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Distribution, Karyology and Taxonomy of *Onosma helvetica* subsp. *lucana* comb. nova (*Boraginaceae*), a Schizoendemic in Basilicata and Calabria (S. Italy).

By

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With 5 Figures

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Key words: *Boraginaceae*, *Onosma helvetica* BOISS. group, *O. lucana* LACAITA, *O. helvetica* subsp. *lucana* (LACAITA) PERUZZI, AQUARO & CESCA comb. nova. – Taxonomy, typification. – Karyology, chromosome numbers, karyotype analysis. – Flora of Italy.

Summary

PERUZZI L., AQUARO G. & CESCA G. 2004. Distribution, karyology and taxonomy of *Onosma helvetica* subsp. *lucana* comb. nova (*Boraginaceae*), a schizoendemic in Basilicata and Calabria (S. Italy). – Phyton (Horn, Austria) 44 (1): 69–81, with 5 figures. – English with German summary.

From the measurements of morphological characteristics (under special consideration of Calabrian material) it is concluded to treat the south-Italian member of *Onosma helvetica* s.l. as a subspecies: *O. helvetica* BOISS. subsp. *lucana* (LACAITA) PERUZZI, AQUARO & CESCA comb. nova. The name *O. lucana* LACAITA is lectotypified. One of the crucial characteristics for this inference is the mean value of the calyx length of 13.5 mm (10.5 mm in the other subspecies). The chromosome number is 2n = 26 and the complement shows the same differentiation in two sets of six long and seven short chromosomes respectively, as the other subspecies. This subspecies actually occurs only in three localities in Basilicata and three in N. Calabria.

Zusammenfassung

PERUZZI L., AQUARO G. & CESCA G. 2004. Verbreitung, Karyologie und Taxonomie von *Onosma helvetica* subsp. *lucana* comb. nova (*Boraginaceae*), ein Schizoendemit

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der Basilicata und Calabriens (S-Italien). - Phyton (Horn, Austria) 44 (1): 69–81, mit 5 Abbildungen. – Englisch mit deutscher Zusammenfassung.

Aufgrund von Messungen morphologischer Merkmale (unter besonderer Berücksichtigung calabrischen Materials) wird für das süditalienische Taxon von *Onosma helvetica* s.l. die Rangstufe der Subspecies als angemessen betrachtet: *O. helvetica* Boiss. subsp. *lucana* (Lacaita) Peruzzi, Aquaro & Cesca comb. nova. Der Name *O. lucana* Lacaita wird lectotypisiert. Ein wesentlichtes Merkmal ist die mittlere Kelchlänge von 13,5 mm (10,5 mm in den anderen Subspecies). Die Chromosomenzahl beträgt 2n = 26 und die Differenzierung der Chromosomen in zwei Sätze aus sechs langen bzw. sieben kurzen Chromosomen entspricht den Verhältnissen bei den anderen Subspecies. *O. lucana* kommt gegenwärtig nur an je drei Stellen in der Basilicata und in N-Calabrien vor.

1. Introduction

There are 33 *Onosma* species in Europe (Ball 1972) of which 5 occur in Italy (Teppner 1982): *O. fastigiata* (Braun-Blanquet) Lacaita, shows only simple setae and occurs in Piedmont and Liguria (NW Italy); *O. visianii* Clem., shows also simple setae only, but occurs in Karst near Trieste (NE Italy); *O. arenaria* Waldst. & Kit. subsp. *pennina* Braun-Blanquet, shows both simple and stellate setae, and is known only from one herbarium specimen from Piedmont; *O. echioides* (L.) L. s.l., shows only stellate bristles and occurs in Sicily, peninsular Italy and in Karst near Trieste; *O. helvetica* Boiss. emend. Teppner, shows stellate setae as well as short simple hairs, and occurs in N Italy and in S Italy (Basilicata and Calabria).

According to Teppner 1971, *O. helvetica* consists of 3 subspecies in Italy, whose variability is related to the geographical distribution: *O. helvetica* subsp. *helvetica* [incl. *O. taurica* Willd. subsp. *cinerascens* Br.-Bl.] in western Alps; *O. helvetica* subsp. *fallax* (Borbàs) Teppner in NE Italy near Udine, *O. helvetica* subsp. *tridentina* (Wettstein) Teppner in NE Italy near the lake of Garda. Subsequently Teppner 1982 includes *O. lucana* in *O. helvetica* also. *O. lucana* was described by Lacaita 1924 (Fig. 1) from Pietrapertosa (Potenza, Basilicata, S Italy), and occurs in the adjoining Calabria too. Teppner 1982 also points out the necessity to study not only these units more closely but also the whole *O. helvetica* complex (Teppner 1996).

