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***Prospero hierae* (Hyacinthaceae), a New Species from Marettimo Island (Sicily)**

By

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With 4 Figures

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Summary

BRULLO C., BRULLO S., GIUSSO DEL GALDO G., PAVONE P. & SALMERI C. 2009. *Prospero hierae* (Hyacinthaceae), a new species from Marettimo Island (Sicily). – *Phyton* (Horn, Austria) 49 (1): 93–104, with 4 figures.

A new species, *Prospero hierae* C. BRULLO, S. BRULLO, GIUSSO, PAVONE & SALMERI (Hyacinthaceae), from Island of Marettimo (Egadi Archipelago, Sicily) is described and illustrated. Its chromosome number ($2n = 14$), leaf anatomy and ecology are examined. This small species with glaucous, adaxially flat leaves is closely related with the taxa belonging to the *Prospero autumnale* group and, in particular, it shows more affinities to *P. corsicum*, *P. pulchellum* and *P. minimum*.

Zusammenfassung

BRULLO C., BRULLO S., GIUSSO DEL GALDO G., PAVONE P. & SALMERI C. 2009. *Prospero hierae* (Hyacinthaceae), a new species from Marettimo Island (Sicily). [*Prospero hierae* (Hyacinthaceae), eine neue Art von der Insel Marettimo (Sizilien)]. – *Phyton* (Horn, Austria) 49 (1): 93–104, mit 4 Abbildungen.

Die neue Art *Prospero hierae* C. BRULLO, S. BRULLO, GIUSSO, PAVONE & SALMERI (Hyacinthaceae) von der Insel Marettimo (Egadi-Archipel, Sizilien) wird beschrieben

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und abgebildet. Chromosomenzahl ($2n = 14$), Blattanatomie und Ökologie wurden untersucht. Diese niedere Art mit blaugrünen, adaxial flachen Blättern gehört zur *Prospero autumnale*-Gruppe und zeigt besonders zu *P. corsicum*, *P. pulchellum* und *P. minimum* Affinitäten.

1. Introduction

During field investigations carried out on Marettimo Island (Egadi Archipelago, W Sicily), some very peculiar populations of an autumn-flowering geophyte referable to *Scilla autumnalis* L. s. l. were found. According to SPETA 1982, 1985, 1993, 1998a, 1998b, EBERT & al. 1996, PFOSSER & SPETA 1999, WETSCHNIG & PFOSSER 2003 and BRULLO & al. 2008, the genus *Scilla* is very heterogeneous and not natural. Most of its subgenera and sections have to be treated as distinct genera, well differentiated by morphological, karyological, anatomical, ontogenetical, biochemical and biomolecular features. In fact, all the taxa belonging to the *Scilla autumnalis* group are now included in *Prospero* SALISB. This genus differs from *Scilla* s. str., typified by *Scilla bifolia* L., in many morphological characters, as well as in the ontogenetical cycle and basic chromosome number. The genus *Prospero* has hysteroanthous, filiform or strap shaped foliage leaves, erect scape, arising laterally by the leaves, bracts absent, 2-ovulate ovary locules, seeds without elaiosomes, autumnal flowering time (IX–XI) and basic chromosome numbers of $x = 4, 5, 6, 7$. In contrast, the genus *Scilla* s. str. is characterized by narrow synanthous foliage leaves, slack scape and prostrate when mature, inflorescence sometimes with minute bracts, many-ovulate ovary locules, seeds with elaiosomes, winter-spring flowering time (II–IV) and a basic chromosome number of $x = 9$.

In Italy, the genus *Prospero* is represented by *P. autumnale* (L.) SPETA, *P. obtusifolium* (POIR.) SPETA subsp. *intermedium* (GUSS.) SOLDANO & CONTI, *P. corsicum* (BOULLU) J. M. TISON, *P. elisae* SPETA (see BRULLO & al. 2008). The specimens from Marettimo differ from the just mentioned taxa in some relevant morphological features mainly regarding leaves, inflorescences, flowers and fruits. In particular, this population is characterized by flat leaves, glaucous and convolute when mature, very short stem, few-flowered inflorescence, small tepals and stamens, and maculate capsule. Therefore, it is here described as a new species to science and named *Prospero hierae*, endemic to the Island of Marettimo, whose ancient old name was „Hiera“.

