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Linaria multicaulis (*Scrophulariaceae*) in Sicily: an investigation within its subspecific and varietal ranks

Abstract

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The taxa belonging to the group of *Linaria multicaulis* (L.) Miller growing in Sicily have been studied. Four entities, put in the rank of subspecies and variety, are circumscribed and described. Among them, three are new: *L. multicaulis* subsp. *multicaulis* var. *panormitana*, *L. multicaulis* subsp. *aetnensis* and *L. multicaulis* subsp. *multicaulis* var. *messanensis*. All the described taxa are Sicilian endemics. In addition an identification key and a distribution map are provided.

Introduction

For a long time the complex *Linaria multicaulis* (L.) Miller (this is the true name of a taxon in the past well known to italian florists as *Linaria heterophylla* Desf. (see Fiori 1926; Pignatti 1982)), including the species and its dependent taxa, was a very troubling matter for taxonomists and scholars of systematics. This problem depended both upon the morphological variability within the group and some trivial nomenclature errors, which caused a great difficulty in understanding what was intended by the various binomials applied to the group.

The story of the nomenclature of the group

Formerly Bernardino da Ucria, the first Italian Linnaean botanist, used incorrectly, applied to our *Linaria*, the name *Antirrhinum linifolium* L. (Ucria 1789), which for its original author would be applied to a distinctly different entity. The addition of the restriction *pro parte* (p.p.), obviously, was not sufficient to permit subsequent botanists to be able to use this binomial.

Some time after, Gussone (1826) correctly noted that the Sicilian populations of this species had a clear autonomy from whatever then known entity, but erroneously he framed them in the taxon *Antirrhinum strictum* Sibth. & Sm. (which he reported as *Linaria stricta* Sibth. & Sm.). He adopted this solution on the basis of the description of the species (too greatly condensed and in consequence scarcely useful in the aim to properly distinguish)