Regarding the taxonomic treatment of *O. lucana*, different authors express different opinions, for instance: Rauschert 1976 reduces *O. lucana* to a subspecies of *O. pseudoarenaria* Schur [*O. pseudoarenaria* subsp. *lucana* (Lacaita) Rauschert], together with *O. pseudoarenaria* subsp. *helvetica* Rauschert, *O. pseudoarenaria* subsp. *fallax* (Borbàs) Rauschert, *O. pseudoarenaria* subsp. *tridentina* (Wettstein) Rauschert, *O. pseudoarenaria* subsp. *cinerascens* (Braun-Blanquet) Rauschert. Fiori 1926 considers *O. lucana* even as a variety of *O. echioides*

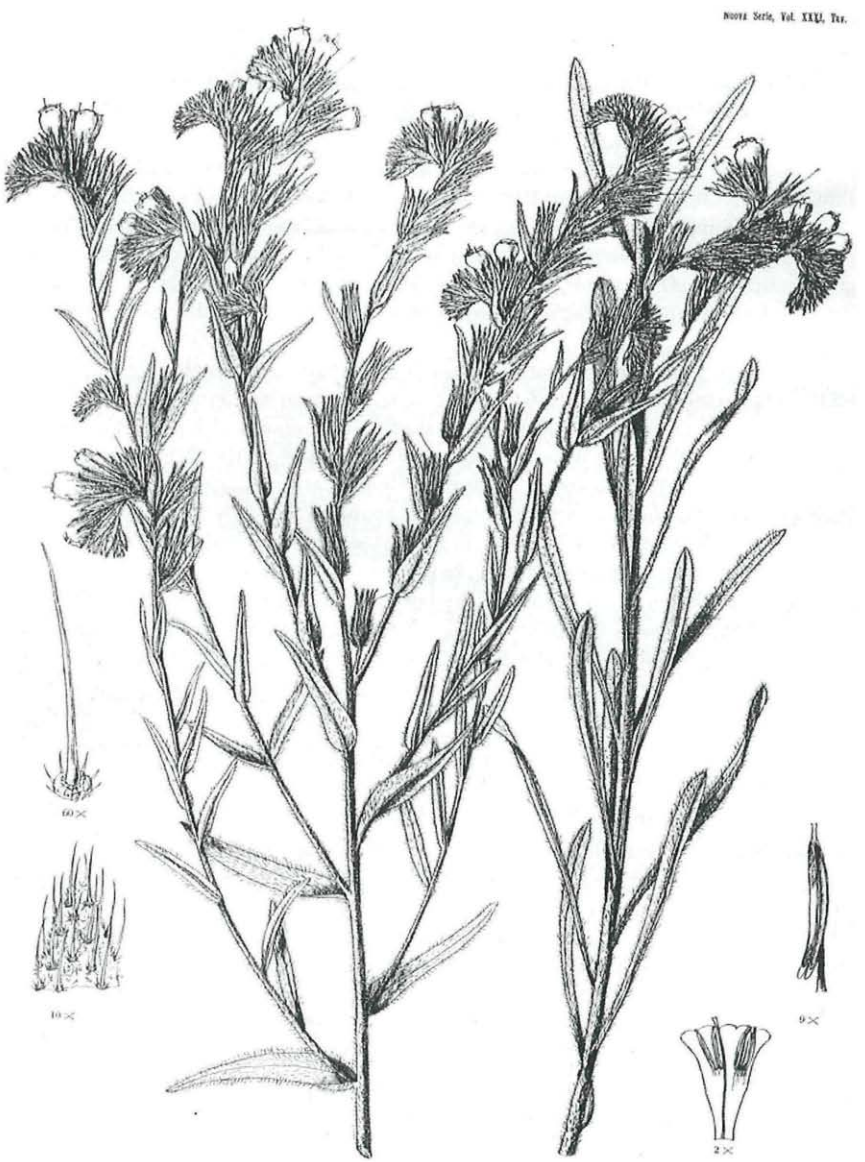

Fig. 1. Original iconograph of *O. lucana* (LACAITA 1924).

[*O. echioides* var. *lucana* (LACAITA) FIORI]. On the other hand *O. lucana* is treated as a good species by BALL 1972 and ZANGHERI 1976.

