana* All., *S. retusa* Gouan, *Primula hirsuta* All. and *P. latifolia* Lapeyr.

History. – *Moehringia argenteria* was first observed by botanists in the second half of the 19th century. Emile BURNAT (1892: 250) reported about some *Moehringia* specimens (*M. boissieri* Boiss. in the original labels) collected by Boissier and Reuter (G) in July 1854 at Colle di Finestra and in August 1866 at Col de Ruins (interpreted as Col de Chipous), during their excursions in the Mercantour area. Both specimens were assumed to be very similar to *M. dasyphylla* by the Swiss botanist, but due to their very small dimensions and to the incompleteness of the specimens he expressed many doubts on them and meant to further study the issue. Unfortunately, this never happened and no further material was collected in order to solve the problem. The same herbarium specimens were later analyzed by Weibel in 1965 and by Hind in 1985 (HIND, 1988), who respectively identified them as *M. dasyphylla* and *M. sedifolia* Willd. (HIND, 1993). Similarly ARDOINO (1867) reported about a *M. muscosa* plant collected by Moris in the above-mentioned location of Colle di Finestra. Identification of these *Moehringia* specimens was

confusing and morphological elements were not enough to ensure conclusive identification.

Relationships. – *Moehringia argenteria* differs in many morphological features (Table 1) and in ecology from the most related taxa studied (see Appendix 1 for the *specimina visa*). The plant as a whole is always much reduced, and never larger than 8–10 cm in diameter. Also NMDS statistical analysis confirmed the small nature of all specimens in their 13 morphological features when compared with those belonging to most related taxa (Fig. 3). This figure clearly shows how the specimens as a whole are different among the species. In particular those belonging to *M. argenteria* are similar and always smaller. The reproductive portions are drastically reduced like the small flowers (sepals, and especially petals) and the very small seeds that are not comparable within the genus (MINUTO & al., 2006b).

The most important morphological characters distinguishing *M. argenteria* (Fig. 1) are observed in the reproductive structures. Flowers are mainly single or in reduced dichasia in a simple inflorescence. Perianth components are always very small if compared to other related entities, the sepals and in particular the petals being shorter than 1 mm. The pollen is related to the type of *Arenaria serpyllifolia* L. (CANDAU, 1978). The hyphal type strophiole originates, as in all other co-generic entities, from the

Table 1. – Morphological patterns of *Moehringia argenteria* Casazza & Minuto compared with most related species of *Moehringia* Loisel. taxa (HIND, 1988, 1993; MINUTO & al., 2006b).

	<i>M. argenteria</i>	<i>M. sedoides</i> (Pers.) Loisel.	<i>M. intermedia</i> Panizzi	<i>M. muscosa</i> L.
Stem [mm]	19-40 mm	35-150 (-250) mm	40-120(-250) mm	100-250(-350) mm
Internodes lower [mm]	2.5-4.4 mm	1.5-6 mm	2-4 mm	4-11 mm
Internodes upper [mm]	3-8.5 (-11) mm	4-15 mm	7-20(-30) mm	10-30(-45) mm
Leaves [mm]	3.5-8 x 0.2-0.5 mm	(1.5-)5-15(-25) x 1-1.5 mm	15-25(-30) x 1.5-2.5 mm	10-35(-70) x 0.5-2 mm
Shape of leaves	oblanceolate, spatulate	terete	lineate to oblanceolate	lineate to filiform
Number of inflorescence	1-3	1-7	(1)-3-7	3-15+
Peduncle [mm]	2.5-10 mm	8-15 mm	6-15 mm	12-40(-60) mm
Bracteoles [mm]	1-1.8 mm	1.5-2.0 mm	1.5-3 mm	1.5-3 mm
Pedicele [mm]	1.5-5(-8) mm	5-15 mm	10-15(-20) mm	12-25 mm
Sepal [mm]	1-2 x 1-1.5 mm	3-4 x 1.5 mm	4 x 1.5 mm	3 x 2 mm
Margin [mm]	0.1 mm	0.3 mm	0.5 mm	0.2 mm
Petal [mm]	0.7-1.3 x 0.5-0.8 mm	5-7 x 2.5-3.5 mm	7 x 3 mm	5-7 x 3 mm
Shape	claw	from narrow to claw-like	winged truncate, obtuse	without a claw, acute
Stamen	antisealous filament with evident shoulders	antisealous filament without shoulders	antisealous filament without shoulders	antisealous filament with shoulders
Pollen [μ m]	23.50	35.88	34.32	37.44
Exine thickness [μ m]	1.62-2.25 μ m	2.34-3.51 μ m	2.34-3.12 μ m	2.73-3.12 μ m
Number of pores	20-22	9	11	11
Pore diameter [μ m]	2.40-2.84 μ m	4.68-7.02 μ m	4.68-7.02 μ m	3.90-5.46 μ m
Interpore distance [μ m]	7.85 μ m	11.70 μ m	11.92 μ m	10.41 μ m
Seed [mm]	0.8 x 0.7 mm	1.20 x 1.00 mm	1.30 x 1.00 mm	1.30 x 0.90 mm
Strophiole [mm]	0.5 x 0.5 mm	1.0 x 0.8 mm	0.8 x 0.7 mm	0.7 x 0.5 mm