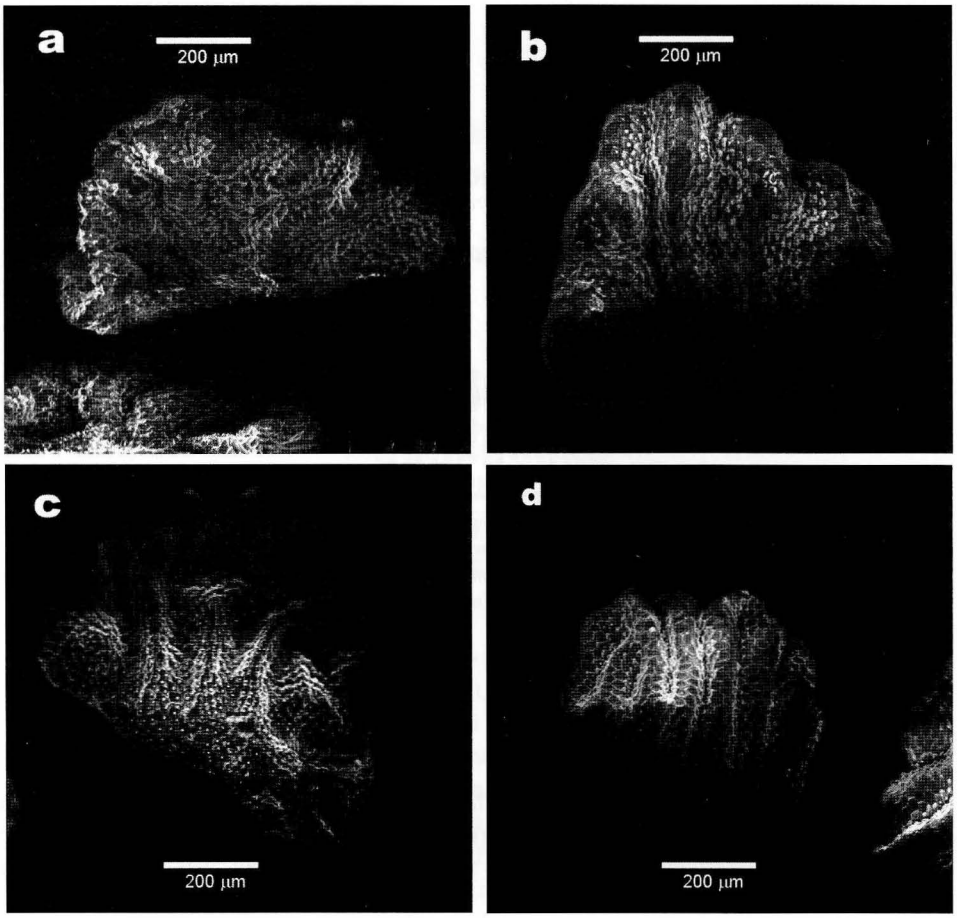

Fig. 1. Seeds of a. *Linaria multicaulis* (L.) Miller subsp. *multicaulis* var. *multicaulis*, b. *L. multicaulis* (L.) Miller subsp. *aetnensis,* c. *L. multicaulis* (L.) Miller subsp. *multicaulis* var. *messanensis,* d. *L. multicaulis* (L.) Miller subsp. *multicaulis* var. *panormitana.*

reported by these English authors in Fl. Graec. Prodr. and on the basis of the phrase "nec non in Sicilia" (i.e. "also in Sicily") there found (see Sibthorp & Smith, 1809). This locality datum is a true mistake, because the sibthorpian *Antirrhinum strictum* does not grow at all in Sicily. In consequence Gussone gave Sibthorp and Smith an unmerited attribution as authors. Truly the correct name would be *Linaria stricta* Guss., with a priority to Gussone himself for this binomial.

An additional confusion was brought in by Bertoloni (1844), who split the species (included by him in *A. aparinoides*) from the variety (*L. stricta* var. *humilis*, now *L. multicaulis* subsp. *humilis*), bringing the second into the Linnaean *Antirrhinum supinum*, an entity very different from the Sicilian taxon.

In the second half of the 19th century also Caruel (in Parlatore 1883) entered into this problem. He, after identifying the Sicilian populations with the similar (not identical) ones

growing in Morocco, Algeria and Tunisia, used for them the Desfontaine's binomial *Linaria heterophylla* Desf. (with a priority with respect to Gussone). On the correctness of this identification Lojacono remained himself doubtful: he continued using the Gussonean binomial, attributing however, like Gussone, its paternity to Sibthorp and Smith.

After Caruel's times, moving through Fiori (Fiori & Paoletti 1902; Fiori 1926) up to Pignatti (1982), the Italian florists continued to use the Desfontaine's binomial: so it appeared for a long time that no critical problem existed for the group. But indeed the problems were not solved at all, because a misunderstood, Linnaean binomial pertained to the species.

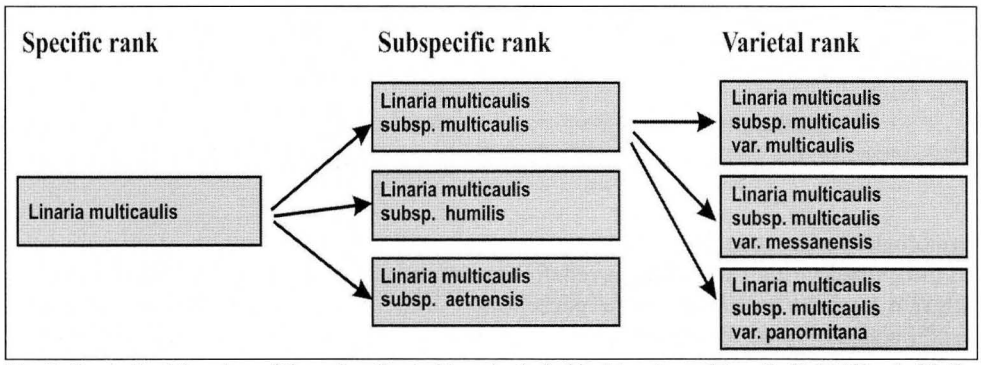

Fig. 2. Synoptical framing of the subordinated taxa included in *Linaria multicaulis* (L.) Miller in Sicily.

The Sicilian *Linaria*: a Linnaean species

After Gussone, lasting more than a century and a half, the majority of scholars thought Sicilian plants were very different from any other Linnaean species (with the exception of Tenore (1810, 1830) and Sampaio (1913), who, however, did not perform any typification). Only recently, in consequence of a careful investigation by Sutton (1988), done in the Linnaean herbaria, the priority of the binomial to the former author was recognized (*Antirrhinum multicaule*, Linnaeus 1753). The lectotypification was performed on a specimen preserved in the Herbarium BM in London, pertaining to the collections quoted in Hortus Cliffortianus (Linnaeus 1733), labelled with the figures 324.7. The character of Linnaean species was not detected by the previous botanists because the protologue (1753) of *A. multicaule* does not contain any apparent reference to a nomenclatural type. Therefore hereafter the correct, legitimate name for this species would be *Linaria multicaulis* (L.) Miller 1768.