2. Material and Methods

Live plants: Italy, Calabria, Paludi (Cosenza) on the left banks of the river Fangaro, 18. 4. 2002, PERUZZI, AQUARO & CESCA (cult. Hort. Bot. University of Calabria, acc. n. 478; 584, 684).

Herbaria of the Botanical Garden of the University of Calabria (CLU), Herbarium Centrale Italicum (FI) and British Museum (BM) were consulted.

Some comparative measurements were carried out within *O. helvetica* s.l., considering the following data among those suitable from LACAITA 1924 as discriminating for *O. lucana*: size of the plant, length and width of the leaves, length of calyx and corolla, number of ramifications and number of stellate bristles.

For karyological investigations, root tips of cultivated plants (acc. n. 478 and 584) were treated with a 0,4–0,5% colchicine solution for around 3 hrs., subsequently fixed in Carnoy's fluid (3 parts of ethylic alcohol and 1 of acetic acid) for around $1^1/_2$ hrs. Root tips were subsequently hydrolysed in 1N HCl at 60 °C for 6–7 minutes, stained with fuchsine for around 3 hrs. and squashed in acetic orcein. Microphotographs of five metaphase plates, acquired through digital camera, were used for the measurements in order to build the haploid idiogram. The karyotype formula is according to LEVAN & al. 1964.

STEARN 1993 discusses the etymology of the name *Onosma* and is of the opinion that it has to be considered of feminine gender. In accordance with the Code [art. 62.2.(b); GREUTER & al. 2000], we treat the name *Onosma* as feminine.

3. Specimina Visa

3. 1. *O. helvetica* BOISS. subsp. *lucana* (LACAITA) PERUZZI, AQUARO & CESCA h.l.

Italy, Basilicata: Lucania prov. di Potenza, in saxosis siliceo arenaceis prope oppidum Pietrapertosa, alt. 600 m. circ., 12. VI. 1924, LACAITA (BM); ibidem (FI); Valle del Basento (Basilicata) alla salita di Pietrapertosa in saxosis arenaceis c. 600 m, flores lutei non lactei, herba virescens non cinerea, 13. 6. 1910, LACAITA (BM, Herb. LACAITA n°12527); Valle del Basento (Basilicata) alla salita di Pietrapertosa in saxosis arenaceis c. 600 m, flores lutei non lactei, differisce per il calice 15 mm contro gli 8–10 dell'*helveticum*, 3. 6. 1910, LACAITA (FI); Lucania – Pietrapertosa in saxosis prope pagum solo siliceo (arenaria) alt. 700 m, locus classicus et unicus, 28. 5. 1947, GAVIOLI (FI); Castelmezzano, in rupestris alt. 700 m s.l.m., 24. 6. 1942, GAVIOLI (FI); Lucania, Anzi, margini della rotabile presso la valle della Canostra alt. 700–800 e radure del bosco "Chiara", 7. 6. 1932, GAVIOLI (FI). – Calabria: La Sila (Calabria) ai piedi di Valle Grande (Longobucco) m. 700, 16. 6. 1950, SARFATTI & CORRADI (FI, sub *O. echioides*); Sila Greca, Longobucco (Cosenza), Vallone Grande, lungo la S.S. 177, tra il Km 45 ed il Km 46, 24. 5. 2002, PERUZZI et AQUARO (CLU); Rupi sotto Oriolo Calabro, 300–350 m, 10. 5. 2003, CESCA (CLU); 3 Km prima di Paludi (Cosenza) alt. 400 m s.l.m., 20. 4. 1979, DEL PRETE, GARBARI

& CESCA (CLU); 3 Km dopo Paludi verso Cropalati (Cosenza) Sila Greca, riva sinistra del torrente Fangaro, 300–400 m, 18. 4. 2002, PERUZZI, CESCA & AQUARO (CLU).

3. 2. *O. helvetica* subsp. *tridentina* (WETTST.) TEPPNER

Italy, Veneto: tra Torbole e Malcesine (Lago di Garda), 1933–1934, COMBONI (FI); Venetia, prov. di Verona, in pascuis glareosis vallis dei Mulini inter Costermono et Garda etc. alt. 150–200 m solo calcareo, 5. 6. 1904, RIGO (FI); Flora Exsiccata Austro-Hungarica 1413, ad confines Tiroliae meridionalis. Ad lacum benacum in collibus apricis 70–100 mt s.m., PORTA with notes of WETTSTEIN (FI); In glareosis et graminosis mt. Lazzo, Colli Euganei, 6.1882, BIZZOREN (FI).