proliferation of funiculus cells during seed development (HIND, 1988; FIOR & KARIS, 2007). Antisealous filaments always show evident shoulders at the base (feature slightly present only in *Moehringia muscosa*), covered by papillae on the lip of the narrow U-shaped (almost V-shaped) nectary. Seed exomorphology and strophiole-type are similar to other Alpine *Moehringia* species, their dimension are reduced than in *M. sedoides*, *M. intermedia* and *M. sedoides*. The elaiosome is frequently blackish, while in the other taxa it is always white.

From the ecological point of view, interestingly *M. argenteria* prefers selective ecological niches with very low competition, such as crevices on cliffs in the alpine belt (altitude > 2600 m), never reached by other species (HIND, 1988). Moreover the plant lives on siliceous bedrocks, an unusual substrate for the genus, while most endemic species (both in the Alps and in the Balkans) prefer calcareous rocks (HIND, 1993). The only exceptions are the granitophilous *M. hypanica* Grynj & Klokov and *M. minutiflora* Bornm., living under granitic boulders in the Dinaric Alps. The presence of *M. argenteria* on gneiss confirms *Moehringia*'s ability to adapt to different substrates (HIND, 1988).

Due to many historical factors, in the Alps *Moehringia* is characterized by high geographical fragmentation. As revealed by recent studies (FIOR & al., 2006; FIOR & KARIS, 2007), com-

mon ancestors were geographically segregated by the presence of the ice sheet. Some survived in local refugia and kept their ancient features (i.e. *M. lebrunii* Merxm.; MERXMÜLLER, 1965), and others were exposed to speciation events like *M. markgrafii* Merxm. & Gutermann, *M. insubrica* Degen (SAUER, 1965), *M. concarenae* F. Fen. & F. Martini (FENAROLI & MARTINI, 1992) and *M. intermedia* (MERXMÜLLER & GRAU, 1967) showing few genetic differences (MINUTO & al., 2006a; FIOR & KARIS, 2007).

Additional material examined. – ITALY. Cuneo: Altipiano del Baus, Mt. Argentera, 2612 m, 44°10'39"N 7°19'06"E, 31.VII.2007, Casazza & Minuto s.n. (GE, FI); Passo del Brochan, Vallone Brochan, 2795 m, 44°09'21"N 7°18'36"E, 1.VIII.2007, Casazza & Minuto s.n. (GE); Montant du Col de la Fenêtre du Coté nord, VII.1854, Boissier s.n. (G); Col de Ruines ad Terme di Valdieri, VIII.1866, Boissier s.n. (G).

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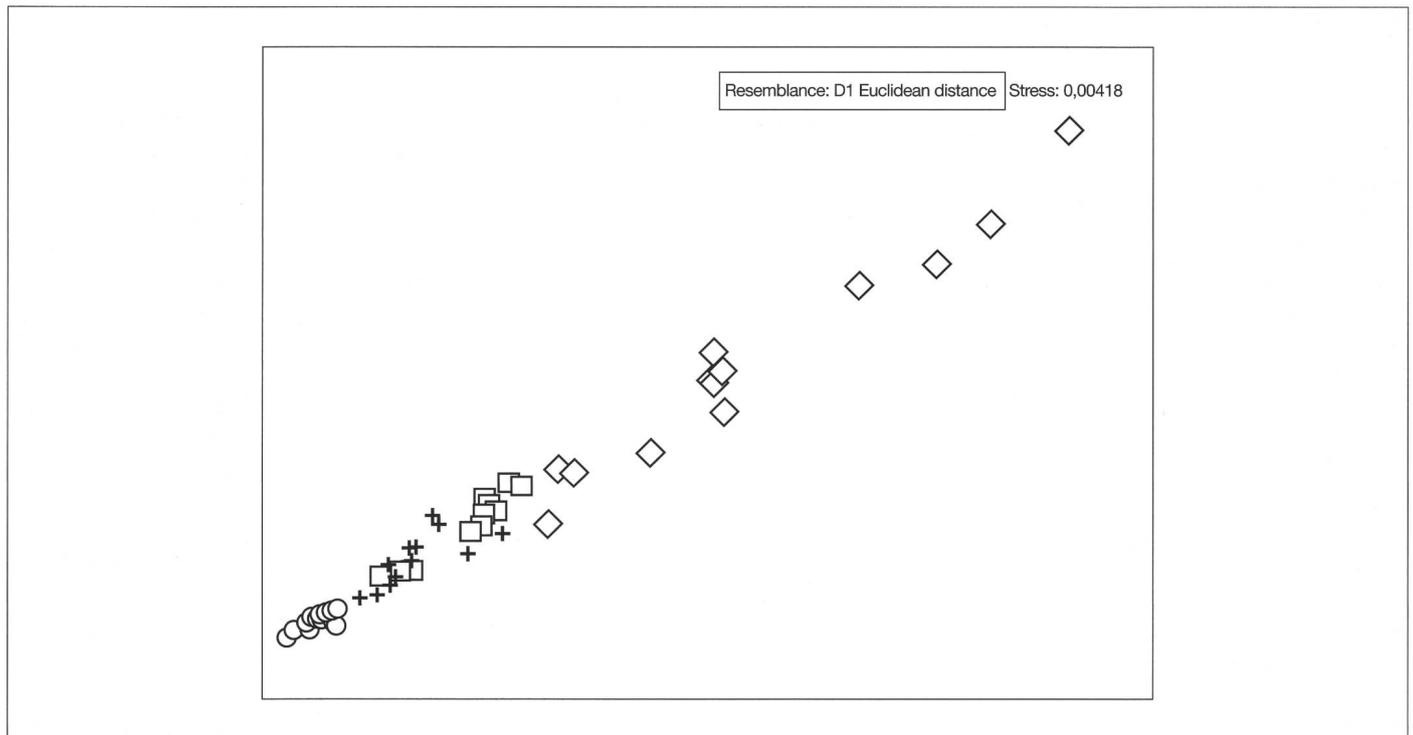