L. multicaulis ranges from Sicily to Calabria, Tunisia, Algeria and Morocco, showing different morphologies in correspondence with the various countries, with its populations all arranged in as many subspecies (see De Leonardis & al. 1999). Limiting the view to Sicily, it is known to date that only two taxa grow there: the subspecies-type *Linaria multicaulis* (L.) Miller subsp. *multicaulis*, and the endemic subspecies *Linaria multicaulis* subsp. *humilis* (Guss.) De Leonardis & al. (basyonim *Linaria stricta* var. *humilis* Guss. –

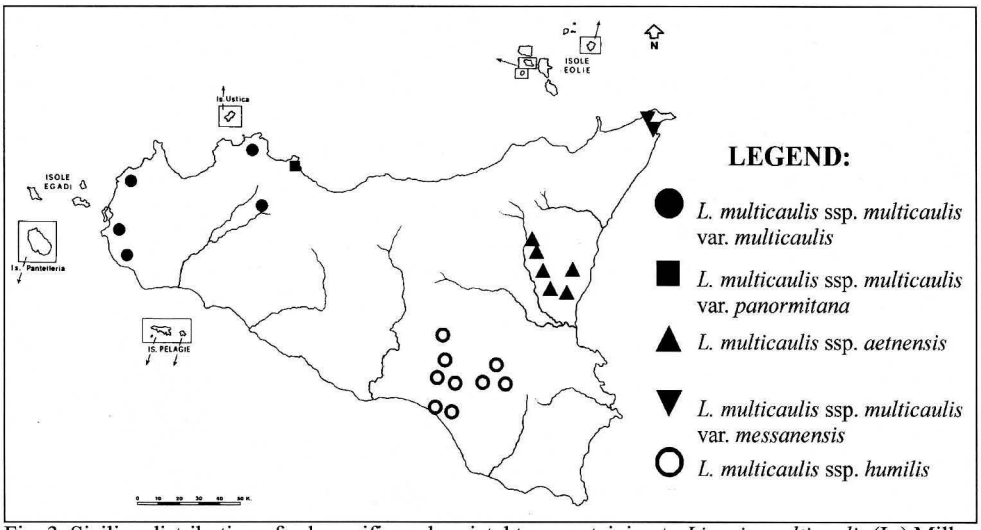

Fig. 3. Sicilian distribution of subspecific and varietal taxa pertaining to *Linaria multicaulis* (L.) Miller.

protologue in Gussone 1828), recently rediscovered by the cited authors. These last ones in the quoted writing gave both a redefinition of the status of the entity of the basyonim (carried from var. to subsp.) and a redescription of its characters. This task was permitted (and imposed) by the fact that they accessed in the field to natural, very rich populations, thus acquiring an apparent understanding (not well acquired by Gussone) of the morphological variability of the taxon. These authors however neglected to investigate the subspecies-type in order to reveal differences (if extant) in the group at the rank of subspecies or variety.

The real existence of subordinated taxa was thought by Gussone ("L. (...) spicato flore candido...; si nova *L. sibthorpiana* appellanda" in Gussone 1844, 2), and also by Lojacono (see De Leonardis & al. 1999), but they acted with uncertainty.

The description of the varieties noted by the two previous authors, with the addition of some other ones, their set up in convenient ranks, and their naming, is what we do in this paper.

Materials and methods

In order to describe taxa in the course of speciation, or at least very close one another, it is well known that the morphology, the autoecology and the analysis of the synergy and/or competition with the other species in the community are the most convenient tools to appreciate the level of segregation and the macroscopic genetic homogeneity of the populations to be described as taxonomic unities. For this reason, we applied procedures mainly based on morphological comparisons, and used them to select a set of differential characters suitable to represent the model descriptions of the entities.

After having explored several sites and collected specimens in the field, we investigated classical material preserved in the herbaria of Catania (CAT) and Palermo (PAL).