2. Material and Methods

For the morphological investigations, living material cultivated for about 15 years in the Botanic Garden of Catania and coming from the Island of Marettimo (Egadi Archipelago) was used, while for what we regard as *P. autumnale* s. str., material collected near Trapani at „Monte Passo del Lupo“ (BRULLO S. & al. 6663, CAT) was used. For the karyological study, mitotic metaphase plates were obtained from

squashed root tips of cultivated bulbs, pre-treated with 0.3 % colchicine water solution for 3 hours and fixed in ethanol-acetic acid (3:1) for 6 hours, then hydrolyzed in 1N HCl for 7' and stained according to the Feulgen method (BOGDANOVIC & al., 2008). Metaphase observations and chromosome measurements were made using the image analysis systems IKAROS 4.6 (Metasystem) and Zeiss AxioVision 5.1. Karyotyping was done with the specialist software Cromolab[®] 1.1 (BRULLO 2002–2003) which was used to recognize homologues, order chromosomes by size and classify them according to morphology and centromere position (LEVAN & al. 1964). Ten mitotic plates from five individuals were used for determining the karyotype parameters. Measurements of each chromosome were processed by an excel worksheet to calculate mean and standard deviation of long and short arm lengths (satellites included), absolute and relative lengths, arm ratio and centromeric index. To estimate the karyotype asymmetry different numerical parameters were calculated, such as categories of STEBBINS 1971, REC and SYi (GREILHUBER & SPETA 1976), TF% (HUZIWARA 1962), A₁ and A₂ (ROMERO ZARCO 1986), DI (LAVANIA & SRIVASTAVA 1992), CV_{CL}, CV_{CL} and A₁ index (PASZKO 2006).

The leaf anatomy was studied on cultivated plant material from the type locality, fixed in Karpechenko solution and embedded in paraffin; the transverse sections were double stained with ruthenium red and light green.

3. Results

3.1. *Prospero hierae* C. BRULLO, S. BRULLO, GIUSSO, PAVONE & SALMERI spec. nova (Fig. 1)

Diagnosis: A *Prospero autumnali* differt scapo brevior, paucifloro, foliis glaucis, brevioribus, planis, adultis convolutis, perigonio parviore, tepalis exterioribus ovatis, acutis, interioribus oblongis, rotundatis, staminibus brevioribus, ovario longiore, obpyriformi, capsula subglobosa, maculata.

Holotypus: Sicilia, Marettimo, Pta Troia, litorale roccioso-calcareo, 8.10.1982, BRULLO S., CAT.

Description: Bulb ovoid, 1.5–2.5 × 1–1.5 cm with outer tunics membranaceous, brown, the inner ones whitish. Leaves 7–8, glaucous, 4–6 cm long, 1–1.5 mm wide, flat in the adaxial face, convex and ribbed in the abaxial one, convolute and prostrate at maturity (Fig. 3B). Stems solitary or paired, 4–10 cm tall, erect to procumbent. Pedicels 3–8 mm long. Raceme 1–3 cm long, provided with 4–12 flowers. Perigone stellate, 3.5–4 mm in diameter. Tepals white-liliaceous to liliaceous, with mibrid violet, outer ones ovate, acute at the apex, 4–4.3 × 2.3–2.5 mm, inner ones oblong, rounded at apex, 3.5–4 × 1.7–2 mm. Stamens equal, 3–3.4 mm long, filaments white below and liliaceous above, anthers dark violet, 1.2–1.3 mm long. Ovary white, obpyriform, 2 × 1.7 mm. Style liliaceous, 1.4–1.5 mm long, with stigma papillose. Capsule subglobose, dark green-glaucous, maculate with purple, 3.5 mm in diameter.