3. 3. *O. helvetica* subsp. *helvetica*

Italy, Valle d'Aosta: Sarre-chezallet (Italien-Aostatal), westlich Aosta, Höhe 650–800 m, Hang, 2. 6. 1974, BERGER (FI); Valle D'Aosta tra Chatillon e Nus m. 550 ca., 20. 6. 1963, BAVAZZANO et RICCERI (FI); sopra P. Martina (Aosta), 21. 5. 1914, ROLZ (FI). – Piemonte: Colli di Crea (Casale Monferrato), 9. 6. 1890, FERRARI (FI); Lieux Arides des Collines de Crea. Casale Monferrato Italia (Piemont), 6.1874, NEGRI (FI); Monesiglio (Cuneo) rupi lungo la strada prima del bivio per Prunetto, 30. 5. 1930, FONTANA (FI); Serralunga circa il Santuario, 13. 6. 1905, ZOLA (FI). – Lombardia: nel mantovano nei colli di Solferino, 1842, s.c. (FI). – Emilia Romagna: M. Mauro (Romagna), 12. 7. 1905, PAMPANINI (FI); Prov. di Reggio Emilia, Monte di Vallestra, suolo siliceo m 850, 1. 8. 1935, FIORI (FI); In agro Parmensi, nasce sulle rive dei fiumi Fiorisce in Luglio, Agosto, s. d., s. c. (FI); In apricis sterilibus solo argillaceo collium sub-Appenninorum prope Costeggio pro. Papiensis, 6.1872, GIBELLI (FI); prov. di Reggio Emilia, Montebabbio, suolo arenaceo alt. m. 370, 20. 9. 1924, FIORI (FI).

3. 4. *O. helvetica* subsp. *fallax* (BORBÁS) TEPPNER

Italy, Friuli Venezia Giulia: Presso Udine (110 m circa), 24. 5. 1898, GORLANI (FI); Buttrio in Monte (Friuli) a 100 m, 20. 5. 1900, GORLANI (FI); Goriziano M. S. Michele, suolo calcareo alt. 250 m, 3. 6. 1925, FIORI (FI).

3. 5. *O. helvetica* subsp. *austriaca* (BECK) TEPPNER

Austria: Austria inferior apud "Förthof" prope Krems, 8. 6. 1902, HAYEK (FI); Slovakia: Slovakia australis, distr. Štúrovò, colles Kovačovské kopce: in clivio collis Burda, 2. 7. 1930, DOMIN (FI).

4. Results

4.1. Distribution

Field research was carried out in spring 2002 on two Calabrian stands. *O. helvetica* subsp. *lucana* currently occurs in both the localities in the Sila Greca (see Figure 2, E, F): we have counted ca. 100 individuals in the po-

pulation of Longobucco in an area of around 500 × 10 meters; ca. 50 individuals in the population of Paludi in an area of around 200 × 20 meters. Despite the fact, that there are in this zone numerous sites with similar ecological characteristics, until now it has not been possible to record *O. helvetica* subsp. *lucana* for other localities. The locality of Longobucco is probably the same one as reported by RAUSCHERT 1976 on suggestion of TEPPNER. The locality of Paludi is around 300–400 meters a.s.l., of calcareous substratum, along the left bank of an ephemeral river in a rocky garigue environment. The stand of Longobucco is situated around 600–700 meters a.s.l., and the population of *O. helvetica* subsp. *lucana* primarily develops along eroded road embankments in a garigue environment. The slopes of both stands mainly show SE exposition. During the spring 2003 a third Calabrian stand of *O. helvetica* subsp. *lucana* was discovered by one of the authors in the lowlands of Pollino area, near the administrative borders between Calabria and Basilicata. This locality (Fig. 2,D) shows ecological characteristics very close to the above mentioned two Sila Greca's stands.

4.2. Morphology and Taxonomy

The observed morphological data are summarized in Table 1. From our field and cultivation observations, we have the impression that *O. helve-*

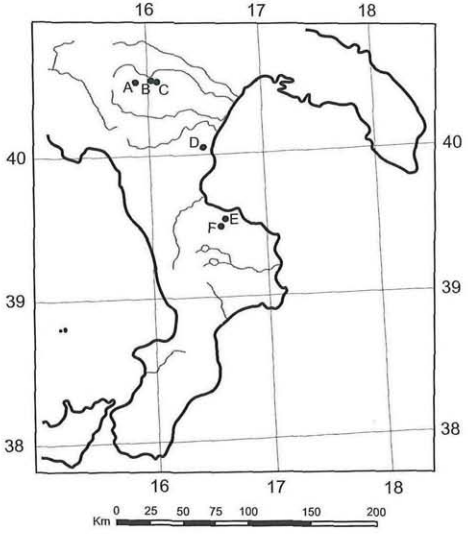

Fig. 2. Distribution map of *O. helvetica* subsp. *lucana* (S. Italy) in Basilicata [A = Anzi, B = Castelmezzano, C = Pietrapertosa (locus classicus)] and Calabria [D = Oriolo, E = Paludi, F = Longobucco].