Fig. 4. Comparison of the corolla of *L. multicaulis* subsp. *multicaulis* var. *panormitana* (on the left) with the one of *L. multicaulis* subsp. *aetnensis* (on the right). The first reaches a length of 3,5 cm vs. 2,1 cm of the second one. Note in addition the lesser length (relative) of the adaxial lip of the first with respect the corresponding of the second one and the smaller curvature of the distal points in the abaxial lip.

It was also necessary to observe seeds under the electron microscope (SEM - Philips 501). Towards this goal the material used was prepared through a dehydratation in alcohol series at 50°, 90°, 100°, followed by fixation on aluminium stubs and covering with a gold film in vacuum evaporator.

Results and discussion

Correspondence specimens-models-distribution

We were able to select the following morphological types, put in correspondence with well defined ecologies and distributions in the territory.

a) The morphological type already established by Lojacono (1904) and given from Palermo, Capaci, Marsala, Trapani (incorrectly (!) also from Madonna del Piano: see De

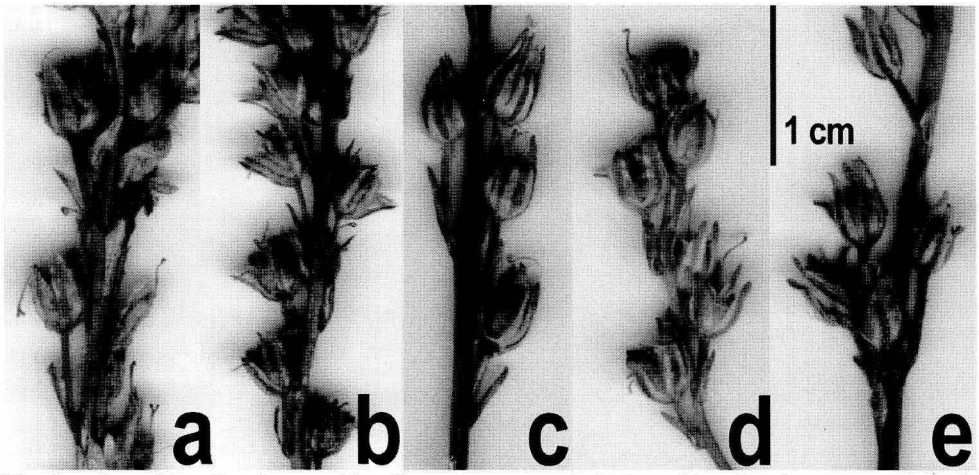

Fig. 5. a. *L. multicaulis* subsp. *multicaulis* var. *messanensis*; b. *L. multicaulis* subsp. *aetnensis*; c. *L. multicaulis* subsp. *multicaulis* var. *panormitana*; d. *L. multicaulis* subsp. *humilis*; e. *L. multicaulis* subsp. *multicaulis* var. *multicaulis*.
Note: in (a) the calyx lobes shorter than in (c) and (e); in (b) the capsule, lobes and pedicels smaller than in a), c), d) and e); in (c) the calyx lobes very long; in (a) and (e) the pedicels very long; in (d) the bract almost reaching the base of the capsule.

Leonardis & al. 1999), characterized by long stems, middle-sized capsule, middle-sized and yellow-chrome pale (quasi-white) corolla, very long pedicels. Its populations grow on geologically young sands originating from tertiary limestones. This corresponds with the Linnaean entity.

b) The morphological type from the territory of Messina (a little different from the previous one, though melted with it by Lojacono, *quot*: 129), with many stems, growing on littoral sands (dunes faced against the Ionian Sea – Ganzirri), characterized by stems and leaves deep green coloured, a middle-sized, deep yellow-chrome corolla and a biennial biological cycle. Its populations are circumscripted to the neighbourhood of Messina and Reggio Calabria.

c) The morphological type growing on Mt. Etna, greyish green, with a small capsule, a short pedicel, short calyx-lobes, and a frequently twisted stem, characterized moreover by a long biological cycle and a moderate fertility (also in presence of manmade-disturbances the number of seedlings near the parent-plants do not increase at all).

d) The morphological type growing at Catalfano (near Palermo), on sands from lixiviated limestone slopes, with a single, perfectly erect stem, yellow pale corolla, very large (about 3-4 cm long including the spur).