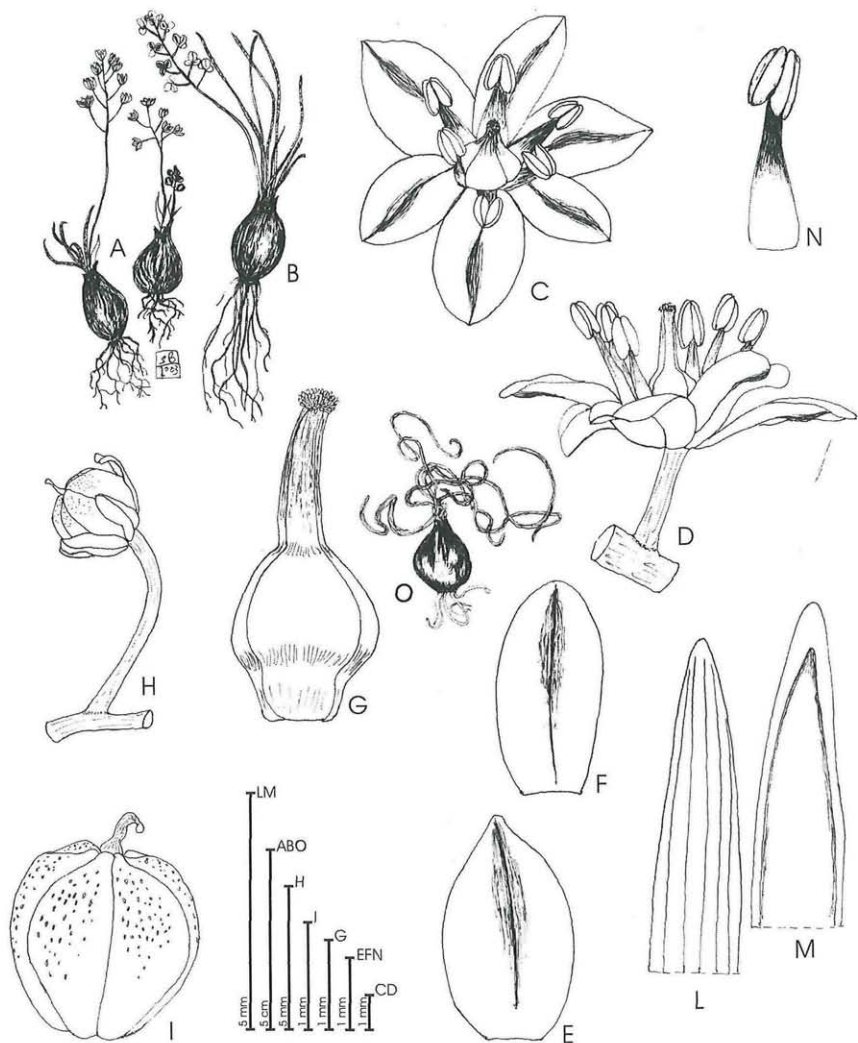


Fig. 1. *Prospero hierae*. A – flowering plants, habit. B – fruiting plant, habit. C – flower (above view). D – flower (lateral view). E – outer tepal. F – inner tepal. G – pistil. H – fructiferous pedicel. I – capsule. L – leaf apex (dorsal view). M – leaf apex (ventral view). N – stamen. O – habit of vegetative plant.

Paratypes: Sicily, Pta Troia, Marettimo, esemplare coltivato, 21.10.1982, BRULLO S., CAT. – Pta Troia, Marettimo, 4.10.1989, MINISSALE & SPAMPINATO, CAT. – Semaforo, Marettimo, 4.10.1989, MINISSALE & SPAMPINATO, CAT. – Marettimo, lungo il sentiero per Pta Troia, 4.10.1989, MINISSALE & SPAMPINATO, CAT. – Marettimo, Pta Troia, litorale roccioso-calcareo, 28.9.2003, BRULLO S., CAT.