Table 1.

Comparison of morphological data between *O. helvetica* subsp. *lucana* (22 specimens) and the other four subspecies (37 specimens). Values are expressed in means, and in 10 to 90 percentiles with the extreme values in brackets. Measurements on the floral parts were taken from flowers in anthesis.

	subsp. *lucana*	sum of the 4 subsp. others than *lucana*	n° 11 specimens subsp. *tridentina*	n° 19 specimens subsp. *helvetica*	n° 2 specimens subsp. *austriaca*	n° 5 specimens subsp. *fallax*
Size of the plant	52 cm (35)43.5–65(80) cm	35.5 cm (20)25–50(55) cm	39 cm (25)27.5–50 cm	35.3 cm 25–48.5(55) cm	37.5 cm 30–45 cm	34 cm 30–38(40) cm
Length of the leaves	8.1 cm (4.5)7–10 cm	6.5 cm (3)4–9(20) cm	5.4 cm (4)4.5–6.5(7) cm	7.2 cm (3)4.8–11.9(20) cm	4.5 cm 4–5 cm	5.8 cm 5–7 cm
Width of the leaves	6. 2 mm 4.5–7.5(10) mm	4 mm (2)2.5–5(7) mm	3.8 mm 3–4.5(5) mm	4.1 mm (2)2.9–5.1(7) mm	4.5 mm 4–5 mm	3.4 mm (2)2.4–4.6(5) mm
Length of the calyx	13.5 mm (11)12.5–15(20) mm	10.5 mm (5)9–12(13) mm	10.5 mm (9)10–12 mm	10.2 mm (5)9–12.3(13) mm	10 mm 10 mm	11.4 mm 11–12 mm
Length of the corolla	21.5 mm (17)19.5–24.5(26) mm	19.5 mm (15)17–22(25)mm	19.5 mm 17–22 mm	17.9 mm 15–22.3(25) mm	17 mm 15–19	20.4 mm (18)18.8–21.6(22) mm
Number of ramifications	6.25 (2)4.5–8	2.75 1–5(10)	2.75 1–5.1(6)	4.3 (1)1.85–7.3(10)	4.75 3-6.5	3.5 (2)2.2–4.6(5)
Number of asterosetae	9 (6)7–11(18)	9 (3)5–15.5(20)	8.2 5–10(11)	9.9 (5)5.9–19.6(20)	6.25 4.5-8	3.9 (3)3.7–4

Table 2.

Measurements carried out on 5 metaphase plates of *Onosma lucana*. Data were obtained from microphotographs and then reported in µm.

	l						s						
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	VII
Mean length of long arm (L)	5.04	4.52	3.86	3.62	3.36	3.32	2.61	2.16	2.33	2.08	1.86	1.63	1.49
Mean length of short arm (S)	3.60	2.97	3.11	3.11	3.10	2.70	2.29	2.02	1.68	1.65	1.22	1.27	1.27
Total length (TL)	8.64	7.50	6.97	6.73	6.47	6.02	4.89	4.18	4.01	3.73	3.08	2.91	2.76
	67.85												
Ratio Long arm / Short arm (L/S)	1.40	1.52	1.24	1.17	1.08	1.23	1.14	1.07	1.39	1.27	1.53	1.28	1.17
Karyotype formula	12m						10m					2m-SAT	2m

tica subsp. *lucana* in Calabria behaves most probably as a true biennial, as already suggested by LACAITA 1924 on the basis of the thin rhizome. In fact, we observed leaf rosettes and individuals in flower without rosettes occurring side by side. Moreover, the first year cultivated plants collected during anthesis disappeared in autumn, while plants collected as rosettes overwintered. These latter plants flowered in the second year and then disappeared as well. Otherwise *O. helvetica* is described as a short-living perennial (TEPPNER 1991a).