The previous morphologies corresponding to well segregated and well characterized populations have imposed new names (with pertaining diagnosis and nomenclatural typifications) inside the ranks of subspecies and variety, as reported in the following text.

TAXONOMY

a. ***Linaria multicaulis*** (L.) Miller subsp. ***multicaulis***

Basyonim (of the species *L. multicaulis*): *Antirrhinum multicaule* L. in Sp. Plant. (1753).

Typus (of *Linaria multicaulis* (L.) Miller and of the type-entities in the ranks of subspecies and variety): Sicilia ("circa Panormum et alibi"), "Linaria sicula, multicaulis, folio molluginis Bocc. Rar. Plant. 38", sine lectore (Lectotypus selected by D. Sutton, known after Sutton 1988, - BM Herb. Clifford. 324.7, seen by us in a photocopy magnified 1:1).

Description: Occasionally stoloniferous, glabrous except in the inflorescence which is glandular-pubescent. Fertile branches 40 to 120 cm long, more or less erect and robust. Leaves of the fertile branches 12-45′ 0,4-2 mm, involute, mostly alternate. Inflorescence with 20-60 flowers, elongate, generally simple, dense in flowers. Pedicels erect, 2 to 3,5 mm long during the anthesis and 5,5 to 6,5 mm at the end of the fruiting. Bract length 4,3 to 6 mm. Calyx lobes obtuse to sub-acute, 3-3,8 mm long at the flowering and 4,5-6 mm at the end of the fruiting. Corolla 20 to 25 mm long, intensely yellow or yellow-pale vanishing up to off-white , with the palato more intensely coloured and sometimes reticulated in red, provided with a spur 9 to 18 mm long.

Distribution: Palermo, Trapani and Messina areas. Not present in southern Sicily or on Mt. Etna.

b. ***Linaria multicaulis*** subsp. ***humilis*** (Guss.) De Leonardis, Giardina & Zizza in Fl. Medit. **9** (1999).

Basyonim: *Linaria stricta* Guss. var. *humilis* Guss. Fl. Sic. Prodr. (1828). *Corrige erratum*: the basyonim of this subspecies was reported in De Leonardis & al. (1999) *erroneously* as *Linaria stricta* Sibth. et Sm. var. *humilis* Guss.

Lectotypus (Specimen without date and collector – likely Gussone): Sicilia, Comiso, "*Antirrhinum strictum b. humile, quondam A. supinum, Apr. Comiso*", *s.d.*, *s.l.* (Folium quartum fasciculi *Linariae strictae* b. *humilis* Herbarii Gussonei Siciliae in NAP) (cited in De Leonardis & al. 1999).

Synonyms: *Linaria humilis* Guss., Fl. Sic. Syn., 1843; *Linaria heterophylla* Desf. subsp. *humilis* (Guss.) Caruel in Parlatore, Fl. It., **6**, 1883; *Linaria stricta* Guss. var. *gussonei* Lojac., Fl. Sic., **II** (2), 1904 erroneously distinguished by Lojacono as *Linaria stricta* Sibth. et Sm. var. *gussonei* (a mistake we see repeated also in De Leonardis & al. 1999).

Table 1. Measures (in mm) of the most discriminant characters in the subordinated taxa of *L. multicaulis* growing in Sicily. All the considered characters maintain themselves unaltered in dry specimens. The characters showing a large variability are expressed by numerical intervals.

Linaria multicaulis							
Rank subsp.	Rank var.	Pedicel	Calyx-lobe lenght	Capsule	Excess lobe/capsule	Calyx-lobe width	Bract lenght
subsp. multicaulis	var. messanensis	5,5-6,0	4,5-6,0	5,0	1,7-2,0	1,7-2,0	5-6
subsp. multicaulis	var. panormitana	6,5	5,5	4,5	1,5-2,0	1,5	5,5-6,0
subsp. multicaulis	var. multicaulis	6,0	6,0	4,0	1,2-2,0	1,5	4,3-4,5
subsp. aetnensis		3,5-4	4,0	4,0	0,0	1,5	3,0
subsp. humilis		6,0	6,2	6,0-6,5	0,7	1,6	4,0

Description: It differs from the typical subspecies in the height lesser, in the capsules larger (6,5 mm long vs. 4-5 in the typical subspecies), in the inflorescence less dense in flowers, in the spur shorter (8 mm against 9 in the typical subspecies) and often curved, in the seeds darker, in the biological cycle annual (biennial or perennating in the type).