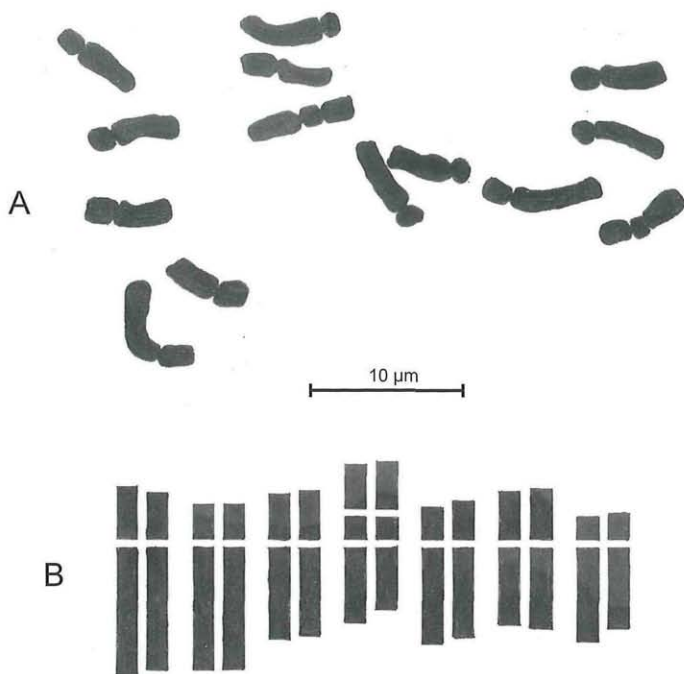


Fig. 2. *Prospero hierae*. A – metaphase plate of mitotic chromosomes. B – karyogram of the diploid set.

3.2. Chromosome Number

According to literature (BATTAGLIA 1952, 1957, 1964, HONG 1982, AINSWORTH & al. 1983, BARTOLO & al. 1984, GUILLEN & RUIZ REJON 1984, SPETA 1986, PARKER & al. 1991, ERBET & al. 1996, GERACI & SCHICCHI 2002), the chromosome complement in the genus *Prospero* (= *Scilla autumnalis* s. l.) is extremely variable. The following basic chromosome numbers $x = 4, 5, 6, 7$ at different ploidy levels ($2n = 8, 10, 12, 14, 26, 28, 42, 56, 70$) are reported from various populations of the Mediterranean area. *P. hierae* is a diploid species with a somatic chromosome number of $2n = 14$. Its karyotype is characterized by submetacentric and subtelocentric chromosomes except for the smallest pair of metacentric type. Two submetacentric chromosomes show very long macrosatellites (Fig. 2). This arrangement corresponds to the basic karyotype of *P. autumnale* (ERBET & al. 1996), apart from the presence of a subtelocentric pair in place of a submetacentric one in the karyotype of *P. hierae*. The absolute chromosome length ranges from $8.38 \pm 0.3 \mu\text{m}$ to $5.17 \pm 0.22 \mu\text{m}$, while the arm ratio varies from 1.31 to 4.23. The chromosome formula according to LEVAN & al. 1964 is $2n = 2x = 14: 2m + 6sm + 2sm^{\text{sat}} + 4st$. As for the symmetry degree, all