Fig. 3. – Non Metric Multi Dimensional Scaling (NMDS) performed with Primer v6 using Euclidean distance on 13 specimens each of the 4 studied species of *Moehringia* Loisel.: □ *M. intermedia* Panizzi; ◇: *M. muscosa* L.; +: *M. sedoides* (Pers.) Loisel.; ○: *M. argenteria* Casazza & Minuto).

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Appendix 1. – Additional material examined of *Moehringia sedoides* (Pers.) Loisel., *M. intermedia* Panizzi and *M. muscosa* L.

Moehringia sedoides. – FRANCE. **Dpt des Alpes Maritimes:** Vallon du Ruiseç, Rocher de Nids, Vallée de la Roja, 892 m., 44°02'54"N 7°37'18"E, 16.VI.2004, *Minuto & Casazza s.n.* (GE); Castel Fortis, Vallée du Vésubie, 461 m, 43°56'37"N 7°17'21"E, 13.IV.2005, *Minuto & Casazza s.n.* (GE); Crête de Penier, Gorges de Lantosque, 300 m, 43°56'03"N 7°15'52"E, 09.VI. 2005, *Minuto & Casazza s.n.* (GE); Tête de Chien, La Turbie, 425 m, 43°43'56"N 7°24'08"E, 16.XII.2004, *Minuto & Casazza s.n.* (GE); Gorges de Paillon, Vallée de Paillon, 229 m, 43°48'20"N 7°24'20"E, 13.IV.2005, *Minuto & Casazza s.n.* (GE).

ITALY. Imperia: Realdo, Valle Argentina, Imperia, 910 m, 44°01'53"N 7°43'10"E, 27.IX.2004, *Minuto & Casazza s.n.* (GE). **Cuneo:** Mezzacomba, Val Grana, Cuneo, 938 m, 44°24'40"N 7°14'08"E, 2.IX.2004, *Minuto & Casazza s.n.* (GE).

Moehringia intermedia. – FRANCE. **Dpt de Haute Provence:** Clue de Carejuan, Gorges du Verdon, 631 m, 43°47'32"N 6°25'47"E, 12.V.2004, *Minuto s.n.* (GE); Pont St. Jean, Gorges du Verdon, 650 m, 43°49'48"N 6°26'52"E, 12.V.2004, *Minuto s.n.* (GE).

ITALY. Savona: Località Semaforo, Capo Noli, Savona, 245 m, 44°11'41"N 8°25'15"E, 20.VIII.2004, *Minuto & Casazza s.n.* (GE).

Moehringia muscosa. – ITALY. **Savona:** Rio Orba, Vara inferiore, Savona, 25.VI.2005, *Casazza s.n.* (GE); Miniera Molinello, Val Graveglia, Genova, 31.V.2005, *Corallo s.n.* (GE); Madonna della Guardia, Genova, 750 m, 5.VI.2005, *Aita s.n.* (GE); Sciarborasca, Cogoleto, Genova, 420 m, 44°24'28"N 8°36'30"E, 28.IV.2005, *Minuto & Casazza s.n.* (GE). **Cuneo:** Inizio Val Roaschia, Val Gesso, Cuneo, 420 m, 2.IX.2004, *Minuto & Casazza s.n.* (GE).