Distribution: In southern Sicily (Mts Iblei, Mts Erei, Piana di Gela, Piazza Armerina, and so on).

c. ***Linaria multicaulis*** subsp. ***multicaulis*** var. ***multicaulis***

Typus: (see above - Ref. to the typus of *Linaria multicaulis* subsp. *multicaulis*).

Description: (particularities with regard to the typical subspecies)**:** Annual, or generally biennial, herb (more rarely perennial); stems 80-120 cm high; corolla yellow pale quasi-white or white shading in intense yellow on the palato, 20 to 25 mm long ; pedicels about 6 mm long; bracts 4,3-4,5 mm; lobes of the calyx normally 6 mm long, exceeding the capsule about 1,2-2 mm, with their herbaceous part narrow; knobs of the capsule more or less equally curved.

Distribution: Palermo and Trapani areas.

d. ***Linaria multicaulis*** subsp. ***multicaulis*** var. ***messanensis*** Giardina & Zizza **var. nova**

Typus: Messina località Ganzirri, sulle sabbie della duna litoranea, 3 m s.l.m., 10.6.1999, G. Giardina (Holotypus in CAT; Isotypus in FI).

Diagnosis: A varietate typica differt statura usque 80-120 cm; corolla intense lutea, 20-23 mm longa; pedunculis 5,5 usque 6 mm longis; bracteis 5-6 mm; calycis lobis 4,5 usque 6 mm longis cum herbacea parte latissima, 1,2 cm superantibus capsulam; capsulae gibbis dissimiliter curvatis.

Description: It differs from the typical variety in the height up to 80-120 cm high; corolla intense yellow, 20 to 23 mm long; pedicels 5,5 to 6 mm long; bracts 5-6 mm; lobes of the calyx 4,5 to 6 mm long, 2 mm large with herbaceous part very large, exceeding the capsule about 1,7-2,0 mm; knobs of the capsule very differently curved.

Distribution: Messina and Reggio Calabria areas.

e. ***Linaria multicaulis*** subsp. ***multicaulis*** var. ***panormitana*** Giardina & Zizza **var. nova**

Typus: Sicilia, Monte Catalfano, versante nord, su sabbie dilavate, 70 m s.l.m., 12.4.1999, G. Giardina (Holotypus in CAT; Isotypus in FI).

Diagnosis: A varietate typica differt statura minore atque minore numero surculorum; corolla maxima, usque 3,4 cm longa; bracteis (6 mm) subaequantibus pedunculos (6,5 mm); laciniis calicinis longioribus; seminibus parvioribus et rotundioribus. Est herba annua.

Description: It differs from the typical variety in the lesser height and in the branches less numerous, in the corolla very large up to 3,4 cm long, in the bracts (6 mm) almost equalling the pedicels (6,5 mm); in the calyx-lobes generally longer, and in the seeds smaller and more rounded. It has an annual biological cycle.

Distribution: On the northern slopes of Mt. Catalfano (Bagheria, province of Palermo).

f. ***Linaria multicaulis*** subsp. ***aetnensis*** Giardina & Zizza **subsp. nova**

Typus: Italy, Sicily, Adrano, Strada Paternò-Adrano c/o campo di calcio, 10.04.97, G. Giardina (Holotypus in CAT; Isotypus in FI).

Diagnosis: A subspecie typica differt caule 80-120 cm alto. Praeterea differt foliis plus minusve glaucescentibus; bracteis minimis (3 mm); pedunculis 3,5-4 mm longis, corolla

intense lutea; capsula minore plus minusve 4 mm longa; laciniis calicinis non superantibus capsulam; seminibus minoribus et fuscioribus. Est herba perennis.

Description: It differs from the typical subspecies in its tendency to be perennial and in having its stem 80-120 cm high. It differs in addition in having its leaves more or less greyish-green, the bracts very short (3 mm), the pedicels 3,5-4 mm long, the corolla intensely yellow, the capsule smaller about 4 mm long, the calyx-lobes not at all exceeding the capsula, the fertile branchs more numerous, the seeds lesser in size and more brown in colour.

Distribution: Mt. Etna.