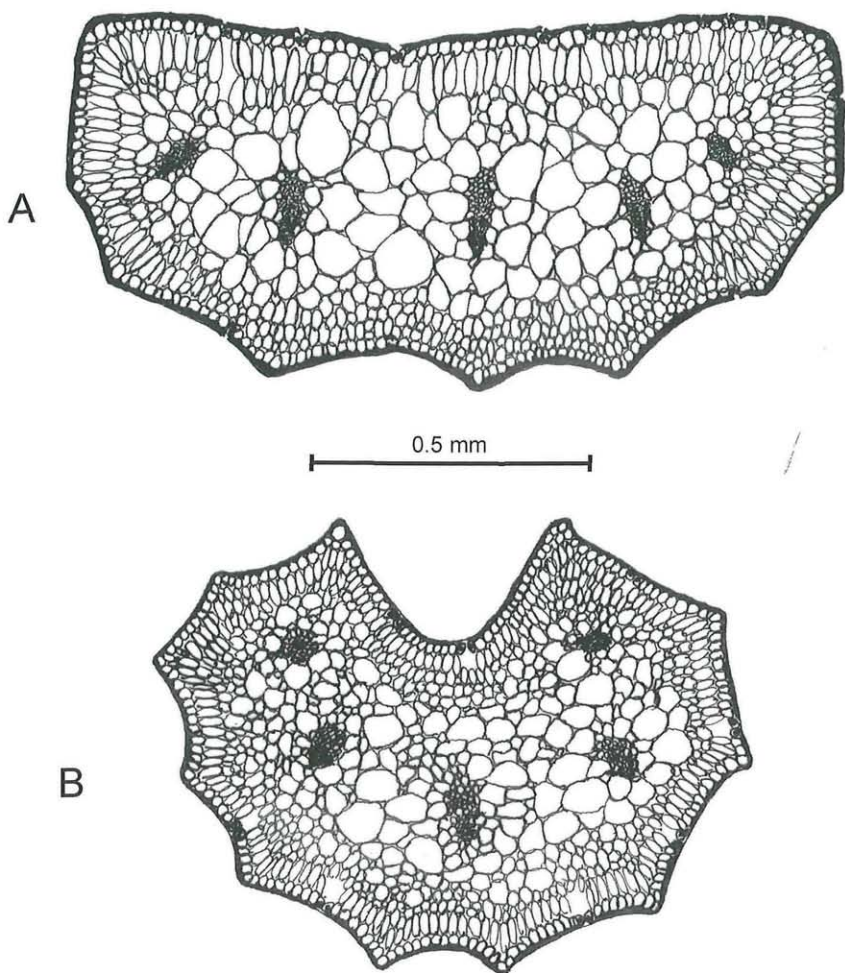


Fig. 3. Leaf cross section of *Prospero hierae* (A) and *P. autumnale* (B) from Trapani (Sicily).

measured indices confirm a certain karyotype asymmetry rather linked to the centromeric position than to the differences in the relative size of chromosomes (Tab. 1).

3.3. Leaf Anatomy

The leaf cross section of *P. hierae* (Fig. 3A) shows a semi-circular outline, with 9 well developed abaxial ribs and a flat adaxial face. The epidermis is covered by a cuticle with several stomata along the perimeter.

Table 1. Measurements, classification and asymmetry indices of the *Prospero hiraе* chromosome complement

N°	Absolute length			Relative length			Ratio <i>l/s</i>	C.I.	Type
	Long arm <i>Mean ± S.D.</i>	Short arm <i>Mean ± S.D.</i>	Sat <i>Mean ± S.D.</i>	Total <i>Mean ± S.D.</i>	Long arm <i>Mean ± S.D.</i>	Short arm <i>Mean ± S.D.</i>			
1	6.01 ± 0.19	2.37 ± 0.15		8.38 ± 0.30	6.99 ± 0.22	2.76 ± 0.09	2.53	28.29	sm
2	5.63 ± 0.41	2.34 ± 0.36		7.97 ± 0.77	6.54 ± 0.34	6.54 ± 0.34	2.41	29.36	sm
3	5.55 ± 0.59	1.31 ± 0.16		6.86 ± 0.62	6.45 ± 0.61	1.53 ± 0.23	4.23	19.11	st
4	5.31 ± 0.56	1.42 ± 0.09		6.73 ± 0.64	6.18 ± 0.64	1.65 ± 0.14	3.74	21.10	st
5	4.48 ± 0.46	1.37 ± 0.34		5.85 ± 0.80	5.20 ± 0.40	1.58 ± 0.36	3.28	23.36	st
6	4.24 ± 0.72	1.38 ± 0.26		5.62 ± 0.96	4.92 ± 0.71	1.60 ± 0.26	3.08	24.51	st
7	3.70 ± 0.25	1.86 ± 0.15		5.56 ± 0.33	4.31 ± 0.33	2.17 ± 0.25	1.99	33.40	sm
8	3.53 ± 0.50	1.87 ± 0.12		5.40 ± 0.62	4.11 ± 0.67	2.17 ± 0.17	1.89	34.62	sm
9	4.12 ± 0.02	1.46 ± 0.05		5.58 ± 0.05	4.79 ± 0.16	1.70 ± 0.02	2.81	26.22	sm
10	3.89 ± 0.08	1.45 ± 0.17		5.34 ± 0.10	4.52 ± 0.05	1.69 ± 0.25	2.68	27.20	sm
11	3.22 ± 0.25	2.46 ± 0.43		5.68 ± 0.50	3.76 ± 0.39	2.85 ± 0.45	1.31	43.27	msm
12	2.95 ± 0.33	2.22 ± 0.13		5.17 ± 0.22	3.44 ± 0.48	2.58 ± 0.08	1.33	42.92	msm
13	3.10 ± 0.29	1.15 ± 0.16	1.91 ± 0.09	6.16 ± 0.52	3.61 ± 0.29	1.33 ± 0.16	2.70	18.62	sm/sat
14	2.77 ± 0.17	1.07 ± 0.21	1.86 ± 0.09	5.69 ± 0.34	3.22 ± 0.20	1.24 ± 0.22	2.58	18.81	sm/sat
Total:	86.01 ± 2.59								