For these morphological reasons we propose formally the status of a subspecies:

Onosma helvetica BOISS. [Diagn. Pl. Orient. 11: 111 (1849)] subsp. *lucana* (LACAITA) PERUZZI, AQUARO & CESCA comb. nova

Basionym: *O. lucana* LACAITA, N. Giorn. bot. ital. n.s., 31: 33 (1924).

Lectotypus (here designated by PERUZZI L. and PASSALACQUA N. G.): Valle del Basento (Basilicata) alla salita di Pietrapertosa in saxosis arenaceis c. 600 m, flores lutei non lactei, herba virescens non cinerea 13. 6. 1910, LACAITA (BM!, Herb. LACAITA n°12527, see Fig. 3). Note: this specimen is the only with the same date of collection quoted in the protologue, and moreover LACAITA 1924 explicitly affirms that this is the plant on which he based his original iconography (see Fig. 1).

Synonyms: *O. echioides* η *lucana* (LACAITA) FIORI, Nuova Fl. Anal. D'Ital. 2: 268 (1926); *O. pseudoarenaria* Schur subsp. *lucana* (LACAITA) RAUSCHERT, Folia geobot. phytotax. 11: 276 (1976).

Chromosome number: 2n = 26.

Distribution: Basilicata and Calabria (S. Italy).

According to the classification criteria of endemics by FAVARGER & CONTANDRIOPOULOS 1961 and FAVARGER & SILJAK-YAKOVLEV 1986, the *O. helvetica* complex can be interpreted in our opinion as schizoendemics, a group of very similar taxa, with separate distributions and same level of karyotypical differentiation.

4.3. Karyology

The karyologically studied material, originating from the station of Paludi, shows (Fig. 4) 2n = 26 chromosomes, 12l+14s (long and short chromosomes; in German L and K, TEPPNER 1971, 1972) as known for this species. The karyotype formula, obtained by the measurements (Table 2) on microphotographs, can be expressed as follows: 2n = 26 = 24m + 2msat. The haploid idiogram is presented in Fig. 5. *O. helvetica* subsp. *lucana* is clearly of allopolyploid origin, as pointed out by TEPPNER 1972 and 1991b for the other subspecies.