ECOLOGY

The described entities are distinguishable also in ecology. Subspecies ***humilis*** grows on pleistocenic and pliocenic, decalcified sands sedimented in many areas of southern Sicily (Piazza Armerina, Caltagirone, Niscemi, S. Michele di Ganzaria, Vittoria, Comiso, Acate, Gela). These sands originate from the washing of the "terre rosse mediterranee" (ever on limestones), relic soils – these – that already in the remote past lost their top-strata. The populations of ***L. humilis*** are particularly rich in individuals in slightly disturbed areas, but they are characterizable, notwithstanding, as ordinary components of natural communities in equilibrium with their environment (garrigues and arid, little acidophilus meadows, frequently classified in *Cisto-Ericion* Horvatic 1958). Subspecies ***panormitana*** and variety ***multicaulis*** grow on fine breaking of tertiary limestones in the Trapani and Palermo areas, with a noticeable preference for sand accumulations originating from lixiviation of calcareous slopes of the mountains faced against the sea. These entities are generally found together with species of *Malcolmietalia* Rivas Goday 1957.

Var. ***messanensis*** grows on littoral sands, where it prefers little or not at all disturbed habitats. On the contrary subsp. ***aetnensis*** grows on volcanic soils of Mt. Etna, where it shows a clear preference to strongly disturbed habitats, as, e.g., borders of roads and mountain-tracks.

Key to the Sicilian endemic, subordinate taxa of Linaria multicaulis (L.) Miller

We present here the under described dichotomic keys based on characters present also in dry samples.

1 Plant small to middle-sized in height (max 60 cm tall)
  2 Capsule big (5 mm); calyx lobes exceeding the capsule; bracts short *L. multicaulis* subsp. *humilis*
  2 Capsule small (4,5 mm); calyx lobes equalling the capsule; bracts long.....*L. multicaulis* subsp. *multicaulis* var. *panormitana*
1 Plant large-sized in height (more than 60 to 120 cm tall)
  3 Capsule small; pedicels short.....*L. multicaulis* subsp. *aetnensis*
  3 Capsule big; pedicels long
    4 Bracts short (4,3-4,5 mm).....*L. multicaulis* subsp. *multicaulis* var. *multicaulis*
    4 Bracts long (5-6 mm).....*L. multicaulis* subsp. *multicaulis* var. *messanensis*

Selected specimens (excluding the types)

Linaria multicaulis subsp. *aetnensis*: Italy, Sicily, Giarre, Piazzola di sosta su Autostrada CT-ME, c/o Uscita Giarre, 21.05.91, Giardina (CAT); Italy, Sicily, Paternò, Strada Paternò-Ragalna km 2, 10.04.92, Giardina (CAT); Italy, Sicily, Trapani, Su autostrada TP-PA km 4 da TP, 24.04.95, Giardina (CAT); Italy, Sicily, Monreale, San Martino delle Scale, 12.05.97, Giardina (CAT).

Linaria multicaulis subsp. *multicaulis* var. *messanensis*: Sicilia, Messina, Ganzirri litorale ionico, 3.05.2000, Giardina (CAT); Sicilia, Messina, Ganzirri litorale tirrenico, 3.05.2000, Giardina (FI).

Linaria multicaulis subsp. *multicaulis* var. *multicaulis*: Sicilia, Monreale, San Martino delle Scale, 12.05.97, Giardina (CAT); Sicilia, Palermo, Mt. Cuccio, 1.05.2000, Giardina (CAT); Sicilia, Piana degli Albanesi, Mt. Pizzuta, 28.05.2000, Giardina (CAT);

Linaria multicaulis subsp. *multicaulis* var. *panormitana*: Sicilia, Bagheria, Mt. Catalfano pendii nord, 13.04.99, Giardina (FI).

Linaria multicaulis subsp. *humilis*: Italy, Sicily, Madonna del Piano, Grammichele, 02.08.96, Giardina (PAL, CAT); Italy, Sicily, Madonna del Piano, Grammichele, 01.04.97, Giardina (PAL, CAT); Italy, Sicily, Madonna del Piano, Grammichele, 15.04.97, Giardina (FI, CAT); Italy, Sicily, Contrada Molara di Caltagirone, 4.05.97, Giardina (PAL, CAT, NAP); Italy, Sicily, Madonna del Piano, Grammichele, 16.05.97, Giardina (K, CAT); Italy, Sicily, Vallata Dirillo, Contrada Dirillo di Acate, 29.09.91, Giardina (CAT).

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