Asymmetry indices: Stebbins' Cat.: 3A; CV_{CL}: 29.26; CV_{CL}: 7.85; AI: 2.30; A1: 0.57; A2: 0.078; DI: 1.87; REC: 71.24; SY: 40.55; TF%: 27.59

The palisade tissue is not uniformly arranged; in fact, it is laterally made by two-layered cylindrical cells, by one-layered cylindrical cells in the adaxial face and by small and numerous subcircular cells in the abaxial side. The spongy tissue is compact with cells of different size. Five vascular bundles take place in the central part of the spongy tissue. Whereas the leaf cross section of the Sicilian populations of *P. autumnale* s. l. (Fig. 3B) is characterized by a sub-circular outline with 11 well developed ribs, a strongly concave adaxial face, and one-layered uniform palisade tissue made of cylindrical cells.

3.4. Distribution and Ecology

P. hierae was exclusively found at Marettimo (Egadi Archipelago, W Sicily) where it grows on rocky stands very close to the sea. This small geophyte is quite rare on the island and it colonizes Mesozoic limestone characterized by small hollows covered by a feeble layer of soil. It is a member of ephemeral sub-halophilous communities characterized by rare or very specialized therophytes such as *Senecio incrassatus* GUSS., *Hymenolobus revelieri* (JORD.) BRULLO subsp. *sommieri* (PAMP) BRULLO, *Sagina maritima* G. DON, *Silene sedoides* POIRET, *Bellis annua* L., *Catapodium balearicum* (WILLK.) SCHOLZ, *Parapholis incurva* (L.) HUBBARD, etc.

3.5. Taxonomic Remarks

P. hierae, due to its small size, is quite well differentiated from the other species belonging to the genus *Prospero*, but for some morphological features, such as few-flowered inflorescence, small flowers, and narrow leaves, it seems to be more related to *P. corsicum* (BOULLU) J. M. TISON from Corse and Sardinia, *P. pulchellum* (MUNBY) SPETA from N. Africa, and *P. minimum* SPETA from Crete (see Tab. 2). In particular, *P. corsicum* differs from *P. hierae* in having smaller bulbs, flowers, pedicels, tepals, ovary, stamens and capsule, as well as shorter, green, subcylindrical leaves. As concerns *P. pulchellum*, it is differentiated by few, green, narrower leaves, smaller tepals, stamens and ovary. Finally, *P. minimum* is characterized by smaller bulbs, ovary and capsule, longer, narrower and subcylindrical leaves, pink and larger tepals. Besides, *P. hierae* is well differentiated from the other Sicilian populations probably referable to *P. autumnale* s. l. In order to highlight the morphological relationships between these species, an iconography of a diploid population with $2n = 14$, coming from Trapani (W Sicily) and belonging to *P. autumnales* s. l., is provided (Fig. 3B, 4). According to literature (KER-GAWLER 1806, STEINHEIL 1834, BAKER 1873, MAIRE 1958, SPETA 1982, 1998, CONTANDRIOPOULOS & ZEVACO-SCHMITZ 1989), the typical populations of *P. autumnale* s. str. are characterized by big bulbs, leaves green, numerous, filiform, up to 35 cm long, stems erect, up to 35 cm long, inflorescence loose and many flowered, tepals 4.5–5 mm