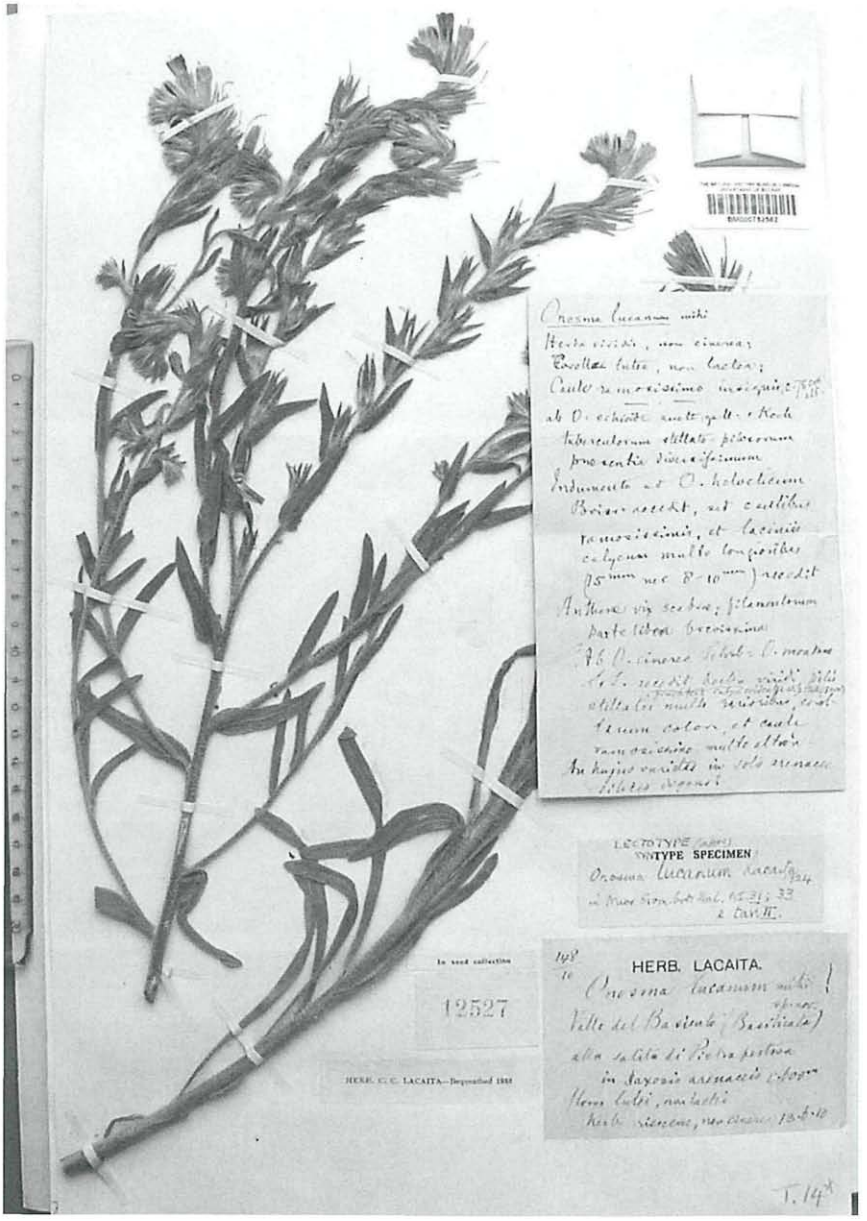

Fig. 3. Lectotype of *O. lucana* LACAITA, conserved in the Herbarium LACAITA at British Museum (BM).

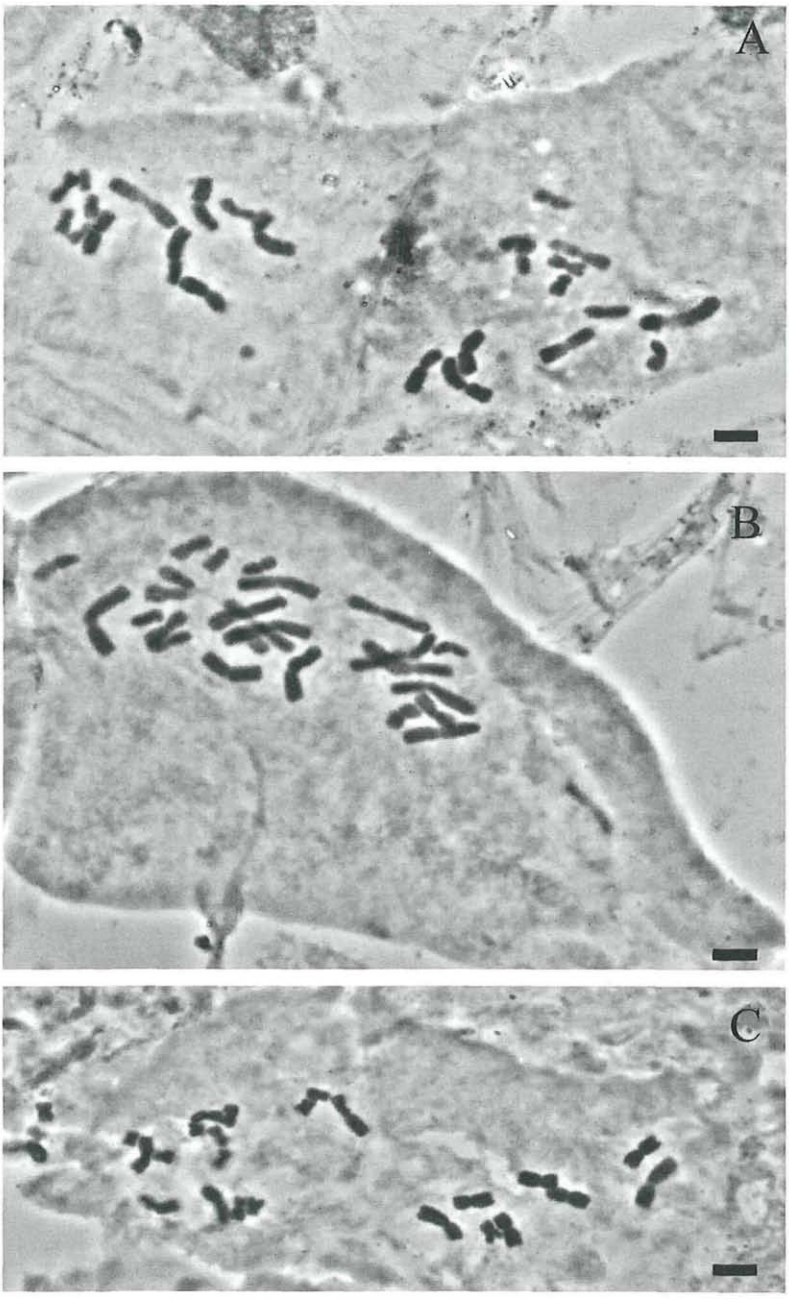

Fig. 4. Metaphase chromosomes (A–C) of *O. helvetica* subsp. *lucana*, 2n = 26. Scale bars: 5 μm.