Table 2. Comparative scheme of the main morphological characters of *Prospero hierae* and allied species

Character	<i>P. hierae</i>	<i>P. corsicum</i>	<i>P. pulchellum</i>	<i>P. pusillum</i>	<i>P. autumnale</i>
Bulb shape	ovoid	ovoid	ovoid	subglobose to ovoid	ovoid
Bulb size (cm)	1.5-2.5 × 1-1.5	0.7-1 × 0.6-0.8	2-3 × 1.5-2	1.1-1.8 × 0.7-1.4	2-3.5 × 1.5-3
Number of leaves	7-8	2-3(6)	2-4	-	5-10
Leaf shape	semi-cylindrical	sub-cylindrical	sub-cylindrical	sub-cylindrical	sub-cylindrical
Leaf colour	glaucous	green	green	green	green
Leaf length (cm)	4-6	1.5-3.5	3-5	6-10	10-35
Leaf width (mm)	1-1.5	max 1	0.5-0.9	0.5-1	0.5-1
Number of stems	1-2	1-2	1(2)	1-2(3)	1-2
Stem	erect to procumbent	ascending	erect	erect	erect
Stem height (cm)	4-10	3-7	6-10	4-10	10-35
Number of flowers					
(per inflorescence)	4-12	2-6	6-15	3-10(17)	10-25
Pedicle length (mm)	3-8	<3.5	3	2-6	4.5-5
Tepals colour	white-lilaceous to lilaceous	violaceous to blue	blue-violaceous	pink	blue-violaceous to purplish
Outer tepal size (mm)	4.4 × 2.3-2.5	3.5 × 1.7	3.5-4 × 2	4.8-5 × 2	4.5-5 × 2-2.2
Outer tepal shape	ovate, acute	ovate, acute	oblong, rounded	-	oblanceolate, obtuse
Inner tepal size (mm)	3.5-4 × 1.7-2	3.5 × 1.7	3.5-4 × 2	4.8-5 × 2	4.5-5 × 1.5-1.8
Inner tepal shape	oblong, rounded	ovate, acute	oblong, rounded	-	elliptical, rounded to retuse
Stamen length (mm)	3-3.4	1.7-2.5	3	3-3.5	3-3.5
Stamen filament (colour)	white below, lilaceous above	violaceous	violaceous	violaceous	white below, pulplish-lilaceous above
Anther size (mm)	1.2-1.3	0.8-0.9	1	-	1-1.2
Ovary (mm)	2 × 1.7	1.5 × 1.2	1.5 × 1.7	1.3 × 1.3	1.4 × 1.2
Style size (mm)	1.4-1.5	1.5	1.5	1-1.3	1
Capsule shape	subglobose	subglobose	-	globose	obovoid
Capsule diameter (mm)	3.5	2-3	-	2.3-3	3-3.2
Chromosome number (2n)	14	14	-	12	14