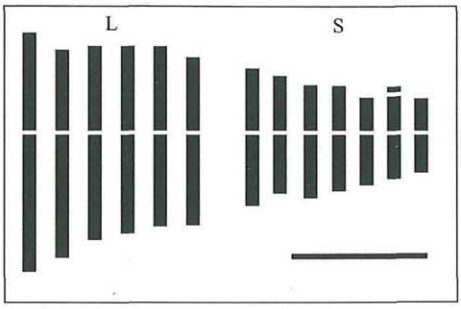

Fig. 5. Haploid idiogram of the chromosome set of *O. helvetica* subsp. *lucana*, showing 6 chromosomes of l type and 7 chromosomes of s type. – Scale bar: 5 µm.

5. Discussion

5.1. Distribution

Herbarium and field studies allowed us to circumscribe the area of distribution of *O. helvetica* subsp. *lucana* in southern Italy, located more precisely in the province of Potenza (Pietrapertosa, Anzi, Castelmezzano) in Basilicata, as well as Paludi, Longobucco (Sila Greca) and Oriolo (Pollino area) in northern Calabria (cfr. Fig. 2). The distribution area of *O. helvetica* subsp. *lucana* is well separated from the other subspecies of *O. helvetica*, since these occupy the territory of northern Italy, southeast of France, Austria, Slovenia, Croatia, Bosnia-Hervegovina, Serbia and Montenegro, Albania, Greece and Romania (RAUSCHERT 1976, TEPPNER 1991a).

O. helvetica subsp. *lucana* appears to be adapted to the Mediterranean climate and grows in typical environment of garigue with scattered vegetation. BERNARDO & al. 1991 describe the climate for Sila Greca (Calabria, S. Italy) as mediterranean, but according to the classification of THORNTHWAITE 1948, a climate of subtype humid B3 is assigned for the stand of Longobucco and a climate of subtype B1 for the stand of Paludi. However, the results from some of our preliminary researches show a predominance of Mediterranean species in the floristic composition of both localities, mainly showing hemicryptophytic and therophytic life forms.

5.2. Morphological Characteristics and Status

The recorded morphological difference (Table 1) between the populations of *O. helvetica* subsp. *lucana* and the other subspecies is mainly the dimension of the calyx, as already affirmed in the protologue by LACAITA 1924. In fact, the calyx in *O. helvetica* subsp. *lucana* shows a mean value of 13.5 mm, with a maximum of 20 mm, against the 10.5 mm of the other subspecies (with maximum of 13 mm). Other characters pointed out by

LACAITA as distinctive, actually overlap partially or totally with those of the other subspecies. This was confirmed, at least as according to the herbarium specimens we studied (cfr. Table 1). Features in average, which aid the morphological distinction of *O. helvetica* subsp. *lucana* are the dimensions of the plant and of the leaves (both greater in *O. helvetica* subsp. *lucana*). All this validate the status of a subspecies. Concerning the nomenclature of the species we follow TEPPNER 1971 and 1991a, and not RAUSCHERT 1976 and GREUTER & al. 1984.

5.3. Karyology

From the results obtained from plants of *O. helvetica* subsp. *lucana* originating from Paludi, it has been possible to establish the chromosome number 2n = 26. The karyotype structure, confirms the hypothesis of an allotetraploid origin of *O. helvetica* (TEPPNER 1971, 1991b, 1996). In fact, by examining the values of the average total lengths of the homologous chromosomes (Table 2), we could distinguish two different groups: a first group of chromosomes with gradually decreasing dimensions between 8.16 μm and 6.02 μm (12 longer chromosomes of l type); a second group of chromosomes [14 briefer of s type (K type in papers of TEPPNER) with gradually decreasing dimensions between 4.89 μm and 2.77 μm. All the chromosomes have centromeres of median position.

O. helvetica has been documented (TEPPNER 1972) to be of hybrid origin among plants of the type of *O. echioides* (2n = 14) and plants of the type of *O. setosa* (2n = 12).

All the units belonging to *O. helvetica* show complements of 2n = 26 normal chromosomes in two specific sets as mentioned above; this confirms the extreme affinity of *O. helvetica* subsp. *lucana* with other subspecies of *O. helvetica*. All other numbers indicated in the literature are erroneous for different reasons (TEPPNER, pers. corresp. 2003).

Acknowledgements

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