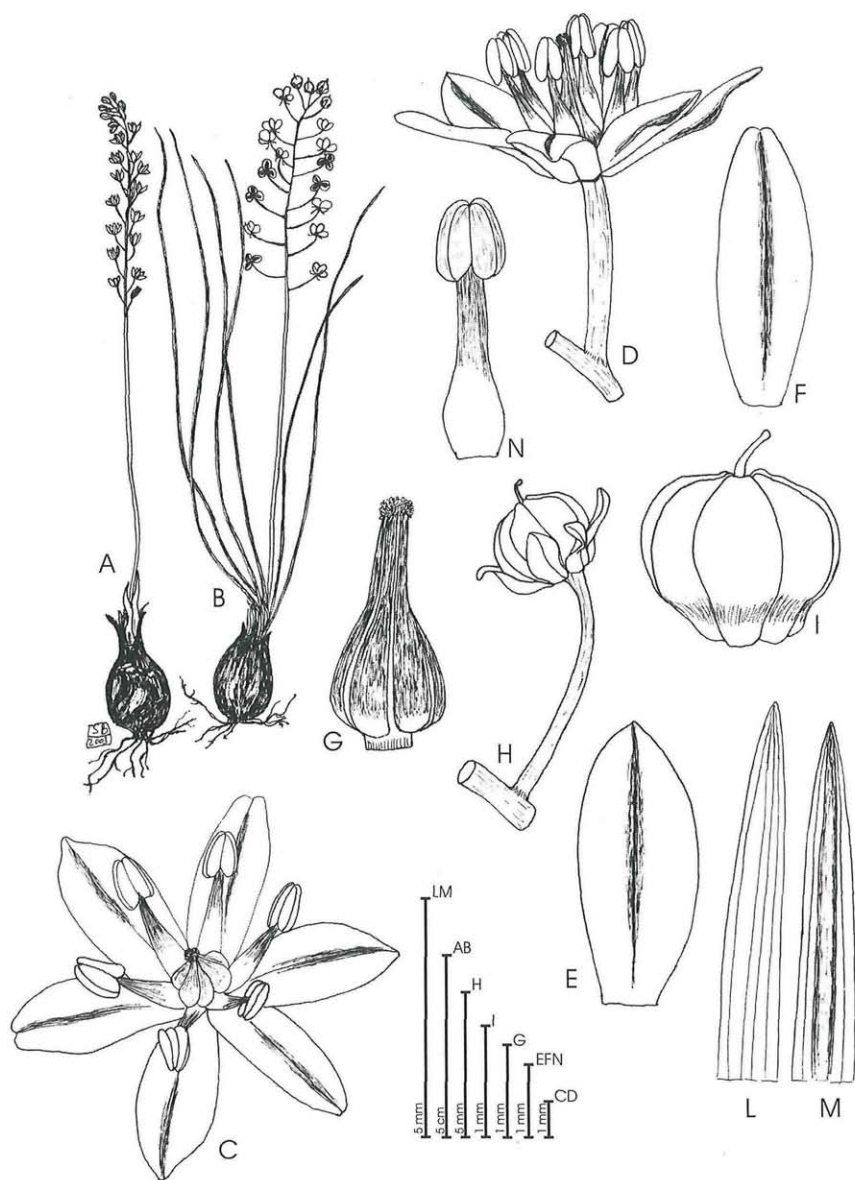


Fig. 4. *Prospero autumnale* (Trapani, Sicily, $2n = 14$). A - flowering plant, habit. B - fruiting plant, habit. C - flower (above view). D - flower (lateral view). E - outer tepal. F - inner tepal. G - pistil. H - fructiferous pedicel. I - capsule. L - leaf apex (dorsal view). M - leaf apex (ventral view). N - stamen.

long, capsule obovoid. As concerns its typification, we agree with SPETA 1982 that proposed as lectotype the original iconography of „*Hyacinthus autumnalis minor*“ published by CLUSIUS 1601 and afterwards quoted by LINNÉ 1753 in his protologue as synonym of *Scilla autumnalis*. Since this is a rough illustration, according to the art. 9.7 of ICBN (MCNEILL & al., 2006) it would be desirable to designate an epitype which should be chosen among tetraploid Spanish populations of *P. autumnale* s. str.

Due to its very peculiar ecological requirement and its punctiform distribution, as well as for some morphological features, *P. hierae* is probably derived from a detached population of *Prospero autumnalis* that likely got isolated as a consequence of the colonization of extremely specialized and geographically isolated habitats.

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